MIAMI HARBOR
MIAMI-DADE COUNTY, FLORIDA
NAVIGATION STUDY

Final
General Reevaluation Report
And Environmental Impact Statement

U.S. ARMY CORPS OF ENGINEERS
Jacksonville District
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SUMMARY

This report provides the results of engineering, economic, environmental, and real estate studies conducted on the advisability of improving Miami Harbor, Florida, for navigation. The Port of Miami, Miami-Dade County Seaport Department, the sponsor, requested the original study through a resolution from the Committee on Transportation and Infrastructure of the United States House of Representatives with an additional request in the Energy and Water Development Appropriations Bill of 1999 to initiate a general reevaluation report to determine the feasibility of further port deepening.

The general reevaluation report examines potential widening and deepening of the existing Federal system of channels. The following problems with the existing channel necessitated this reevaluation: the groundings of container ships at the entrance channel; difficulty in turning and handling of larger vessels in the inner harbor due to difficult currents; surge effects on docked ships; and transportation inefficiencies due to existing and future container ships not being able to fully load as a result of current channel depths.

Study results concluded that a combination of measures, identified as components, to deepen and widen the existing Federal system of channels from the beginning of the entrance channel to the Lummus Island (Middle) Turning Basin represents the National Economic Development (NED) plan of improvements; the Locally Preferred (LP) plan is also addressed in this study:

- Component 1C – Widen seaward portion of Cut-1 from 500 to 800 feet and deepen Cut-1 and Cut-2 from a project depth of 44 to 51 feet for the NED plan and to 52 feet for the LP plan;
- Component 2A – Add turn widener at the southern intersection of Cut-3 with Fisherman's Channel and deepen to a project depth of 49 feet for the NED plan and to 50 feet for the LP plan;
- Component 3B – Increase the Fisher Island Turning Basin from 1200 to 1500 feet. Truncate the northeast section of the turning basin to minimize seagrass impacts. Deepen from a project depth of 42 feet to 49 feet for the NED plan and to 50 feet for the LP plan;
- Component 4 – Realign the western end of the existing 36-foot main channel about 250 feet to the south, no dredging required; and
- Component 5A – Expand the Sponsor's berthing area by 60 feet and widen the southern edge of Fisherman's Channel (Lummus Island Cut) about 40 feet for a 100-foot increase in total width, reduce the Lummus Island (Middle) Turning Basin to a 1500-foot diameter from the currently authorized 1600-foot diameter, and deepen from a project depth of 42 feet to 49 feet for the NED plan and to 50 feet for the LP plan.

Proposed mitigation plans include restoration of seagrass beds and construction of artificial reefs. For seagrass impacts mitigation includes restoration of

previously dredged borrow sites within northern Biscayne Bay. Construction of artificial reefs will offset impacts to low and high relief hardbottom/reef habitat.

The total first cost of the NED plan is estimated at $148,821,000, including mitigation costs; there is an annual cost for aids to navigation of about $15,000. Interest during construction cost is about $19,262,000. For the NED plan the AAEQ benefit is about $16,231,000. The AAEQ costs total $10,140,000. The benefit to cost ratio for the NED plan is 1.60 to 1 with net benefits of about $6,091,000.

The total first cost of the LP plan is estimated at $157,295,000, including mitigation costs; there is an annual cost for aids to navigation for about $15,000. Interest during construction cost is about $21,568,000. The estimated average annual equivalent benefits and costs are $16,262,000 and $10,789,000 respectively. The benefit to cost ratio for the LP plan is 1.51 to 1 with net benefits of about $5,473,000. **Table 1** Displays the project features costs for both the NED plan and LP plan.

Table 1

	NED Plan	LP Plan
General Navigation Features		
Mobilization	$4,141,921	$4,141,921
Channel Dredging	$80,683,452	$87,881,252
Disposal Area	$597,486	$597,486
Environmental Mitigation	$7,791,156	$7,791,156
Mitigation Monitoring (Reef Construction)	$120,000	$120,000
Planning, Engineering, and Design	$3,380,000	$3,570,000
Construction Management (S&I)	$9,570,000	$10,100,000
Total GNF:	$106,284,015	$114,201,815
Aids to Navigation	$165,300	$165,300
Lands, Easements, Rights of Way, and Relocations		
Real Estate, Administrative (Federal)	$12,500	$12,500
Utility Relocations	$4,617,577	$4,617,577
Associated Non-Federal Costs		
Berthing Area Dredging (Alt. 5A)	$14,444,521	$14,999,907
Port Bulkhead Construction	$22,800,000	$22,800,000
Mitigation Monitoring (Post-Const. Seagrass)	235,000	235,000
Mitigation Monitoring (Post-Const. Reef)	250,000	250,000
Real Estate, Administrative (non-Federal)	$12,500	$12,500
Total Project First Cost	$148,821,413	$157,294,599
Rounded :	**$148,821,000**	**$157,295,000**

SUMMARY OF COORDINATION

An environmental scoping letter was sent to interested parties on January 6, 2000 (EIS - Appendices A and B). In addition, all parties were invited to participate in the plan formulation process by identifying any additional concerns on issues, studies needed, alternatives, procedures, and other matters related to the project. A local, state, and Federal resource agency meetings occurred on March 13, 2000, and May 13, 2000, to determine the areas of coverage for an environmental baseline resource survey. A meeting followed on November 1, 2000, with those resource agencies to review preliminary results. An Intent to prepare a Draft Environmental Impact Statement (DEIS) appeared in the Federal Register, Volume 66, No. 167, on August 28,2001. An Alternative Formulation Briefing occurred on June 20,2002. The Notice of Availability of the Draft EIS appeared in the Federal Register on March 14, 2003. A notice for a public meeting appeared in the *Miami Herald* on April 27, 2003. The public meeting followed on May 6, 2003, at Terminal 12 of the Port of Miami. A two day Blasting Workshop occurred from September 8 – 9, 2003, at the Port of Miami Terminal 12. Compliance with other environmental requirements is included in Section 6.0 of the Environmental Impact Statement.

As a result of the information received through the coordination process, modifications to the proposed components resulted in reduced environmental impacts to reef and seagrass areas while increasing navigation safety. Four different versions of component one received consideration during the plan formulation process. Iterative reviews involving resource agencies, ship simulation results, and the Biscayne Bay Pilots resulted in a reduction in the length of the proposed entrance channel widener, which completely avoids one reef area resulting in component 1C. Continued dialogue with interested parties produced similar reductions in seagrass impacts and construction costs, which resulted in components 2A, 3B, and 5A, previously described on page i.

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Final EIS

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INTRODUCTION

1. The Port of Miami, Miami-Dade County Seaport Department, working through the House Committee on Transportation and Infrastructure requested the Corps study the feasibility of improving navigation in Miami Harbor. The Port Authority and other interests believe that the existing navigation project could be improved for operational efficiency and safety of deep draft commercial vessels by providing a deeper channel with widening in certain areas. Such deepening and widening could reduce vessel operation costs on the existing project resulting in transportation cost savings.

2. House Document 101-205, dated June 21,1990, recommended the current channel dimensions and depths for Miami Harbor. That authorizing document recommended, "that the authorized project for Miami Harbor be modified to include Federal maintenance of the Fisher Island turning basin, and to provide a channel 44 feet deep and 500 feet wide from the open ocean to the existing beach line, 42 feet deep and 500 feet wide from the beach line to Cut 3 station 33+00 (near Fisher Island turning basin), and 42 feet deep and 400 feet wide from Fisher Island turning basin to the west end of the container berths located on Lummus/Dodge Island. This channel would terminate in a turning basin with a depth of 42 feet and a diameter of 1,600 feet." See figure 1.

3. Construction of those authorized dimensions as of February 2003 includes the 44-foot deep by 500-foot wide channel from the open ocean to the existing beach line and, the 42-foot deep by 500-foot wide segment from the beach line to Cut 3 station 33+00 (near Fisher Island turning basin). The remaining 42-foot deep by 400-foot wide segment from the Fisher Island turning basin to the west end of the container berths on Lummus/Dodge Island is partially complete. The Miami-Dade County Seaport Department has requested the U.S. Army Corps of Engineers to complete construction of that remaining segment. The port authority's contractor had difficulty removing rock in that segment which resulted in the request for the Corps to takeover the work. That work occurred under a 204e agreement which allows the project sponsor to pay for all design and construction initially and then seek reimbursement for the Federal share upon satisfactory completion of each usable increment.

4. This General Reevaluation Report examines potential navigation improvements for the existing Federal system of navigation channels. Four turn wideners and two turning basin modifications received consideration with associated deepening. One non-structural channel realignment also received evaluation. Ship simulation testing of the proposed structural turn wideners and turning basin modifications allowed for further design refinements in consultation with the Biscayne Bay Pilots. An environmental resource baseline survey provided the initial starting point for coordination of environmental impacts as a result of the proposed navigation improvements with resource agencies.

Coordination of the environmental resource survey with the Biscayne Bay Pilots resulted in further modifications to the proposed turn wideners and turning basin designs to minimize impacts to hardbottom/reef habitats, rock/rubble habitat and seagrasses. Economic benefits for the proposed improvements received a detailed evaluation in this study.

STUDY AUTHORITY

5. A resolution from the Committee on Transportation and Infrastructure, United States House of Representatives, adopted October 29, 1997, provides the study authority as follows:

> "Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That the Secretary of the Army is requested to review the report of the Chief of Engineers on Miami Harbor published as Senate, Document 90-93, 90th Congress, 2nd Session, and other pertinent reports, with a view to determining the feasibility of providing channel improvements in Miami Harbor and channels."

6. Additional authorization appeared in a subsequent appropriations bill for Miami Harbor, Florida, which contained the following language:

> “The Committee has provided $25,000,000 to reimburse the Miami-Dade Seaport Department for the Federal share of dredging work which has been accomplished and an additional $300,000 to initiate a General Reevaluation Report (GRR) to determine the feasibility of further Port deepening.”

STUDY PURPOSE AND SCOPE

7. The study involved an evaluation of problems associated with navigation on the existing Miami Harbor project. Specifically, the study reviewed the needs of the Port Authority, commercial shippers, pilots, and concerns of the United States Coast Guard (USCG). Overall environmental, social, and economic concerns were evaluated in the study area and identified to the extent possible within the limits of available technology and study funding restrictions.

8. Alternative solutions for correcting problems and providing deeper and wider channels for safer transit of large commercial vessels with more cargo tonnage onboard were identified for evaluation of costs, benefits, and environmental impacts associated with implementation. Base data for that evaluation came from an environmental resource survey, hydrographic surveys and core borings on the harbor project as well as information from the sponsor, commercial shippers, USCG, Federal, State, and local resource agencies. Two ship

simulation studies tested various components to correct navigation problems identified by the harbor pilots and other shipping interests. A numerical model study provides an evaluation of the impacts of the proposed Miami Harbor deepening on tidal current velocities and salinity in Miami Harbor, and on tidal current velocities along the coastal ocean shoreline in the vicinity of Government Cut.[1]

9. Economic investigations provided tangible navigation benefits. An environmental impact statement contains U.S. Fish and Wildlife Service Coordination, National Marine Fisheries Service coordination, cultural resource investigations, and other environmental resource agency considerations. The study resulted in the formulation of a plan that safely, effectively, and economically resolves the commercial navigation problems with a minimum impact on the environment.

PRIOR STUDIES AND REPORTS

10. This study represents a final General Reevaluation Report, which provides a response to the authorizing Congressional resolution. It evaluates potential navigation improvements. Once approval of the final report occurs from higher authority, further public coordination of the document will follow. Results of that coordination process will provide the necessary information for higher authority to complete additional reviews. Pending approval of the final report by higher authority and submission to Congress for authorization, if Congress concurs with the report findings and authorizes the project, a request for funds to perform construction would occur.

11. Federal interest in navigation of Miami Harbor started as early as 1902. Interest in improving Miami Harbor for deep draft commercial shipping has continued since that time. **Table 1** contains the prior studies and reports over the years on the deep draft portion of the Miami Harbor project.

[1] These simulations were not designed to include coastal processes such as littoral currents, and hence any assessment of the impact of harbor deepening on coastal currents should be made with an understanding of this limitation.

Table 1 - Prior Studies and Reports

		CHIEF OF ENGINEERS	PUBLISHED DOCUMENTS				
STUDY[1]	ACTS	RECOMMENDATIONS	TYPE[2] /NO./ CONGRESS/ SESSION				
S	06/13/1902	Channel (Government Cut) 18 feet deep across peninsula and north jetty	H	662	56	18	
	03/02/1907	South jetty and channel 100 feet wide					[3]
S	07/25/1912	Channel 20 X 300 feet and extension of jetties	H	554	62	2	
S	03/03/1925	Channel 25 feet deep at entrance and 25 X 200 across Biscayne Bay	H	516	67	4	
S	07/03/1930	Channel 300 feet wide across Biscayne Bay and enlarging municipal tuning basin	R&H	15	71	2	[4]
PE	08/30/1935	Depth of 30 feet to and in turning basin	S	73	2		[5]
S	08/26/1937	Widen turning basin 200 feet on south side	R&H	86	74	2	
S	03/02/1945	Virginia Key improvement	S	251	79	2	
S	03/02/1945	Consolidation of Miami River and Miami Harbor projects: widening at mouth of Miami River to turning basin and Government Cut; and channel from Miami River to the Harbor of Refuge	H	91	79	1	
S	07/14/1960	Channel 400 feet wide across Biscayne Bay; enlarge turning basin 300 feet on south and northeasterly sides; dredge turning basin on north side of Fisher Island; delete Virginia Key development and Dinner Key approach channel	S	71	85	2	
S	08/13/1968	Enlarging the existing entrance channel to 38-foot depth and 500-foot width from the ocean to the existing beach line; deepening the existing 400-foot wide channel across Biscayne Bay to 36 feet; and deepening the existing turning basins at Biscayne Boulevard terminal and Fisher Island to 36 feet	S	93	90	2	
FR	11/28/1990	Include Federal maintenance of the South Fisherman's channel for 9,200 feet westward of the Fisher Island turning basin; provide a channel 44 feet deep and 500 feet wide from the open ocean to the existing beach line; 42 feet deep and 500 feet wide from the beach line Cut 3 station 33+00 (near Fisher Island turning basin); and 42 feet deep and 400 feet wide from Fisher Island turning basin to the west end of the container berths located on Lummus/Dodge Island. The channel would terminate in turning basin with a depth of 42 feet and a diameter of	H	205	101	2	

		CHIEF OF ENGINEERS	PUBLISHED DOCUMENTS				
STUDY[1]	ACTS	RECOMMENDATIONS	TYPE[2] /NO./ CONGRESS/ SESSION				
		1,600 feet.					
GRR	10/12/1996 Public Law 104-303	Provide a 34-foot deep channel over a 400-foot bottom width from the Lummus Island turning basin west about 1,200 feet					

1 Abbreviations are: PE = Preliminary Evaluations R = Reconnaissance Report FR = Feasibility Report S = Surveys GRR = General Reevaluation Report

2 Symbols are: H = U.S. House of Representatives Document S = U.S. Senate Document

3 Specified in Act

4 R. & H. Comm. Doc. 15/71/2

5 S. Comm. Print 73/2

EXISTING WATER PROJECTS

12. Besides the Miami Harbor Federal navigation project, several other Federal water projects exist in the area that have an association with the Miami Harbor. Those projects include Miami River; Intracoastal Waterway, Jacksonville to Miami; Virginia Key and Key Biscayne Beach Erosion Control; and Dade County, Florida, Beach Erosion Control. Two potential water projects under consideration include Virginia Key, Section 111, and, Virginia Key, Section 1135.

MIAMI RIVER

13. The Miami River channel has a depth of 12 to 15 feet over a bottom width that varies from 90 to 170 feet. The total project length is about 5.5 miles. A 12-foot deep by 100-foot wide channel from Miami River provides access to a harbor of refuge in Palmer Lake.

INTRACOASTAL WATERWAY, MIAMI TO JACKSONVILLE

14. The Intracoastal Waterway Project is primarily a small boat channel that extends from Trenton, New Jersey to Miami, Florida along the east coast of the United States. That waterway has a bottom width of 125 feet and a depth that varies from 10 to 12 feet.

VIRGINIA KEY AND KEY BISCAYNE BEACH EROSION CONTROL

15. The Virginia Key and Key Biscayne Beach Erosion Control Project provides for Federal participation of 70 percent of the cost of periodic nourishment of 1.8 miles of beach on Virginia Key for an initial period of 10 years, and 70 percent of the initial cost of 3 groins on Virginia Key and 1 groin on Key Biscayne, construction of which is subject to future determination of their need. Also, provides for a protective beach fill along the southern 2.4 miles of shoreline at Key Biscayne with a variable berm width from 15 to 25 feet wide at elevation from 7 to 9 feet above mean low water and seaward slopes of 1 on 14 from the berm to the existing sea bottom; an anchor groin with additional rock to be placed as a subtidal habitat. Original nourishment portion of project deauthorized 1 January 1990.

DADE COUNTY, FLORIDA, BEACH EROSION CONTROL

16. The Dade County Beach Erosion Control Project provides for Federal participation in the cost of a project along the ocean shore of Dade County, Florida. It provides: a protective dune with a 20 feet crown at elevation 11.5 feet and side slopes of 1 on 5 down to a protective and recreational beach, with a level berm 50 feet wide at elevation 9 feet mean low water (mlw), and a natural slope seaward as would be shaped by wave action, all for beach erosion control and hurricane flood protection along the 9.3 miles of shore between Government Cut and Bakers Haulover Inlet; a protective and recreational beach with a 50 feet level berm at elevation 9 feet mlw, and a seaward slope as would be shaped by wave action, for beach erosion control along 1.2 miles of shore at Haulover Beach Park, periodic nourishment of both of the above reaches for an initial period of 50 years. Project modification provides for reimbursement to local interests for the appropriate federal share of costs of construction for beach fill and south jetty extension at Bal Harbour Village.

VIRGINIA KEY SECTION 111 SHORELINE STABILZATION REPORT

17. The Virginia Key Section 111 Report, completed in August 2002, provides the results of feasibility studies conducted to stabilize the shoreline in the vicinity of Virginia Key, Dade County, Florida. This report was conducted under the authority of the River and Harbor Act of 1968, as amended. Section 111 authorizes the study, design, and construction of work for prevention or mitigation of damages to both non-Federal public and privately owned shores to the extent that such damages can be directly identified and attributed to Federal navigation works located along the coastal and Great Lakes shorelines of the United States. Construction and maintenance of the Miami Harbor Federal navigation project has had an adverse impact on the shoreline at Virginia Key.

18. The study proposes modifications to stabilize the shoreline. The recommended plan consists of several features: (1) constructing 3 new timber groins, (2) placing approximately 3,000 cubic yards of material onto the beaches, and (3) removing and replacing 25 timber groins.

19. The original authorization for Miami Harbor construction indicated 100% Federal funding, therefore, as provided by Section 111 authority, the cost of work to correct the erosion attributable to the navigation project at Miami Harbor will be a 100% Federally funded responsibility. The benefits consist of the stabilization of the shoreline at Virginia Key and the preservation of the historical Virginia Key Beach Park.

20. Potential sources of sand for the beach placement will come from the upland confined disposal facility on Virginia Key, which could receive sand from maintenance of the Miami Harbor Federal channels or from new construction modifications under consideration for the harbor in this report.

VIRGINIA KEY RESTORATION – CONTINUING AUTHORITY PROGRAM, SECTION 1135, MIAMI-DADE COUNTY

21. Currently in progress, the proposed project will consider restoration of native plant communities in selected areas on Virginia Key. These areas currently contain a high percentage of exotic vegetation, primarily Australian pine and Brazilian pepper. The restoration plan includes removing exotic vegetation from the environment and replacing them with the historic plant communities including mangrove, coastal strand, tropical hardwood, and aquatic/wetland species. The proposed project would restore tropical hardwood hammock, wetlands, coastal strand, freshwater pond and provide for selective clearing. This would provide a more suitable habitat for fish and wildlife resources than what currently exists.

PLAN FORMULATION

22. Section 904 of the Water Resources Development Act of 1986 requires the Corps to address the following matters in the formulation and evaluation of alternative plans:

a. Enhancing national economic development, including benefits to particular regions that are not transfers from other regions.

b. Protecting and restoring the quality of the total environment.

c. The well-being of the people of the United States.

d. The prevention of loss of life.

e. The preservation of cultural and historical values.

23. The planning process on the Federal level aimed to assist in formulating and evaluating water resources projects is the National Economic Development objective or NED. The NED principle provides policy guidance to help Federal water resources planners define problems and develop solutions. The NED process ensures the recommended project maximizes net benefits. The process also ensures the recommended project outputs, defined, as the benefits to the Nation from the use of the resource, will exceed the cost implementing the project.

24. The Federal objective in water and related land resources planning is to develop a plan, which would provide the maximum contribution to the NED objective consistent with protecting the Nation's environment. In accordance with this policy, the following apply to the Miami Harbor navigation study for developing structural and non-structural plans. The Federal planning process consists of the following major steps:

a. Defining of the water and related land resource problems and opportunities associated with the Federal objective and specific state, county, and municipal concerns.

b. Inventory, forecast and analyze water and related land resource conditions within the planning area relevant to the identified problems and opportunities.

c. Formulation of plans.

d. Comparison of plans.

e. Select a recommended plan based on the comparison of plans.

25. Improvements to the existing navigation project, which would improve the operational efficiency and safety for deep draft commercial vessels by providing a deeper channel with widening in certain areas are considered. Such deepening and widening reduces vessel operation costs on the existing project. This results in national benefits in transportation cost savings.

26. The assessment of water and related land resources problems and opportunities specific to the study area includes an evaluation of existing conditions and future without project conditions.

PROBLEMS AND OPPORTUNITIES

27. The problems and opportunities of the study area provide direction for the study. The initial request for harbor improvements focused on reducing ship groundings at the beginning of the entrance channel from variable and unpredictable crosscurrents, the turn from the entrance channel to Fisherman's channel due to difficult crosscurrents, vessel turning in the Fisher Island and Lummus Island turning basins, and surge impacts on ships moored along Lummus Island.

Existing Conditions

28. Miami Harbor is in Biscayne Bay, a shallow salt-water sound on the Atlantic Coast near the southern end of the Florida peninsula. The bay has a length of about 38 miles and a width that varies from three to nine miles with average depths of 6 to 10 feet. A narrow chain of small islands known as keys separate the bay from the Atlantic Ocean. Shallow natural passages between the keys along with artificial cuts through the peninsula such as Bakers Haulover Inlet and Government Cut connect the bay with the ocean. Government Cut, near the south end of the peninsula, forms the entrance to the main ship channel leading to Miami Harbor. The City of Miami is located on the western shore of Biscayne Bay. Miami Harbor is about 23 miles south of Port Everglades and 130 miles northeast of Key West Harbor.

29. Miami Harbor provides access to deep draft vessel traffic using terminal facilities located in the Port of Miami. According to the Port of Miami, 2001 Official Directory, those port facilities handled in fiscal year 2000 over 7.8 million tons of cargo. That total includes about 4.5 million import tons and 3.3 million export tons. That total also represents a 13 percent increase over 1999 totals. The Port of Miami continues to rank in the top 10 cargo container ports in the United States and remains the largest container port in Florida. As a result of cruise ship operations over 3.3 million passengers traveled through the Port of Miami.

30. The Port offers the greatest frequency of cargo service, with the largest number of shipping lines, calling at the most destinations in the world. The Port has more than 35 shipping lines calling on over 100 countries and over 254 ports. In addition to its strength as a cargo port, the Port is also the largest multi-day cruise passenger homeport in the world. The Port's link to important trading and cruise routes, as well as the strength and characteristics of its large and growing hinterland, have positioned the Port as a top performer, and will continue to drive the Port's growth as long as the infrastructure to support marine transportation is in place. The total economic impact of Port operations on the nation is estimated at more than $8 billion per year. More than 45,000 jobs are directly or indirectly attributable to Port operations. Jobs created by Port and trade activity tend to be good jobs: they pay significantly more than other job

growth sectors in the local economy, have better long-term opportunities for employees and offer better training programs (particularly for minorities). The Port also utilizes the local, regional, and inter-regional transportation network components consisting of roads, railway lines, and channels to facilitate the efficient movement of goods and passengers.

Tributary Area

31. The immediate tributary (hinterland) area for Miami Harbor includes Miami-Dade County, which depends on the port for some basic commodities. Containerization of general cargoes and the expansion of port properties by dredge and fill operations has opened Miami Harbor to the transport of high value manufactured products, machinery, foodstuffs, and transportation equipment. Much of that cargo originates in the central section of the United States for export to Latin America. Also, with the expansion of port facilities, Miami Harbor has become a major distribution port for cargo shipped from Europe and the Far East bound for Latin and Central America.

32. According to the Port of Miami, 2001 Official Directory, Miami Harbor facilities process nearly 50 percent of all U.S. exports to the Caribbean and Central America, and more than 30 percent of all U.S. exports to South America. More than 40 shipping lines calling on 132 countries and 362 ports around the world operate from the Port of Miami. Markets served by those carriers include Africa, Asia, the Caribbean, Central America, Europe, the Middle East, North America, and South America.

33. Virtually all the liquid bulk shipped through the Miami Harbor is handled by the liquid bulk facility on Fisher Island known as Coastal Refining and Marketing, Inc. The Port of Miami, located in environmentally sensitive Biscayne Bay, considers itself a “clean port” since the it does not handle bulk cargoes or potentially dangerous or hazardous cargoes such as fuel oil.

Waves

34. The waves that occur in the vicinity of the study area consist of “sea” and “swell”. “Seas” consist of waves generated by local winds and generally travel in the same direction as the wind. Swells involve waves generated from distant storms or open ocean prevailing winds that enter the study area independent of local winds. Swells out of the north and middle Atlantic cannot reach the study area without modification of wave pattern or wave energy in the shallows of the Bahama Banks or by refraction along the Florida shoreline to the north. Locally-generated seas occur with the greatest frequency, but the less-frequent large storm swells create the most adverse conditions for navigation in the project area.

Tides and Currents

35. Tides within the Miami area are semi-diurnal; there are two high and two low tides each day. The mean range at Miami Beach is 2.5 feet (3.0 - foot spring range) and the lowest recorded tide is 1.4 feet below mean low water. The most significant ocean current in the region is the Gulf Stream current off the east coast of Florida, which flows north and varies in velocity from 17 miles per day in November to 37 miles per day in July. Gulf Stream eddies add to and/or may be responsible for some of the ship handling problems in the entrance channel. Tidal currents generated by the astronomical tides produce a greater impact on the project area. Maximum tidal current velocities through Government Cut are ordinarily about 5.5 feet per second on an average tide, but occasional velocities of 6.2 feet per second have been recorded during spring tide. From September through February, waves and prevailing winds are predominantly from the northeast and east. During March, April, and May, winds and waves are usually easterly.

36. The United States Coast Pilot (USCP) - 4, 2001, 33rd Edition, page 303, warns of strong tidal currents in the entrance between the jetties. A northerly wind causes a considerable southerly set across the ends of the jetties. Vessels are advised to favor the southerly side of the entrance channel during southerly winds, as a pronounced northerly set may be experienced. See figures 1 and 2.

37. The USCP also notes that the Biscayne Bay Pilots report variances between predicted and actual currents. Cross-channel current variations in Government Cut are particularly difficult to negotiate. Caution should be exercised when entering Government Cut from the sea during flood tide with northeasterly winds; a strong turning torque occurs when the bow is just inside the north jetty. A similar but less serious situation occurs when leaving the port during ebb tide. Horizontal current gradients, which may make maneuvering difficult, occur in the turning basin north of Fisher Island. See figures 1 and 2.

Bridges

38. The Port is connected to the Miami mainland by two bridges, figure 1; a 65-foot vertical clearance, fixed span vehicular bridge with a horizontal clearance of 90 feet, and a bascule rail bridge with a vertical clearance of 22 feet at center and a horizontal clearance of 90 feet. It is linked to the Florida East Coast Railroad Company's main line track.

Utilities

39. The Miami-Dade Water and Sewer Department (WASD) owns a force sewer main in a submarine crossing within Component #2A, figure 3, leading from Miami Beach to its Virginia Key Wastewater Treatment Plant. The crossing consists of a 54-inch concrete pipe running under the riverbed with top of pipe

elevation at elevation –50 feet. The 54-inch force sewer main will require relocation if any additional depth is justified. The Engineering Appendix contains additional detail on the utility relocations; see Plate B-18 for location of the utilities. Additionally, WASD owns a water main in a submarine crossing leading from Fisher Island to Lummus Island. This crossing consists of a 20-inch ductile iron pipe running under the riverbed with top of pipe elevation at elevation –53.0 feet. The WASD water main requires relocation for any proposed project depths.

40. The Florida Power and Light Company (FP&L) owns two transmission lines in a submarine crossing leading from its Fisher Island plant to Lummus Island. The crossing consists of one 69 kV circuit and one 138 kV circuit each inside 24-inch pipe conduits with top of pipe elevation at elevation –45.8 feet and 45.6 feet Local Mean Low Water (LMLW). Those cables should have been relocated under the previously authorized phase I deepening. Removal will occur as part of a new Project Cooperation Agreement (PCA) with Miami-Dade County Seaport Department in which the Corps will complete construction of the phase II project previously started under a 204e agreement by the port authority. As such, the relocated FP&L lines are part of the without project condition.

Existing Terminal Facilities

41. The Port of Miami is a 660-acre island facility developed from placement of dredged material to initially form two islands, Dodge Island and Lummus Island. Additional development connected the western end, Dodge Island, with the eastern end, Lummus Island as shown in figure 1.

42. As previously mentioned, the Port of Miami is a “clean port” (i.e., the designation of a seaport that does not handle bulk cargoes or potentially dangerous or hazardous cargoes such as fuel oil). The Port handles only palletized, roll-on/roll-off (RO/RO), and containerized cargo. In addition to cargo traffic, the Port of Miami is also a major cruise ship port. It is the year-round homeport of one of the largest cruise ships in the world, the VOYAGER OF THE SEAS. As reported in the 1999 Port of Miami Master Development Plan (April 30,1999), the Port consists of 518 acres of actual landmass. Of the 518 acres, 372.5 acres (71.9 percent) is devoted to cargo operations, mainly on Lummus Island, and 52 acres (10.0 percent) is devoted to cruise operations on Dodge Island. The Port also leases 34 acres from the Florida East Coast Railway at its Buena Vista yard, which is located approximately 2.5 miles northwest of the Port. This leased property is used as an intermodal container marshaling and storage area for transshipments.

43. In addition to 10 existing gantry cranes (3 panamax and 7 post-panamax) there are two super panamax cranes scheduled for delivery with an option for two more on order. The Port’s cargo handling equipment includes forklifts, toploaders, and mobile truck cranes including three Mi-Jack 850-P Rubber Tire Gantries (RTGs), which allow containers to be stacked 6-wide and 4-high. There

are eleven passenger terminals that accommodated 3.3 million passengers in Fiscal Year 2000. The Port's passenger terminals are designated Terminals 1 through 5, Terminal 6/7, Terminal 8/9, Terminal 10, and Terminal 12 (figures 1, 4, and 8). As identified in the Port's 1999 Master Plan, approximately 47.5 acres of the Port's land area is utilized by support facilities: parking, 17.0 acres; circulation and open space, 10.5 acres; office – Federal Government, 8.5; recreation, 7.5 acres; office-miscellaneous and office-Seaport Department, 1.7 acres.

44. CSX Transportation, Inc serves the Port of Miami. The Miami-Dade County Seaport Department owns 2.1 miles of trackage at the Port of Miami on Dodge Island, which consists of a main line track extending the length of the island and a four-track, closed-end intermodal rail yard. The main track on Dodge Island connects with the Florida East Coast Railway via a rail bridge. A connection with CSX Transportation, Inc. is effected through an interchange in the west part of the city of Miami. Also, the Port is less than one mile from major highways: Interstate 95 and Federal Route 1 via Interstate 395, and Interstate 75 via Dolphin and Palmetto Expressways. The Miami International Airport (MIA) is located on a 3,300-acre site about five miles northeast of downtown Miami.

45. There is a private petroleum facility at Fisher Island (see figure 1). This facility receives Number 6 fuel oil and diesel fuel by tankers and barge (integrated tug and barge units - ITBs). The fuel is used solely for bunkering the Port's cargo and cruise ships, which are bunkered at the berth by tank truck or by bunkering barge. This facility has an 800-foot long berth with a depth of 36 feet and 12 storage tanks having a total capacity of 667,190 barrels.

46. As reported in the U.S. Army Corps of Engineers' Port Series No. 16 document (revised 1999), within Metropolitan Miami and Dade County 12 companies operate warehouses having a total of over 1,000,000 square feet of dry storage space and over 6,000,000 cubic feet of cooler and freezer space. All except three of the warehouses have railroad connections, and each is accessible to arterial highways. Anchorage for deep-draft cargo vessels lies north of the entrance channel to Miami Harbor. There are no bridges crossing the shipping channels for Dodge and Lummus Islands.

Cargo Movement and Fleet Composition

47. The vessels currently calling at Miami Harbor range in size from small general cargo vessels to Royal Caribbean International's Voyager-class cruise ships (length overall, 1,021 feet; breadth, 156 feet; draft, 28 feet). The largest dry cargo vessel class is the Panamax class of containership (length overall, 965 feet; breadth, 106 feet; draft, 44 feet). A Panamax class vessel is a vessel with dimensions that allow it to transit the Panama Canal: 950 feet long with a beam of 106 feet, except for passenger and container ships, which may have a length of 965 feet (lock dimensions are 1,000 feet long and 110 feet wide).

48. The Port of Miami handles container, trailer, neobulk (united/bundled), and breakbulk (loose non-containerized) cargo. The Port Authority records for fiscal year 2000 (October 1999 to September 2000) report a total of 7,804,946 short tons of cargo. Containerized cargo represented about 61.8 percent of all cargo; trailer, 35.6 percent; and neobulk and breakbulk, 2.6 percent. Cargo vessels recorded 2,424 calls, or 70.3 percent of all ship calls (3,447). The cargo is carried on container ships, Roll-on/Roll-off (RO/RO ships), and Load-on/Load-off (LO/LO ships). The LO/LO ships have on-board cranes, and are primarily used in the Caribbean and Latin American trade, as many of the ports in these trade areas do not have gantry cranes. The trailer cargo is carried on the RO/RO ships that, except for auto carriers, carry containers. Most cargo is carried on "cellular" container ships that are designed to carry only containers.

49. Most of the container and trailer cargo recorded at the Port is classified as general cargo, not otherwise specified (N.O.S.). Examples of individual classes are refrigerated fruits and vegetables, miscellaneous apparel, textiles, and foodstuff. Buses and trucks are examples of breakbulk cargo. Lumber is an example of neobulk cargo.

50. In addition to handling cargo traffic, the Port of Miami is a major homeport for 17 cruise ships belonging to Carnival Cruise Lines, Norwegian Cruise Line, and Royal Caribbean International. These companies offer 4 to 11 day cruises. For fiscal year 2000 there were 3,364,643 passengers embarked/disembarked, and 1,023 ship calls were recorded, representing 29.7 percent of the total number of calls.

Current Trade Routes/Vessel Itineraries/Historical Tonnage

51. General patterns were identified for the container ships calling at Miami Harbor. For the European, Mediterranean, and Asian trade regions, the overall general itinerary pattern is that Miami Harbor is part of an itinerary in which it is not the originating port, nor is it the first or the last port of call. This pattern is generally true for the U.S. ports within the itineraries, but there are exceptions where Miami Harbor is the first, or the last U.S. port of call. The container ships are mainly foreign-flag, Panamax size, with a cargo capacity of 2,500- to 4,500-TEUs. However, for the Latin American and Caribbean trade routes Miami Harbor is the port of origin within the itinerary. The container ships are also mainly foreign-flag, but are smaller in size than those on the European, Mediterranean, and Asian trade routes. The maximum cargo capacity is 3,700 TEUs.

52. European export cargo destined for the United States east coast ports is usually carried on container ships that typically call first at Halifax, Canada, or New York/New Jersey, United States. These container ships then call at ports along the U.S. east coast unloading import cargo and loading export cargo. With

respect to Miami's position in the itinerary, at this time Charleston is typically the prior port of call. After calling at Miami, the itineraries vary.

53. Container ships in the Mediterranean/United States East Coast Container Trade have itineraries that are similar to the itineraries in the European/United States East Coast Container Trade. There is one significant difference. Some of the Mediterranean itineraries are actually part of an Asia/Mediterranean/United States East Coast itinerary, which includes transiting the Suez Canal. As these vessels do not transit the Panama Canal and the Suez Canal and have a maximum vessel draft of 56 feet, the only potential constraint to the efficient utilization of Post-Panamax container ships would be the depth at United States East Coast ports.

54. Asian containerized cargo arrives at United States East Coast ports on container ships that have either transited the Panama Canal or the Suez Canal. Container ships transiting the Suez Canal typically stop at Mediterranean ports; then continue on to United States East Coast ports (Asia/Mediterranean/United States East Coast itinerary). The alternative itinerary includes transiting the Panama Canal.

55. Latin American and Caribbean trade represents a significant portion of Miami Harbor's cargo activity. Latin American trade includes ports in Mexico, Central and South America. The vessel itineraries in this trade form a pattern that is similar to those in the European, Mediterranean, and Asian trade routes, except that in some itineraries, Miami Harbor is the originating port. The typical pattern is for the container ships to combine calls at various U.S. East Coast ports and Latin American and/or Caribbean ports. Most often, a shipping company will have a separate itinerary for the west and east coasts of South America. The itineraries that involve the west coast of South America include a transit through the Panama Canal. Because of the relatively shallow harbor depths and the absence of landside gantry cranes at ports in Latin America and the Caribbean, the container ships usually have onboard cranes for cargo handling. Site conditions at the ports and the onboard cranes, necessitate the container ships to be smaller than those used in the European, Mediterranean, and Asian trade routes. Furthermore, the lack of landside gantry cranes is also a reason for the extensive use of RoRo vessels, which carry trailers, as well as containers.

56. **Table 2** displays the historical imports tonnage for the Port from 1990 to 2000 by region. **Table 3** displays the historical export tonnage for the Port from 1990 to 2000 by region. **Table 4** displays the import and export distribution by commodity group for Fiscal Year 2001. As can be seen from these tables both imports and exports have more than doubled in this 1990 to 2000 time period.

Table 2 - Miami Harbor: Import Tonnage by Region

Data years: 1990-2000

Short Tons

Fiscal Year	Caribbean	Central America & Mexico	Europe	Far East, Asia, Pacific	Middle East SW Asia, Africa	North America	South America	Other	Total
1990	259,214	412,452	502,519	278,654	30,035	48,301	464,920	n/a	1,996,095
1991	212,968	383,924	451,645	352,150	35,452	35,040	514,258	n/a	1,985,437
1992	246,582	457,193	435,786	511,909	n/a	n/a	524,240	55,148	2,230,858
1993	267,945	467,618	564,551	571,726	n/a	n/a	664,935	60,338	2,597,113
1994	274,176	379,373	529,563	667,273	70,413	145,684	732,195	n/a	2,798,677
1995	314,712	555,833	734,177	793,022	84,462	137,324	844,645	n/a	3,464,175
1996	268,975	568,528	627,445	589,014	68,438	128,499	664,802	n/a	2,915,701
1997	284,386	655,709	750,589	573,791	45,007	200,019	781,115	n/a	3,290,616
1998	321,919	704,512	973,647	562,499	35,335	215,487	654,119	n/a	3,467,518
1999	303,656	713,142	1,252,393	605,068	26,925	214,279	624,140	n/a	3,739,603
2000	313,280	879,169	1,513,975	609,198	35,840	242,043	869,682	n/a	4,463,187

Source: State of the Port

Table 3 - Miami Harbor: Export Tonnage by Region

Data Years: 1990-2000

Short Tons

Fiscal Year	Caribbean	Central America & Mexico	Europe	Far East, Asia, Pacific	Middle East, SW Asia, Africa	North America	South America	Other	Total
1990	595,982	356,024	218,188	23,127	32,800	0	339,797	n/a	1,565,918
1991	544,142	443,928	208,866	24,706	37,964	3,714	598,092	n/a	1,861,412
1992	667,527	483,890	304,441	26,515	n/a	na/	810,849	42,123	2,335,345
1993	840,030	511,121	218,480	44,733	n/a	n/a	883,508	66,295	2,564,167
1994	798,601	332,974	239,168	182,237	15,704	314,615	892,276	n/a	2,775,575
1995	510,278	409,580	219,534	271,858	38,178	20,884	916,503	n/a	2,386,815
1996	608,729	533,994	317,411	284,664	51,709	63,236	1,194,350	n/a	3,054,093
1997	807,328	658,682	258,335	306,604	8,768	61,751	1,534,103	n/a	3,635,571
1998	994,965	624,387	260,153	242,831	9,548	82,875	1,517,254	n/a	3,732,013
1999	1,021,046	658,575	232,926	261,005	14,996	77,855	924,366	n/a	3,190,769
2000	894,252	719,388	344,650	278,311	9,042	73,348	1,017,768	n/a	3,336,759

Source: State of the Port

Table 4 - Miami Harbor: Import and Export Distribution

Import	Distribution
Cargo Not Otherwise Specified (NOS)	Evenly distributed
Tiles, Stone, Cement	90% Europe; 10% S.A.
Fruits & Vegetables	75% C.A.; 15% Carib; 10% S.A.
Apparel	70% C.A.; 30% Caribbean
Beverages, Alcoholic	70% Europe; 15% Carib; 15% S.A.
Lumber & Wood	50% C.A.; 50% S.A.
Iron, Steel, Other Metal Products	50% S.A.; 50% Far East
Coffee	60% C.A.; 35% S.A.; 5% Carib
Seafood	60% S.A.; 40% C.A.
Wood Products	50% C.A.; 50% S.A.

Export	Distribution
Cargo NOS	Evenly distributed
Textiles	70% C.A.; 30% Caribbean
Paper, Newsprint	25% C.A.; 25% S.A.; 25% F.E.; 25% Europe
Food Products	35% C.A.; 35% Carib; 30% S.A.
Spare Parts	40% C.A.; 40% S.A.; 20% Carib
Iron, Steel, Other Metal Products	80% Far East; 20% C.A.
Building Materials	35% C.A.; 35% S.A.; 30% Far East
Electrical Machinery & Equip	40% C.A.; 40% S.A.; 20% Carib
Machinery & Industrial Equip	40% C.A.; 40% S.A.; 20% Carib
Trucks & Buses	40% C.A.; 40% S.A.; 20% Carib

C.A. = Central America
S.A. = South America
Carib = Caribbean

Prospective Future Conditions

57. The container and trailer cargo class represents 97.4 percent of all cargo. The remaining 2.6 percent consists of neobulk and breakbulk cargo. Historical growth rates for these commodity types were computed for the 10-year period 1990 to 2000, (as shown in **Tables 2** and **3**). The historical growth rates were used as a basis to calibrate future growth for the 50-year period of analysis.

Future Cargo Traffic

58. Container cargo grew from 2,225,152 short tons in 1990 to 4,827,102 short tons in 2000, which represents a 117 percent increase, or a compound annual growth rate of 8.05 percent. For the 5-year period 1995 to 2000, the compound annual growth rate was about 3 percent lower (5.04 percent). This resulted from slower growth in export container trade for this period (1.98 percent). Container cargo exports recorded a compound annual growth rate of 6.46 percent for the period 1990 to 2000. Container imports demonstrated the most growth. From 1990 to 2000, the compound annual growth rate was 9.02%, and only about 2 percent lower for the period 1995 to 2000.

59. The overall compound annual growth rates of 9.02 percent for imports and 6.46 percent for exports are higher than the overall world and overall United States rates. As reported in Lloyd' Register's Fairplay Market Forecast - Container (February 2000), "Containership trade expansion has nearly doubled the world growth rate in the 1990s. Loaded TEU volumes averaged just under 7 percent annual growth in the 1990s." In "U.S. Industry & Trade Outlook 2000", The McGraw-Hill Companies reported an annual growth rate in United States liner import trade of 7.5 percent and 3.6 percent for United States liner export trade for the period 1993 to 1999.

60. In 2000, about 60 percent of the Port's trade (short tons) is in the Latin America and Caribbean (North-South) trade region. European trade represents about 24 percent, while the Far East trade represents approximately 11 percent. Domestic (North American) trade represents about 4 percent, while trade in the Middle East/Southwest Asia/Africa region represents 1 percent. The Far East and European trade regions grew faster than the Latin American and Caribbean regions, and are expected to do so in the future. U.S. and Asian trade has slowed in the last few years due to the Asian financial crisis. However, industry experts are predicting significant growth in the United States and Asia trade as markets continue to expand in China, and in developing countries like Vietnam.

61. Through the first 20 years (2010-2030) of the 50-year planning period (2010-2060), cargo average annual growth rates by trade region are based primarily on the historical average annual rates for the 10-year period 1990 to 2000 (see **Tables A-15** and **A-16** in the Economics Appendix). Any historical

average annual growth rates that exceeded the U.S. Labor Department's projected general overall annual rates of change for U.S. exports and imports through 2010 were adjusted to the Department's rates. This procedure capped average annual rates for imports and exports at 7.6 and 6.0 percent, respectively, resulting in significant reductions in the historical double-digit rates for cargo moving in the U.S. East Coast-Europe and Asia trade, as shown in **Tables A-15** and **A-16** of the Economics Appendix. Consistent with Corps guidance, the average annual growth rates for each trade region were reduced for the last 30 years of the planning period (2030 to 2059) based on a review of national, state and regional economic indicators.

62. This methodology resulted in an overall average annual growth rate of 4.72 percent for the period 2002 to 2060, and 4.47 percent for the period 2010 to 2060. In contrast, the overall average annual rate of growth for the period 1990 to 2000 was 8.07 percent (see **Table A-14** of the Economics Appendix). See the PORT AND INDUSTRY TRENDS section of the Economics Appendix for a detailed discussion of historical and future cargo traffic.

63. Neobulk and breakbulk ("Other") cargo represent 2 to 3 percent of all tonnage handled at the Port. Lumber, steel reinforcing bars, and paper are examples of this type of cargo. These commodity types have experienced overall negative growth: 1990 to 2000, -4.29 percent; 1995 to 2000, -6.68 percent. However, imports for the period 1995 to 2000 had a positive compound annual growth rate, 11.07 percent. Many of these commodities are dependent on construction activity, which is dependent on population growth and the general level of business activity and expansion. As such, it is anticipated that future compound annual growth rate for neobulk and breakbulk cargo will be between 1 and 2 percent for imports, while no growth is predicted for exports. For this analysis, a compound annual growth rate of 1.5 percent will be used for neobulk and breakbulk import cargo traffic.

64. It is assumed for this analysis that the compound annual growth rate for cruise ship passengers will be 2 percent, the same as the historical compound annual growth rate for the 10-year period, 1990 to 2000.

Problem Identification

65. Navigation Concerns: The Miami-Dade County Seaport Department provided correspondence (See letter dated October 23, 1997 in Pertinent Correspondence Appendix D.) from the Biscayne Bay Pilots outlining their concerns for the need to widen certain segments of the navigation channels in addition to the need for deepening. According to the harbor pilots several Maersk container ships have grounded off of buoy "1", figure 2, at the beginning of the entrance channel due to variable and unpredictable currents. The pilots have requested widening the entrance channel from an existing 500-foot width to an 800-foot tapered entrance. The second location of proposed widening

includes an area south of Government Cut between beacons 13 and 15, figure 3. That portion of the channel includes an area where ships turn from one channel into another.

66. Strong currents at that intersection of three different channels combined with the required decreased speed of the ship make it important to have as much swinging room as possible for the ship. As recently as August 30, 2001 a general cargo ship grounded in the location of Component #2A, figure 3. A third location for widening recommended by the harbor pilots includes the south part of the Lummus Island (Fisherman's) Channel, figures 6 and 7. Vessels docked along Lummus Island swing their onboard cranes 90 degrees out into the channel thereby blocking a portion of the channel. Under different conditions of wind, current, ship size and draft, passing those docked vessels results in an unsafe situation. Ships at dock sometimes experience a surging effect. The pilots suggest extending the southern edge of the Fisherman's channel 100 feet to the south. Other components for channel modifications relate to requests by the Miami-Dade County Seaport Department to expand their cruise ship terminals.

67. Information was requested from the Coast Guard for incidences of historical groundings, collisions, and allisions of vessels within the navigable waterways of Miami Harbor. This information was provided based on latitudinal and longitudinal data available on the coast guard database from 1992 to 2001. **Table 5** provides a summary of this information.

Table 5 - Coast Guard Vessel Groundings, Collisions, and Allision Incidences

cal_yr	month	service	vessel use	Incidence	location
2001	5	PASSENGER BARGE		ALLISION	CAUSEWAY ISLAND, MIAMI, FL
2001	5	COMMERCIAL		ALLISION	CAUSEWAY ISLAND, MIAMI, FL
1995	9	FREIGHT SHIP	BREAK BULK	ALLISION	CG BASE MIAMI BEACH FL
1995	9	PUBLIC VESSEL,UNC.		ALLISION	CG BASE MIAMI BEACH FL
1994	8	TANK BARGE	BULK OIL/PRODUCTS	ALLISION	DODGE ISLAND BRIDGE
1995	3	TOWBOAT/TUGBOAT		ALLISION	FISHERMANS CHANNEL
1995	3	TANK BARGE	OIL PRODUCTS	ALLISION	FISHERMANS CHANNEL
1999	9	FREIGHT SHIP	ROLL ON, ROLL OFF	GROUNDING	GOVERMENT-CUT - POM
1996	3	TOWBOAT/TUGBOAT		GROUNDING	GOVERNMENT CUT
1995	10	FREIGHT SHIP	BREAK BULK	GROUNDING	GOVERNMENT CUT
1995	10	TOWBOAT/TUGBOAT		GROUNDING	GOVERNMENT CUT
1995	10	TOWBOAT/TUGBOAT		GROUNDING	GOVERNMENT CUT
1996	12	TOWBOAT/TUGBOAT	TOWING	ALLISION	GOVERNMENT CUT BUOY #16
1996	12	TOWBOAT/TUGBOAT		ALLISION	GOVERNMENT CUT BUOY #16
1996	12	FREIGHT SHIP	CONTAINER	ALLISION	GOVERNMENT CUT BUOY #16
1992	6	TOWBOAT/TUGBOAT		GROUNDING	GOVERNMENT CUT, MIAMI, FL
1994	3	FREIGHT SHIP	CONTAINER	ALLISION	LUMMUS ISLAND
1994	3	FREIGHT SHIP	CONTAINER	ALLISION	LUMMUS ISLAND
1997	12	FREIGHT SHIP	BREAK BULK	GROUNDING	MIAMI ANCHORAGE
1995	12	TOWBOAT/TUGBOAT		COLLISION	MIAMI ANCHORAGE
1995	12	FREIGHT BARGE	DREDGE	COLLISION	MIAMI ANCHORAGE
1995	12	RECREATIONAL		COLLISION	MIAMI ANCHORAGE
1994	8	FREIGHT SHIP	CONTAINER	GROUNDING	MIAMI ANCHORAGE
1993	3	PASSENGER	OCEAN CRUISE	ALLISION	MIAMI SHIP CHANNEL
1993	5	FREIGHT SHIP	BREAK BULK	GROUNDING	MIAMI, FL
2001	2	TANK BARGE	BULK OIL/PRODUCTS	GROUNDING	PORT OF MIAMI
2001	2	TOWBOAT/TUGBOAT		GROUNDING	PORT OF MIAMI
1997	12	PASSENGER	FERRY BOAT	COLLISION	PORT OF MIAMI
1997	12	RECREATIONAL		COLLISION	PORT OF MIAMI
1993	12	PASSENGER	PASSENGER O/B	COLLISION	PORT OF MIAMI
1993	12	TANK SHIP	BULK OIL/PRODUCTS	COLLISION	PORT OF MIAMI
1999	6	FREIGHT SHIP	UNCLASSIFIED	COLLISION	PORT OF MIAMI ANCHORAGE
1999	6	INDUSTRIAL VESSEL	DREDGE	COLLISION	PORT OF MIAMI ANCHORAGE
1997	1	PASSENGER	OCEAN CRUISE	ALLISION	PORT OF MIAMI TERMINAL 2
1994	1	FISHING BOAT		GROUNDING	PORT OF MIAMI, FLORIDA
1999	12	FREIGHT SHIP	CONTAINER	ALLISION	PORT OF MIAMI
1999	12	TANK BARGE	BULK OIL/PRODUCTS	ALLISION	PORT OF MIAMI
1996	9	FREIGHT SHIP		GROUNDING	PORT OF MIAMI

Definitions: Grounding—Contact between a vessel and a submerged object. Collision—Contact between two moving vessels. Allision –Contact between a moving vessel and a stationary object, including another vessel.

68. Environmental Considerations: The proposed navigation improvements for widening mentioned above impact reef and seagrass areas. Mitigation proposals

are under evaluation by resource agencies. The Bill Sadowski Critical Wildlife Area (CWA) located south of the Fisherman's Channel has a northern boundary, which appears close to the proposed widener. The boundary for the northern corner of the Bill Sadowski Critical Wildlife Area (CWA) remains unclear between the Port of Miami and the Florida Fish and Wildlife Conservation Commission (FFWCC). According to a consultant for the Port of Miami the coordinates provided in the CWA Establishment Order are unsound. Port of Miami representatives continue to work with FFWCC to resolve the issue. As part of that process, a Specific Purpose survey located the boundary between City of Miami and the Port properties. The minimum distance from the existing channel toe and the boundary is greater than 250 feet. The proposed project extends the existing channel 100 feet to the south and the maximum anticipated slope impact extends 78.25 feet from the new channel toe to top of slope. The worst-case scenario of the NW corner of the CWA coinciding with the maximum extension of the channel 178.25 feet (100 + 78.25) continues to place the proposed project with Port owned lands (178.25 feet < 200 feet), outside the CWA.

69. Terrestrial and marine habitats in the vicinity include beaches, mangroves, seagrass beds, hardbottom and reef communities, rock/rubble bottom, and unvegetated bottom. The Biscayne Bay Aquatic Preserve and the Bill Sadowski Critical Wildlife Area are located in the vicinity. Manatees, crocodiles, sea turtles, and many important species of managed fishes and invertebrates utilize Biscayne Bay and offshore habitats. Protection of vital habitats is essential to the survival and maintenance of stocks of these and other fish and wildlife resources.

70. In accordance with the National Environmental Policy Act (NEPA), an information letter was sent to interested parties on January 6, 2000. In addition, all parties were invited to participate in the plan formulation process by identifying any additional concerns on issues, studies needed, alternatives, procedures, and other matters related to the project. A local, state, and Federal resource agency meeting was held on March 13, 2000, to determine the areas of coverage for an environmental baseline resource survey. A meeting followed on November 1, 2000, with those resource agencies to review preliminary results. Appendix A and Appendix B of the Environmental Impact Statement include all documents associated with scoping including comments received from various stakeholders during the scoping process.

71. Two related environmental documents that have been generated for other Miami Harbor Expansion projects are the 1989 USACE Navigation Study for Miami Harbor Channel Feasibility Report and Environmental Impact Statement and the 1996 USACE Miami Harbor Channel 10140 General Reevaluation Report (GRR).

PLANNING OBJECTIVES AND CONSTRAINTS

72. The Federal objective, required in water and land resource planning, is to make a contribution toward National Economic Development (NED) consistent with protecting the nation's environment. Planning objectives of this study involved the use of available information to evaluate improvements for Miami Harbor to efficiently and safely accommodate larger vessels while preserving natural and recreational resources impacted by navigation improvements. Specific planning objectives for the General Reevaluation Report for Miami Harbor were to:

(1) Determine if sufficient light loading, tidal delay, or other commercial navigation benefits exist to deepen the Federal system of channels from existing project depths of 42 and 44 feet to depths of 50 and 52 feet;

(2) Evaluate components which would reduce the impact of variable and unpredictable crosscurrents in the area of buoy 1, figure 2, at the beginning of the entrance channel and at the Fisher Island turning basin, figure 3, where three channels converge;

(3) Examine components to reduce or eliminate the surge effect on ships docked at the Lummus Island terminals from other passing ships in Fisherman's channel;

(4) Determine if the proposed components meet the needs of future commercial ship navigation requirements;

(5) Identify environmental and cultural resources in the study area and potential impacts from deepening or widening to those resources;

(6) Review the impact of proposed components on the existing harbor maintenance and future dredged material management plans; and

(7) Identify the NED plan for Miami Harbor, which most efficiently and safely accommodates larger vessels while preserving natural and recreational resources.

73. Constraints are restrictions that limit the planning process. Constraints could include resources, legal, or policy constraints. Resource constraints are usually associated with limits on knowledge, expertise, experience, ability, data, information, funding, and time. Legal and policy constraints include those defined by law, Corps policy and guidance. Plan formulation involves meeting the study objectives while not violating constraints. Specific study constraints include:

(1) Structural constraints: Widening at Fisherman's channel and the radius of the Fisher Island turning basin is constrained to the south by development on Fisher Island. The design engineer on behalf of the residents of Fisher Island has requested a 50 ft. buffer from the south edge of the Federal channel to the bulkhead, figure 6.

(2) Environmental constraints: The Fisher Island turning basin is also constrained by seagrasses to the north, figure 3, which will require mitigation if impacted. The Bill Sadowski Critical Wildlife Area (CWA) located south of Fisherman's channel may constrain future channel widening to the south in that area, figures 6 and 7. Reef and seagrass areas impacted by widening within a proposed project area will require mitigation. A proposed project would minimize or avoid possible adverse effects of the action on seagrasses, fish, and wildlife resources including affects due to potential blasting during construction.

74. The formulation and analysis of alternative plans to achieve planning objectives were based on Water Resources Council's Principles and Guidelines (P&G), the National Environmental Policy Act (NEPA) of 1969, and related Corps regulations. Those guidelines provide for developing alternative resource management systems that address planning objectives.

75. The P&G has a general requirement that all studies formulate and evaluate alternative improvement plans. The aim is to provide a basis for determining the completeness, effectiveness, efficiency and acceptability of the recommended plan. The comparison of NED benefits and costs serves as the basis for determining the efficiencies of the various plans, including the locally preferred plan if it differs from the Federally supportable plan (i.e., the NED plan or granted exception to the NED plan). The cost of the Federally supportable plan is the foundation from which special cost sharing for the locally preferred plan is determined.

76. The NEPA requires analysis, public comment, and reporting for environmental impacts of Federal actions. Title I requires that all Federal agencies prepare detailed environmental impact statements for "every recommendation or report on proposals for legislation and other major Federal action significantly affecting the quality of the human environment". Title II of this statute requires annual reports on environmental quality from the President to the Congress, and establishes a Council on Environmental Quality (CEQ) in the Executive Office of the President with specific duties and functions. The CEQ regulations state "Agencies shall make diligent efforts to involve the public in preparing and implementing their NEPA procedures". NEPA also requires consultation with agencies or technical experts that have participated in the planning process and have provided significant information and recommendations. This coordination is presented in the Environmental Impact Statement that is part of the report.

SHIP SIMULATION TESTING

77. In order to allow larger cruise ships and container vessels the opportunity for safer transits into and out of the Port of Miami, study team members including the Biscayne Bay Pilots, Port of Miami representatives, shipping interests, environmental interests, U.S.C. G. and the U.S. Army Corps of Engineers have proposed a series of improvements to the navigation channels and turning basins at the Port. These improvements are measures or components that provide the basis to form alternatives and are shown in figures 1-10. They are described as follows:

- **Component 1**(figures 1-2)**:** Government Cut serves as the entrance channel for the port. It consists of a series of channel segments identified as Cuts 1 and 2. Proposed project depths for Government Cut range from 44 feet up to 52 feet. A 50-foot project depth represents the maximum depth under consideration for any of the inner harbor channels. An additional two feet for the outer channel allows for vertical motion due to waves. Component 1 widens the seaward portion of Cut 1 from 500 to 800 feet.

- **Compoment 2** (figure 3): To ease the turn between Government Cut and Fisherman's Channel, a widener on the south side of Government Cut, just inside the jetties, was proposed. The proposed maximum channel depth would be 50 ft.

- **Component 3** (figures 3 and 6)**:** Expand Fisher Island Turning Basin from 1200 ft to 1500 ft. Ships turning to back into Fisherman's Channel or ships docked bow first and backing into the turning basin will use the enlarged turning basin. The proposed turning area will have a maximum depth of 50 feet.

- **Component 4** (figures 4 and 5) **:** To allow additional cruise ship berths on the north side of the main channel it is proposed to shift the western end of the main channel south. This will allow ships transiting to the main channel turning basin to pass ships docked at the proposed berths. There will be no deepening for this component; depth will remain at 36 feet.

- **Component 5** (figures 6 and 7)**:** Widen Fisherman's Channel 100 ft to the south. This will allow larger beam containerships to pass vessels docked along the Fisherman's Channel piers.

- **Component 6** (figures 7 and 8)**:** Deepen Dodge Island Cut and the proposed 1200 feet turning basin to 36 feet. The western end of

Dodge Island Cut will be extended westward to accommodate proposed port expansion.

78. Evaluatation of the proposed six improvements proposed for Miami Harbor consisted of a navigation study involving real-time ship simulation modeling. Because of their proximity to the project site, the study was contracted to the Simulation Training Analysis and Research (STAR) Center in Fort Lauderdale, FL. The online testing for the simulation study was conducted during the fall of 2000. Engineering - Appendix B contains a summary of the ship simulation modeling results.

79. The Port of Miami has also conducted a Passing Ship-Moored Ship Study for Container Ship Berths, draft dated July 2002 (Project Number 172585. This report was prepared by Gee & Jensen, a Division of CH2M Hill, Tampa, Florida). This study evaluated the safe mooring of a Maersk S-Class vessel at container berths 1 and 2 while another S-class transits through Fishermen's Channel. Recommendations for container berth mooring improvements and safe mooring practices are based on an analysis that considers widening Fisherman's channel by 100 feet to the south and a project channel depth of 50 feet. The mooring analysis indicates that the existing configuration of wharf mooring hardware with a limited number of new intermediate mooring points and 10-foot diameter foam-filled fenders provide suitable restraint for the moored ships during passing ship events. The super post-panamax ships are beyond the scope of this study.

ALTERNATIVE PLAN CONSIDERATIONS

80. Alternative plans are different combinations of individual measures or components. Components that generate benefits interdependently are inseparable and must be included collectively in the formulation of alternative plans. Potential transportation cost reduction benefits that are attainable through improvements to the Port are as follows: reduction in the number of tug assists needed for Post-Panamax container vessels, resulting from widening of the channel; a decrease in the time spent by vessels while navigating the channel because of the availability of an additional turning basin, resulting from extending the Fisher Island Turning Basin; and, a reduction in, or an elimination of, light loading, resulting from deepening the channel.

Components of Alternatives

81. The following components provide the necessary navigation improvements to achieve cost reduction benefits required to evaluate transportation savings:

- Component 1C (figures 1 and 2) – 1C involves flaring the existing 500-foot wide entrance channel to provide an 800-foot wide entrance at buoy 1. The widener extends from the beginning of the entrance channel about 150 feet

parallel to both sides of the existing entrance channel for about 900 feet before tapering back to the existing channel edge over a total distance of about 2000 feet. Deepening of the entrance channel and proposed widener along Cut-1 and Cut-2 from an existing depth of 44 feet in one-foot increments to a depth of 52 feet received consideration.

a. Four different versions of Component 1 received consideration during the plan formulation process as shown in figure 2. Receipt of the Baseline Environmental Resource Survey and ship simulation results allowed additional evaluations of the entrance channel alternatives based on the location of environmental resources and ship transits.

b. Further discussions with the Biscayne Bay Pilots resulted in three additional modifications of component 1 to arrive at 1C, which totally avoids one reef area. 1B avoided both reef areas, but did not provide widening in the area of the variable and unpredictable north and south currents, which have resulted in several ships grounding. Component 1A avoided one reef location, but did not provide sufficient widening in the area where currents impact vessel transits.

- Component 2A (figure 3) – 2A widens the southern intersection of Government Cut with Fisherman's channel at buoy 15. The length of the widener is about 700 feet with a maximum width of about 75 feet. Depths considered for 2A varied from an existing project depth of 42 feet to 50 feet.

  a. Two different orientations for the widener received consideration, which included alternatives 2 and 2A. The first recommended by the Biscayne Bay Pilots labeled as alternative 2 in figure 3 extended from the southern edge of Fisherman's channel parallel to Government Cut between buoys 13 and 15 over a distance of about 2400 feet.

  b. Ship simulation testing of component 2 indicates the pilots did not use the widener during any of the simulation exercises. Subsequent discussions on May 16, 2001, with the Biscayne Bay Pilots resulted in a reduction of the widener from a length of 2400 feet to 700 feet. During a later review of the revised component 2A at the pilot station, a ship grounded at the location of the proposed widener.

- Component 3B (figure 3) - Component 3B involves extending the existing Fisher Island turning basin to the north. A turning notch of about 1500 feet by 1200 feet extends approximately 300 feet to the north of the existing channel edge near the West End of Cut-3. Depths from 43 to 50 feet at one-foot increments below the existing depth of 42 feet received consideration in the area of the turning notch.

a. Component 3 proposed a 1600-foot diameter turning basin. Review of the Baseline Environmental Resource Survey and ship simulation tests resulted in component 3A, which reduced the turning basin to a turning notch of about 1500 by 1450 feet. Since ship simulation testing indicated the pilots did not use the northernmost section of component 3, component 3A resulted. This avoided most of the seagrasses to the north, but still had some impacts.

b. Later discussions on May 16, 2001, with the Biscayne Bay Pilots resulted in the pilots' proposal 3B, which almost completely avoided the seagrass area to the north by truncating the northeast section of the turning basin.

- Component 4 (figures 4 and 5) - Component 4 consists of relocating the west end of the main channel (cruise ship channel or Cut-4) about 250 feet to the south between channel miles 2 and 3 to the existing cruise ship turning basin. No dredging is expected for component four since existing depths allow for continuation of the authorized depth of 36 feet.

- Component 5A (figures 6 and 7)- Component 5A proposes to increase the width of the Lummus Island Cut (Fisherman's Channel) about 100 feet to the south of the existing channel. Deepening proposals examined depths below the existing 42-foot depth at one-foot increments from 43 to 50 feet along the proposed widened channel.

    a. During the ship simulation exercise, Component 5 provided additional room for vessels passing berthed ships along the container terminals. The pilots used the additional width during almost every proposed condition tested in the Fisherman's Channel.

    b. Component 5A resulted from the coordination with Fisher Island's engineering representatives to improve clearance between the proposed widener and a proposed new bulkhead in that area.

- Component 6 and 6A (figure 8) - includes deepening of Dodge Island Cut and the proposed 1200-foot turning basin from 32 and 34 feet to 36 feet. It also involves relocating the western end of the Dodge Island Cut to accommodate proposed port expansion.

    a. During the ship simulation testing a number of ships left the south side of the channel segment between Lummus Island Turning Basin and Dodge Island Turning Basin.

    b. The USACE Engineering Research and Development Center (Waterway Experimental Station) recommended Component 6 on

the condition that the southern edge of that segment is widened 50 feet, which resulted in Component 6A.

Alternative Plan Formulations

82. Alternative plans are different combinations of individual measures or components, figure 1. Components that generate benefits interdependently are inseparable and must be included collectively in the formulation of alternative plans. Nine alternative plans can be formed from the three benefit categories presented:

- Alternative Plan A: No Action Plan
- Alternative Plan B: Widen the Channel (Components 1C, 2A, and 5A)
- Alternative Plan C: Extend the Fisher Island Turning Basin (Component 3B)
- Alternative Plan D: Widen the Channel (Components 1C, 2A, and 5A) and Extend the Fisher Island Turning Basin (Component 3B)
- Alternative Plan E: Deepen the Previously-Authorized Channel Configuration
- Alternative Plan F: Widen the Channel (Components 1C, 2A, and 5A) and Deepen the Resulting Channel Configuration
- Alternative Plan G: Extend the Fisher Island Turning Basin (Component 3B) and Deepen the Resulting Channel Configuration
- Alternative Plan H: Widen the Channel (Components 1C, 2A, and 5A), Extend the Fisher Island Turning Basin (Component 3B), and Deepen the Resulting Channel Configuration.
- Alternative I: Consists of components 6 and 6A.

83. Three categories of potential transportation cost reduction benefits are attainable through improvements to the Port:

- The first benefit category is a reduction in the number of tug assists needed for Post-Panamax container vessels, resulting from widening the channel (Components 1C, 2A, and 5A—these components are inseparable; they all need to be in place in order to accrue this benefit).
- The second benefit category is a decrease in the time spent by vessels while navigating the channel because of the availability of an additional turning basin, resulting from extending the Fisher Island Turning Basin (Component 3B).
- The third benefit category is a reduction in, or an elimination of, light loading, resulting from deepening the channel.

With and Without Project Conditions

84. The alternatives provide engineering solutions to address the problems identified. However, in order to assess the environmental and economic viability of these problems, an evaluation in terms of channel widening, turning basin extension, and deepening was required to assess the with and without project conditions related to improvement features.

Channel Widening

85. Channel widening components comprise widening the seaward portion of the entrance channel from 500 feet to 800 feet (Component 1C – figure 2), dredging the widener between buoys 13 and 15 (Component 2A – figure 3), and widening Fisherman's Channel approximately 100 feet to the south (Component 5A – figures 6 and 7). The purpose of Channel Widening is to increase safety, reduce damages, reduce delays, and avoid increases in tug assist costs for the Post-Panamax vessels that are expected to call in the future. Ships have grounded at the entrance channel due to variable and unpredictable currents. Existing conditions allow surging effects that prevent cargo vessels at berth from discharging or loading cargo when a vessel passes.

86. In the without-project condition, as Post-Panamax vessels begin to call, grounding frequency and associated safety reduction and incurred damages will increase. Surging caused by passing vessels will worsen. The Post-Panamax vessels will require extra tug assistance.

87. In the with-project condition, groundings will be significantly reduced. Surging caused by passing vessels will be lessened. Post-Panamax vessels will require less tug assistance. Benefits attributable to channel widening include: (1) reduced damages; (2) reduced delays (vessels holding until grounded vessel is removed and less interruption to discharging vessels); (3) increase in navigation safety; and (4) reduction in tug assist costs.

Fisher Island Turning Basin Extension

88. The existing Fisher Island Turning Basin is not large enough for maneuvering the Post-Panamax container vessels that are expected to call in both the without- and with-project conditions. Without the Fisher Island Turning Basin Extension (Component 3B – figure 3), these vessels can turn in the previously authorized 42' deep Lummus Island Turning Basin, but extending the Fisher Island turning basin would provide a closer place to turn for the larger vessels. Therefore, this increment would provide more flexibility in allocating turning basin use among vessels, leading to timesaving efficiencies.

Fisherman's Channel, Fisher Island Turning Basin, and Lummus Island Turning Basin Deepening

89. Panamax and future-calling Post-Panamax container vessels arriving to or departing from Miami Harbor cannot fully load because of current channel depths. In the without-project condition, this light loading of vessels will sustain current transportation costs. Deepening the channel will allow vessels to more fully load, increasing efficiency. Benefits to deepening are reduced transportation costs resulting from the partial or full elimination of light loading.

ECONOMIC CONSIDERATIONS FOR BENEFIT EVALUATION

90. National Economic Development (NED) benefits were assessed for all alternatives following the methodology for deep-draft commercial navigation analysis described in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* and other relevant Corps of Engineers analyses and policy guidance.

91. Proposed channel improvement alternatives that would result in delay reduction benefits include: widening the entrance channel, inner entrance channel between buoys 13 and 15, and the Fisherman's Channel to provide safe navigation for all vessels, particularly post-Panamax containerships; widening the Fisher Island turning basin to improve vessel access and reduce delays; extending the Dodge Island Channel to provide access to planned expanded cruise facilities; and constructing a turning basin at Dodge Island to accommodate the cruise ships using the channel.

92. The benefits of channel widening improvements were estimated in terms of reductions in harbor transit times and consequential vessel delays. Transit times and transportation costs were estimated by analyzing the most likely condition in the absence of an improved channel at Miami Harbor, that is the without project condition, and the proposed channel improvement alternatives for the period 2010-2060. Deepening the channel results in cost efficiencies that accrue, as vessels are able to increase loading and reduce transits.

93. Transit times for navigation of Miami Harbor are largely a function of vessel speed. Variations in vessel speeds are due to vessel size and type and geographic limitations. The larger the vessel, the more difficult it is to maneuver, and therefore, the slower the transit speed. Restricted reaches along the channel also necessitate slower transit speeds. A survey of Miami Harbor's pilots was conducted to elicit information on transit speeds by vessel class for each reach of the Miami Harbor navigation channel. Additionally, the pilots provided information on transit times based on experience by vessel type and destination berth.

94. The key factors in determining the level of benefits derived from proposed improvements are the fleet composition and vessel operating features (cost and underkeel clearance), and cargo growth. Another key factor is the design vessels used in the analysis. The selection of design vessels is not only critical for estimating benefits, but for determining the operational feasibility of the proposed improvements.

Fleet Composition

95. Vessels were divided into classes according to size and use. The vessel classifications describe the attributes of all vessel types that were analyzed. Vessel classifications were standardized for this effort and are summarized in the Economics - Appendix A. The important characteristics of the existing vessel fleet are the dimensions and types of the vessels.

96. Vessel operating costs by vessel class for FY 2004 were obtained from the Institute for Water Resources (IWR). The costs represent daily operating costs for U.S. and foreign vessel classes engaged in trade at U.S. deep-draft ports and are specific for vessel flag, type, and size**.** The costs are published annually by IWR in an Economics Guidance Memorandum (EGM) and intended for use in Corps' planning studies. The latest IWR publication is EGM 02-06, Deep Draft Vessel Operating Costs. The vessel replacement cost component was updated using the FY 2004 Federal interest rate of 5 5/8 percent.

97. The historical minimum underkeel clearance is at least three feet for Panamax container ships. This was determined by analyzing the minimum underkeel clearance used by each vessel as it transited the channel. A sample of historical transit drafts of vessels calling at Miami Harbor was matched with actual tide elevations occurring at the times of transit. Maersk Sealand has a standard of 1.1 meters (3.6 feet) for underkeel clearance for its containerships when they are underway. A review of current practice for the Maersk Sealand Panamax Class (M-class) shows that they use at least three feet of underkeel clearance at the dock. Taking into consideration the Corps of Engineers channel design standard of three feet of underkeel clearance for hard bottom channels, the current actual practice of using at least three feet of underkeel clearance at the dock, and the Maersk Sealand standard of 3.6 feet of underkeel clearance while underway, three feet of underkeel clearance was used for the economic analysis for the large container ships. It should be noted that through a partnering agreement other shipping companies ship their containers on the Maersk Sealand vessels. So, with respect to Maersk Sealand vessels, the Maersk Sealand M-class and S-class container ships are considered generic; that is, they represent similar size container ships owned by other shipping companies.

Commodity Growth

98. Historically, cargo growth has varied by trade region and by direction (origin/destination). It is expected that cargo will continue to grow in a similar pattern in the future; that is, the future will reflect, in part, the past, as no significant changes in the pattern of cargo traffic are anticipated without or with the project.

99. Container and trailer cargo represents 97.4 percent of all cargo. The remaining 2.6 percent consists of neobulk and breakbulk cargo. Because neobulk cargo and breakbulk cargo represent such a small portion of the overall cargo handled at the Port of Miami, they have an insignificant impact on current and future cargo and vessel traffic at the Port. Accordingly, for the analysis, neobulk cargo and breakbulk cargo are not analyzed separately, but are accounted for by including them in containerized cargo. Specifically, tonnage associated with these cargo types is accounted for in the projected future. This is a reasonable simplification as more and more neobulk and breakbulk cargos are being shipped in containers.

100. Details of the commodity tonnage can be found in the Economics - Appendix A. **Table 6** displays the summary of actual and projected short tons by the trade regions of Latin America and Caribbean, Asian Far East, Europe, Middle East, and North America. The projected total short tons are displayed by trade region to include study year through base year 2010, and 5-year increments. Using the previously described procedure for estimating the average annual rate of change in cargo tonnage from 2002 (last full year of actual recorded tonnage) to the end of the study period (2060) resulted in the following the average annual rates of growth by trade region: Latin America and Caribbean, 4.43%; Asian Far East, 5.26%, Europe, 5.28%,Middle East, 0.99%, North America, 2.93%, and an overall rate of 4.72%.

Table 6 - Summary of Actual and Projected Short Tons by Trade Region

Year	Latin America & Caribbean Total Short Tons	Far East (Asian) Total Short Tons	Europe Total Short Tons	Middle East Total Short Tons	North America Total Short Tons	All Regions Total Short Tons
2000	4,693,539	887,509	1,858,625	44,882	320,391	7,804,946
2001	5,072,892	954,163	1,817,706	62,981	339,262	8,247,004
2002	5,281,079	1,082,402	1,944,306	190,899	183,049	8,681,735
2003	5,601,144	1,159,296	2,080,549	193,243	190,371	9,224,603
2004	5,940,609	1,241,712	2,226,607	195,630	197,986	9,802,544
2005	6,300,651	1,330,050	2,383,201	198,058	205,905	10,417,865
2006	6,682,516	1,424,739	2,551,105	200,530	214,141	11,073,031
2007	7,087,528	1,526,242	2,731,151	203,046	222,707	11,770,674
2008	7,517,091	1,635,051	2,924,233	205,607	231,615	12,513,597
Base yr. --**2010**	8,455,910	1,876,757	3,353,418	210,866	250,515	14,147,465
Year 5 -- 2015	11,348,538	2,651,213	4,731,217	224,855	304,790	19,260,613
Year 10 -- 2020	15,230,851	3,749,397	6,691,339	240,134	370,824	26,282,545
Year 15 -- 2025	20,441,515	5,308,132	9,484,393	256,821	451,164	35,942,025
Year 20 -- 2030	26,651,098	7,268,967	13,012,751	273,161	538,354	47,744,330
Year 25 -- 2035	30,942,368	8,682,893	15,565,936	282,854	594,386	56,068,437
Year 30 -- 2040	35,924,707	10,374,534	18,628,495	292,986	656,250	65,876,972
Year 35 --2045	41,709,420	12,398,890	22,303,128	303,577	724,553	77,439,568
Year 40 --2050	48,425,745	14,821,925	26,713,378	314,647	799,965	91,075,660
Year 45 -- 2055	56,223,736	17,722,769	32,007,880	326,220	883,226	107,163,832
Year 50 --2060	65,277,624	21,196,363	38,365,471	338,316	975,153	126,152,927

1/ 2002 is latest complete fiscal year of reported cargo from port records.

101. Projection of tonnage based on two commodity classes (container and Ro/Ro-General Cargo) are shown in **Table 7**, along with projected cruise ship passengers. The annual growth rates used for the 50-year study period (2010-2060) resulted in the following effective compound annual growth rates: containers, 4.47 percent. Ro-Ro cargo (i.e., trailer cargo that is containerized cargo that is carried on RO/RO's), 4.47 percent; and passengers, 2.00 percent for the period 2010-2060. It is assumed for this analysis that the compound annual growth rate for cruise ship passengers will be 2 percent, the same as the historical compound annual growth rate for the 10-year period, 1990 to 2000. These growth rates are assumed to occur without or with any harbor improvements.

Table 7 - Forecast Tonnage by Commodity Class

Forecast Commodity Tonnage Without Project/ With Project Conditions	2010	2020	2030	2040	2050	2060
Containers	9,058,295	16,827,157	30,565,148	42,247,460	58,394,870	80,713,985
Ro-Ro, Lo-Lo	5,095,291	9,465,276	17,192,896	23,764,196	32,847,114	45,401,616
Total	14,153,586	26,292,433	47,758,044	66,011,656	91,241,984	126,115,601
Cruise Passengers	4,183,511	5,099,676	6,216,477	7,577,851	9,237,357	11,260,287

102. Given forecast commodity traffic, future vessels calls were estimated based on forecast vessel calls at the port under the without project condition and the proposed channel improvement alternatives. The future fleet includes the addition of the SUSAN MAERSK and other Post-Panamax containerships, as well as the continued arrivals of mega-cruise ships. The forecasted vessel trips that were used to estimate delay reduction benefits are displayed in **Table 8**. It is important to note that the forecast future vessels calls are identical in the with- and without project conditions (without deepening).

Table 8 - Forecast Vessel Trips

Forecast Vessel Trips Without/ With Project Conditions						
Commodity	2010	2020	2030	2040	2050	2060
Containers	1,225	1,391	1,695	2,119	2,642	3,377
Ro-Ro, Lo-Lo	1,313	1,431	1,677	2,004	2,245	2,603
Cruise	1,177	1,224	1,278	1,366	1,525	1,690
Total	3,715	4,046	4,650	5,489	6,412	7,670

Design Vessel

103. A design vessel represents the largest vessel class that is expected to call over the study period of analysis. It is important to identify the design vessel(s) so that decision makers can be reasonably confident that the significant study

and project costs will result in a channel design that will accommodate vessel traffic for the foreseeable future at Miami Harbor. Miami Harbor is considered a "clean port"; (i.e., it does not handle bulk cargoes or potentially dangerous or hazardous cargos such as fuel oil). Accordingly, only two types of vessels need to be considered: container ships and passenger (cruise) ships.

104. The District was advised by Maersk that the largest container ships that it would use at the Port of Miami in the near-term future are its 6,600-TEU S-Class container ships that are 1,138.4 feet long with an extreme breadth 140.8 feet and a design draft of 47.6 feet. There are 37 6,000+ TEU Post-Panamax container ships in the world fleet (Lloyd's Register of Ships, April 2001). Of the 37, Maersk owns and operates 21 S-Class vessels in its fleet, which are currently deployed in the Europe-Far East trade and the Far East-U.S. West Coast trade. The Maersk Sealand's SUSAN MAERSK was selected for the design vessel for the economic analysis.

105. Because of the growth in cruises, channel improvements, as well as a Dodge Island turning basin, are being considered for the Dodge Island Terminal Number 12 (south western side of Dodge Island). Since November 2001, Celebrity Cruise Lines' HORIZON has utilized this terminal. The HORIZON is 682 feet long, with a beam of 96 feet, and a draft of 24 feet. Based on discussions with the Port, the CARNIVAL DESTINY was selected as the design vessel for this project alternative. The CARNIVAL DESTINY is 893.5 feet long, with a beam of 116, and a draft of 27 feet.

106. Lloyd's Register of Ships was also reviewed for the selection of a cruise ship design vessel. Based on the review, the Royal Caribbean International's VOYAGER OF THE SEAS was selected as the design vessel for the study. It is 137,300 GRT, is 1,021 feet long, and has a beam of 156 feet and a design draft of 28.2 feet. This cruise ship, which is currently calling, is considered the largest cruise ship likely to call at Miami Harbor for the foreseeable future. Presently, Royal Caribbean International has two VOYAGER-class ships calling at Miami Harbor: the VOYAGER OF THE SEAS and the EXPLORER OF THE SEAS. The draft requirement of the design vessel does not present a problem as the Main Channel has a project depth of 36 feet. Modern cruise ships are designed with drafts that can be accommodated by the shallow depths at their ports-of-call. However, the QUEEN MARY II, which is scheduled for completion in 2003, will be 1,131 feet long with a beam of 131 feet and a design draft of 32.8 feet. Thus, the QUEEN MARY II is 110 feet longer than the VOYAGER OF THE SEAS, but its beam is 25 feet less. Because it is longer, and could potentially call, the SUSAN MAERSK container ship with a length of 1,138 feet and a beam of 141 feet was turned in the Main Channel Cruise Ship Turning Basin during the ship simulation. There were no problems with turning the large container ship.

BENEFIT SUMMARY

107. The benefit methodology considers historical, present, and expected, future trends in vessel fleet composition, vessel itineraries, and trade routes that impact the Port of Miami. Given that so many Post-Panamax container ships are being built, it is assumed that Post-Panamax container ships will be deployed on the East-West Atlantic trade route, with calls at U.S. East-Coast ports, before the base year (2009) of the Miami Harbor project. It is also assumed that the itineraries will include calls at Miami Harbor. Accordingly, it is assumed for this analysis that the Panamax container ships currently calling at Miami Harbor as part of the European, Mediterranean, and Asian trade will be gradually replaced by Post-Panamax container ships over the study period beginning prior to the base year (2009) of the study.

108. The only thing that is physically preventing the deployment of Post-Panamax container ships at Miami Harbor is an adequate size turning basin. The Lummus Island Turning Basin has been authorized, funded, and will be constructed prior to the base year. The 1500 foot diameter turning basin will be sufficient for turning the Post-Panamax container ship design vessel SUSAN MAERSK. The Ship Simulation verified this. Thus, it is assumed that Post-Panamax container ships will call in the without-project condition, prior to the base year. The depth of the Lummus Island Turning Basin will be commensurate with the existing project channel depth, 42 feet.

Streams of Benefits and Costs

109. The bulk of a project estimated cost is generally incurred during the construction period. Benefits on the other hand, typically are realized as uneven flows of income or monetary benefits that accrue over a long period of time. The time frame period of analysis is 50 years. Decision criteria must provide a means of comparing the values of these streams of money on an equal basis.

110. It is recognized that a dollar today is worth more than a dollar in the future. To account for these differences in the time value of money, monetary values are “discounted”, i.e., amounts of money realized in the future are expressed as equivalent amounts of money today tied in to a discount rate at a given price level. Planners are directed to use price levels prevailing during the planning period, i.e., fixed to a month and year. The discount rate formula has been prescribed by Section 80 of the Water Resources Development Act of 1974. It is published annually by the Headquarters of the U.S. Army Corps of Engineers on a fiscal year basis. The discount rate in affect for FY 2004 is 5 5/8%

Channel Widening Analysis

111. The first increment examined is channel widening. These are components 1C, 2A, and 5A, of figure 1 which comprise Alternative B. However, with the

inclusion of Post-Panamax vessels in the fleet, a second increment of extending the Fisher Island turning basin, Component 3B of figure 1 is considered. Component 3B alone is called Alternative C. The combination of Alternative B and C formulates Alternative D (channel widening components 1C, 2A, and 5A along with component 3B, Fisher Island turning basin extension). Adjustments were made to each alternative to incorporate the following assumptions:

1) Widening entrance channel, buoys 13-15, figure 3, and Fisherman's channel – In the absence of improvements in Miami Harbor, the *Susan Maersk* (S-Class) and similarly-sized Post- Panamax vessels, would need to lightload and transit the channel with the assistance of 3 tugs at a dead-slow speed. The transit would be 30 minutes slower than normal. The container fleet distribution would change over time, eventually composed entirely of Panamax and Post-Panamax vessels in the Far East, European and Mediterranean trades. With improvements, the container vessels would continue to lightload and require the assistance of two tugs, but could transit the channel at a more normal speed. The incremental savings, which represents vessel delay reduction benefits, are the foregone costs of the third tug assist and reduced transit time (input from Biscayne Bay pilots and Coastal Tug and Barge).

2) Widening Fisher Island Turning Basin (figure 3) - In the absence of improvements, Post-Panamax vessels calling at Miami are constrained to use of the Lummus Island turning basin (figure 7) only, resulting in additional transit time and delays for vessels berthing closest to the Fisherman's Channel entrance. With improvements, vessels have the option of turning before or after berthing. Pilots will have more flexibility to manage traffic and minimize delays within Miami Harbor. The incremental savings, which represent vessel delay reduction benefits, are the reduced transit times and delays for vessels transiting and berthing on Fisherman's channel.

3) Constructing Dodge Island Turning Basin (figure 8)- In the absence of improvements, cruise ships on the south pier would use the Lummus Island turning basin for maneuvering. Given the priority of cruise ships in Miami Harbor, such use would interfere with commercial cargo operations and result in delays for cargo vessels. With improvements, the cruise ships would have an exclusive turning basin. The incremental savings, which represent vessel delay reduction benefits, are the foregone interference and delay costs for cargo vessels transiting Fisherman's channel. The interference costs take into account the cruise ship's schedule and probability of being delayed.

112. In analyzing the benefits of the Dodge Island Channel extension, a different technique was used. According to guidance developed by IWR, benefits associated with cruise ships from harbor improvements could accrue from three sources: 1) existing vessels using a harbor under without-project conditions operate more efficiently in that same harbor under with-project conditions; 2) vessels using one harbor under without-project conditions transfer to the improved harbor under with-project conditions; and 3) new vessels (larger, with more amenities) begin using a harbor under with-project conditions that they did not use under without-project conditions. Benefits could accrue to both vessel operators and passengers under each of the three scenarios.

113. In the absence of improvements, the cruise ship *Horizon* would represent the maximum-sized/capacity vessel that could operate on the south pier. The vessel LOA is 727 feet and it passenger capacity is 1,354. With improvements, a larger vessel could operate in place of the *Horizon.* The design vessel is the *Destiny,* which has an LOA of 893 feet and a passenger capacity of 2,642. Given an identical itinerary, the *Destiny* could accommodate nearly twice the number of passengers per trip. While additional passengers and a larger vessel result in higher costs per voyage, the opportunity to use the larger vessel on the same itinerary will result in increased income. The incremental benefits are the net incomes that accrue from the additional passengers. The annual reports of the major cruise lines were referenced to calculate a representative net income per passenger estimate. Over time, as the demand for cruises increase, additional vessels would be expected to berth on the south pier.

114. Incremental savings, by decade, for each of the channel improvement alternatives are presented in **Table 9.** Each of the alternatives result in significant transportation cost reductions over the without project condition. The Channel Widening results in average annual savings ranging from about $ 0.3 million in 2009 to about $ 15.6 million in 2059. While the entrance channel widening provides safe navigation for the SUSAN MAERSK and other Post-Panamax vessels, another advantage of the widened channel is that it allows smaller vessels (maximum 80’ beam) to pass in the channel. These vessels make up a significant proportion of traffic at Miami Harbor. Given that cruise ships do not experience delays because of priority berthing and pilotage, no delay reduction savings were claimed for any of their vessel classes.

Table 9 - Annual Transportation Costs Savings
($ 000)

Annual Transportation Cost Savings (Thousands of FY04 dollars)						
Alternatives	2010	2020	2030	2040	2050	2060
Without Project Condition	--	--	--	--	--	--
Widening (EC, Buoys 13-15, FC)	$431	$1,455	$3,585	$5,466	$9,663	$15,565
Fisher Island Turning Basin Widening	$250	$639	$1,515	$2,570	$4,416	$7,239
Dodge Island Channel Extension	$529	$1,058	$2,115	$2,115	$2,115	$2,115
Dodge Island Turning Basin Construction	$519	$650	$773	$943	$1,123	$1,339

115. Cost reduction benefits for the proposed channel improvement increments of entrance channel widening, Fisher Island turning basin widening, Dodge Island channel extension, and Dodge Island turning basin construction for Miami Harbor are summarized in **Table 10**. The benefits reflect an interest rate of 5 5/8 percent and October 2003 (FY04) price levels.

Table 10 - Miami Harbor Benefits Summary for Channel Widening

Miami Harbor Improvement Component Sets Benefit Summary (Thousands of FY04 dollars)		
Alternatives	Total Present Worth	Average Annual Benefits
Without Project Condition	--	--
Widening (Ent. Chan., Buoys 13-15, Fishmn's Chan.)	$47,343	$2,848
Fisher Island Turning Basin Widening	$21,483	$1,292
Dodge Island Channel Extension	$23,014	$1,384
Dodge Island Turning Basin Construction	$12,158	$731

116. As shown in Tables10 and 19 the Average Annual Equivalent (AAEQ) transportation benefit for widening the entrance channel at buoys 13 and 15, and Fishermans channel is $2,848,000. The AAEQ cost is $1,455,000. The net benefit of this feature is $1,393,000. This widening is necessary prior to the accruing benefits to the Fisher Island Turning Basin and channel deepening. This finding eliminates four of the alternative plans, leaving Alternative Plans B, D, F, H, and I.

117. The second increment examined is extending the Fisher Island Turning Basin, Component 3B. The incremental AAEQ benefit realized from adding this component is $1,292,000. The incremental AAEQ cost is $238,000. The incremental AAEQ benefit is $1,054,000. As this increment shows that the marginal benefit exceeds the marginal cost this finding eliminates two of the remaining alternatives, leaving Alternative Plans D, H, and I.

118. For Alternative Plan I, comprising the extension of the Dodge Island Channel and the construction of the Dodge Island Turning Basin the components were found to be unfeasible following a preliminary benefit/cost analysis. Therefore, they were not included in the final set of Alternative Plans

Vessel Utilization Savings (Deepening Benefits)

119. The final set of increments examined is deepening the newly configured channel from 43 to 50 feet. Transportation costs for the without and with-project conditions were estimated in one-foot increments to compute the National Economic Development (NED) benefits associated with the project deepening. The difference between the without- and with-project costs represents the benefits of the deepened channel. Cost efficiencies accrue, as vessels are able to increase loading and reduce transits. A detailed description of the methodology, assumptions and parameters employed is found in Vessel Utilization Savings (Deepening Benefits) section of the Economics - Appendix A.

120. As previously discussed in ECONOMIC CONSIDERATIONS FOR BENEFIT EVALUATION, total transportation costs are estimated using the specifications of each vessel (average deadweight, length overall, beam, design draft, speed, and so forth) along with estimated vessel transit characteristics, transit mileage, and vessel hourly operating cost data developed by the Corps' Institute for Water Resources (IWR).

121. Vessels currently calling that could benefit from a deeper channel at Miami Harbor are the Panamax Class vessels represented by the Maersk Sealand M-class container ships; vessels expected to call in the future that could benefit are Post-Panamax container ships, like the design container ship, SUSAN MAERSK, a Maersk Sealand S-class vessel. The analysis assumes that as the Post Panamax vessels begin to call at Miami Harbor, they will gradually replace smaller Sub Panamax vessels; in later years of the project, they will gradually replace some of the Panamax vessels. The analysis focused on these vessel classes and their proportion of the total cargo handled by the Port.

122. The analysis predicted a gradual transition to larger vessels for the life of the project. The assumed distribution of calls for each year of the project was a function of the distribution of calls that actually occurred in 1999. Post-Panamax vessels replace smaller vessels, that is, Sub-Panamax class container ships. This replacement increases in a straight-line fashion until in the later years of the

50-year study period the fleet consists of only Panamax and Post-Panamax container ships in the Far East, European and Mediterranean trades. **Table 11** displays the percentage of export and import tonnages for these trade regions.

Table 11: Percentage of Tonnage by Trade Region at Miami Harbor

Trade Region	2002 Import Tonnage	Trade Region Share of Import Tonnage	2002 Export Tonnage	Trade Region Share of Export Tonnage	2002 Total Tonnage	Trade Region Share of Total Tonnage
Far East	746,862	31%	335,540	43%	1,082,402	34%
Europe	1,549,637	64%	394,669	50%	1,944,306	60%
Mediterranean	131,713	5%	59,186	7%	190,899	6%
Total	2,428,212	100%	789,395	100%	3,217,607	100%

123. The Economics - Appendix A provides a detailed description of transportation costs without and with the project in one-foot deepening increments. The difference between transportation costs in the without- and with-project conditions equals the project deepening benefits. These detailed calculations are summarized in **Table 12**, which displays both total discounted benefits and their average annual equivalent (AAEQ).

Table 12 - Total Discounted and Average Annual Equivalent Benefits for Each Potential Project Depth at Miami Harbor

Channel Depth	Total Discounted Benefits	AAEQ Benefits	Incremental AAEQ Benefits
43 Feet	$40,788,344	$2,453,354	$2,453,354
44 Feet	$78,205,117	$4,703,914	$2,250,560
45 Feet	$112,673,088	$6,777,108	$2,073,194
46 Feet	$139,055,626	$8,363,976	$1,586,868
47 Feet	$160,522,169	$9,655,154	$1,291,179
48 Feet	$180,868,182	$10,878,934	$1,223,780
49 Feet	$199,628,174	$12,007,318	$1,128,384
50 Feet	$200,133,356	$12,037,704	$30,386

QUANTITIES ESTIMATE

124. The quantities for the plan components included project depths from 42 to 50 feet. The components for the quantities are defined as follows:

a. Component 1C – Cuts 1 and 2: Quantities for the entrance channel include 45 – 52-foot required depths with a one-foot allowable

overdepth. Examination of widening depths started with the existing project at 44 feet plus one-foot allowable overdepth.

b. Component 2A – Cut 3 new widener. Quantities for the channel depths include 43 – 50-foot required depths with a one-foot allowable depth. Examination of widening depths started with the existing project at 42 feet plus one-foot allowable overdepth.

c. Component 3B – Cut 3, Fisher Island turning basin. Quantities for the channel depths include 43 – 50-foot required depths with a one-foot allowable overdepth. Examination of widening depths started with the existing project at 42 feet plus one-foot allowable overdepth.

d. Component 5A – Fisherman's Channel and Lummus Island Turning Basin. Quantities for channel depths include 43 - 50 foot required depths with a one-foot allowable overdepth and include designated port berthing areas identified as Gantry Crane Berths 99-140 adjacent to Fisherman's Channel at required depth plus one-foot for allowable overdepth. Examination of widening depths started with the existing project at 42 feet plus one-foot allowable overdepth.

125. **Table 13** displays a summary of the estimated quantities for each considered depth, as found in the MCACES estimate in Engineering – Appendix B. It also displays the quantities required for the utility relocations of the water line and sewer main.

Table 13 - Dredging Quantities

	Depth Alternative (ft.)								
	42	43	44	45	46	47	48	49	50
Mechanical Dredging (cy)									
Alt 2A - Cut 3 Widener	9,624	10,608	11,950	13,292	14,634	15,976	17,318	18,660	20,002
Alt 3B - Cut 3	47,162	90,609	130,191	195,533	268,547	342,306	416,124	489,965	563,829
Alt 5A - F.C. & L.I.T.B.	281,648	434,078	613,789	812,034	1,015,218	1,219,019	1,422,983	1,627,006	1,831,123
Alt 5A - Port Berths	----------	23,620	62,014	91,916	124,428	154,548	191,581	228,617	254,725
Total for Mechanical Dredging	338,434	558,915	817,944	1,112,775	1,422,827	1,731,849	2,048,006	2,364,248	2,669,679

Pipeline Dredging (cy)									
Alt 1C - Cut 1/2 & Wid.	34,145	62,935	176,999	422,369	744,730	1,083,181	1,423,216	1,764,160	2,105,972
Alt 3B - Cut 3	31,441	60,406	86,794	130,355	179,031	228,204	277,416	326,643	375,886
Alt 5A - F.C. & L.I.T.B.	70,412	108,520	153,447	203,009	253,805	304,755	355,746	406,752	457,781
Alt 5A - Port Berths	----------	15,314	30,560	36,018	40,114	47,036	47,036	47,036	47,036
Total for Pipeline Dredging	135,998	247,175	447,800	791,751	1,217,680	1,663,176	2,103,414	2,544,591	2,986,675
Utility Relocation (cy)									
Trench Excavation - 20" Water	----------	31,607	35,311	39,015	42,719	46,422	50,126	53,830	57,533
Trench Excavation - 54" Sewer	----------	33,704	37,407	41,111	44,815	48,519	52,222	55,926	59,630
Backfill Trench – 20" Water	----------	27,904	27,904	27,904	27,904	27,904	27,904	27,904	27,904
Backfill Trench – 54" Sewer	----------	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Total Quantities	474,432	929,305	1,396,366	2,042,556	2,785,945	3,547,870	4,311,672	5,076,499	5,831,421

* Each depth contains an additional two-foot wave allowance for the entance channel Cuts 1 and 2

F.C. = Fisherman Channel; L.I.T.B. = Lummus Island Turning Basin

GEOTECHNICAL INVESTIGATIONS

126. The majority of the material to be removed is rock that is moderately hard to very hard and will require blasting. While a portion of the materials in Miami Harbor can potentially be excavated using a heavy-duty rock cutterhead dredge and/or excavator, past dredging events have shown that both have experienced great difficulty in removing the rock. The matrix of the rock, with the addition of solution activity and recrystallization, exhibits zones of differential rock strength that cause the rock to fragment into large pieces that makes excavation very difficult, as seen in past dredging activities. Due to previous dredging episodes, gravel, cobbles and boulders are expected to be located throughout the project. In many areas, throughout the project, material has been removed well below the existing project depth.

127. Geotechnical analysis has identified areas from Cut 1, Sta. 0+00 to 90+00 and Cut 2, Sta. 13+00 to Cut 3, Sta. 5+00, where moderately hard to hard rock is present but fractured and exhibits frequent layers of weaker rock or sand. This rock is primarily moderately hard calcareous sandstone and sandy limestone with areas of sand present. Rock similar to this was previously dredged in Phase I of the deepening in the same area using a large cutterhead dredge. Based on existing Geotechnical data, this area exhibits potential for deepening with minimum or no blasting based on proposed equipment use. Additional core borings are required in addition to a recommended Resistivity Study to further define the rock quality in this area and throughout the project.

INITIAL FIRST COST OF CONSTRUCTION FOR ALTERNATIVES

128. The engineering analysis considered alternative plans for widening at the existing 42-foot project depth and widening and deepening for proposed depths in one-foot increments to a depth of 50 feet mean lower low water. As previously noted the entrance channel has an additional two-foot wave allowance. The MCACES estimate in Engineering - Appendix B contains a detail breakdown of initial first costs for the National Economic Development (NED) and Locally Preferred (LP) plans. The costs obtained from the MCACES estimate and presented in table 14 below do not include the post-construction monitoring costs of $250,000 (over 5 years), annual maintenance cost for navigation aids of $15,000 for 50 years, and the economic costs of $291,000 for the Fisher Island bulkhead replacement, which appear as part of the annual costs in Table 19. **Table 14** (reference Table A-88 in Economics – Appendix A) summarizes the total first costs as derived from the MCACES and estimated duration:

Table 14 - First Cost Summary for Depth Alternatives

Alternative depth (inner channel and entrance channel)	Construction Cost (October 2003 price level)	Estimated MCACES duration (months)
42 ft. and 44 feet	$25,767,649	15
43 feet and 45 feet	$91,919,439	29
44 feet and 46 feet	$104,018,662	31
45 feet and 47 feet	$111,533,189	32
46 feet and 48 feet	$118,369,644	33
47 feet and 49 feet	$126,900,641	35
48 feet and 50 feet	$137,025,498	36
49 feet and 51 feet	$148,571,414	40
50 feet and 52 feet	$157,044,600	43

129. The estimated costs as computed in the MCACES (as per Engineering - Appendix B) are based on historic contractor rates for similar work. A 20 percent contingency on the estimated construction costs is used, as appropriate for this

level of project design. Planning, Engineering, and Design (PED) and Supervision and Administration (S&A) costs are also included. Associated costs for port bulkheads were provided by the Miami Port Authority. Monitoring for preconstruction and during construction were based on cost requirements for the mitigation area. Real Estate costs include administrative costs for certification of lands as available under navigational servitude for all dredging work including relocations and placement of material in the upland confined disposal facility on Virginia Key, the offshore Ocean Dredged Material Disposal Site, offshore artificial reef sites, and northern Biscayne Bay borrow sites. No known acquisition of lands is required at this time. Real Estate - Appendix C also contains a description of the administrative costs.

130. The Miami-Dade Water and Sewer Department (WASD) owns a 54-inch force sewer main with a top elevation of 50 mlw, crossing Government Cut-2 and a 20-inch ductile iron water main with a top elevation of 53 mlw, crossing Fisherman Channel as per WASD as-builts. To allow for adequate minimum coverage over utility removal of these utilities relocation will occur at the proposed depth of 43 feet. Therefore, this relocation cost is included for all of the alternatives.

131. Post construction cost items are for monitoring of the seagrass mitigation areas for a period of five years. Aids to navigation costs are also a post construction item for the period of the authorized project.

INTEREST DURING CONSTRUCTION

132. Interest During Construction (IDC) accounts for the opportunity cost of expended funds before the benefits of the project are available and is included among the economic costs that comprise NED project costs. The amount of the pre-base year cost equivalent adjustments depends on the interest rate, the construction schedule, which determines the point in time at which costs occur, and the magnitude of the costs to be adjusted. Preconstruction, Engineering and Design (PED) costs are included in the IDC as well as construction costs. The current construction schedule assumes authorization of the project in a potential Water Resources Development Act (WRDA) of 2004. Assuming Congress provides funding for that potential WRDA the proposed schedule of activities would follow resulting in baseline date of 2010 for completion of the proposed project.

Task	Months	Months
Div Engineer's Public Notice	0	Start = S
Initiate Plans & Specifications	1	S+1
Continue Draft Plans & Specifications	2-13	S+13
Complete Request For Proposal Process	14-16	S+16
Complete Project Cost Sharing Agreement	17-19	S+19
Receive Funds	20	S+20

Execute Project Cost Sharing Agreement	21-22	S+22
Advertise	22	S+22
Receive Proposals	23-24	S+24
Complete Engineering & Design Reviews	25	S+25
Award First Contract/Start Pre-Construction/Mitigation Activities	1	S+26
Award Second Contract	4	S+29
Complete First Contract	12	S+37
Complete Construction/Mitigation Activities	43	S+68

133. **Table 15** (references Tables A-88 and A-89 of Economics Appendix-A) displays the IDC estimated for the project feature for the total first cost associated with each of these features. The AAEQ for the IDC and the total construction cost and IDC is also displayed. The AAEQ for environmental monitoring of $12,799(cost of $50,000 per year for first five years, amortized for 50 years at the 5 5/8% discount rate) is the same for all plan alternatives. All plans include an additional annual maintenance cost of $15,000 attributed to aids to navigation. An AAEQ economic cost of $17,527 for replacement of the Fisher Island bulkhead is also included for each plan. **Table 19** contains all the previously mentioned annual costs.

Table 15 - Interest During Construction

Project	Construction Cost	IDC	Total Construction Cost and IDC	AAEQ Construction Cost	AAEQ IDC	Total AAEQ Construction Cost and IDC
1C, 2A, 5A	$22,137,147	$1,306,100	$23,443,247	$1,331,514	$78,560	$1,410,074
1C, 2A, 5A and 3B	$25,767,649	$1,626,130	$27,393,779	$1,549,883	$97,809	$1,647,692
Deepen System to 43 Feet	$91,919,439	$8,976,522	$100,895,961	$5,528,809	$539,924	$6,068,732
Deepen System to 44 Feet	$104,018,662	$10,899,345	$114,918,007	$6,256,558	$655,578	$6,912,136
Deepen System to 45 Feet	$111,533,189	$12,078,924	$123,612,113	$6,708,545	$726,528	$7,435,073
Deepen System to 46 Feet	$118,369,644	$12,873,054	$131,242,698	$7,119,746	$774,294	$7,894,040
Deepen System to 47 Feet	$126,900,641	$14,337,505	$141,238,146	$7,632,872	$862,378	$8,495,251
Deepen System to 48 Feet	$137,025,498	$15,924,445	$152,949,943	$8,241,867	$957,830	$9,199,697
Deepen System to 49 Feet	$148,571,414	$19,262,453	$167,833,867	$8,936,335	$1,158,606	$10,094,941
Deepen System to 50 Feet	$157,044,600	$21,568,088	$178,612,688	$9,445,984	$1,297,286	$10,743,270

NED PLAN SELECTION

134. The final set of increments examined is deepening the newly configured channel from 43 to 50 feet. Since utility relocation is a project implementation cost that will be incurred with all the proposed deepening alternatives, a benefit can be claimed when the utility relocation involves replacement.

ADVANCED UTILITY REPLACEMENT BENEFIT

135. If a railroad, highway, street, or utility is replaced as a result of a federal project, a benefit can be claimed to at least partially offset the cost of the replacement. An advanced utility replacement benefit can be taken for the useful life that the utility is extended by the project. For example, the useful life of the water main has been estimated to be about 50 years from the date of its original placement. The water main will be 22 years old (2010-1988) at the base year (2010), with a useful remaining life of about 28 years. By replacing this utility as a result of a proposed federal project, with one that also has an estimated life of 50 years, the life of the utility has been extended by 22 years (50 years minus the remaining useful life of the existing utility). The cost of the relocation varies by the cubic yards of trench excavation.

136. The forced sewer main will be 34 years old (2010-1976) at the base year (2010), with a remaining useful life of about 16 years. Replacement of the utility as a result of a proposed federal project, with one that also has an estimated life of 50 years, the life of the utility has been extended by 34 years (50 – 16). **Tables 16** and **17** display benefit calculations for the water line, and forced sewer main, respectively for alternative depths from 43 to 50 feet, using the MCACES cost estimate at an October 2003 price level, and a federal discount rate of 5 5/8 percent. The AAEQ benefit total for the sum of those utilities is about $84,000 as show in these two tables.

Advanced Utility Replacement Benefit Information for Tables 16 and 17		
Utility	Sewer Force Main	Water Line
Year Built	1976	1988
Base Year of Project	2010	2010
Age of Utility at Base (Years)	34	22
Estimated Remaining Life (Years)	16	28
Elevation	-50 feet	-53 feet

Table 16 - Advanced Utility Replacement Calculation for All Depths
20-Inch Water Line

	Project Depth:	43 ft.	44 ft.	45 ft.	46 ft.	47 ft.	48 ft.	49 ft.	50 ft.
	mob and demob	$102,729	$102,729	$102,729	$102,729	$102,729	$102,729	$102,729	$102,729
	trench excavation	$1,148,980	$1,148,980	$1,148,980	$1,148,980	$1,148,980	$1,148,980	$1,148,980	$1,148,980
	pipeline installation	$242,274	$242,274	$242,274	$242,274	$242,274	$242,274	$242,274	$242,274
	backfill trench	$373,828	$373,828	$373,828	$373,828	$373,828	$373,828	$373,828	$373,828
	test and inspect new line	$1,664	$1,664	$1,664	$1,664	$1,664	$1,664	$1,664	$1,664
	clean and abandon old line	$6,796	$6,796	$6,796	$6,796	$6,796	$6,796	$6,796	$6,796
		$25,463	$25,463	$25,463	$25,463	$25,463	$25,463	$25,463	$25,463
		$25,463	$25,463	$25,463	$25,463	$25,463	$25,463	$25,463	$25,463
1.	Cost of new UTILITY	$1,927,197	$1,927,197	$1,927,197	$1,927,197	$1,927,197	$1,927,197	$1,927,197	$1,927,197
2.	Life of new UTILITY (years)	50	50	50	50	50	50	50	50
3.	Remaining useful life of existing UTILITY (years)	28	28	28	28	28	28	28	28
4.	Extension of UTILITY life (years) (#2-#3)	22	22	22	22	22	22	22	22
5.	Annual O&M of existing UTILITY	$0	$0	$0	$0	$0	$0	$0	$0
6.	Annual O&M of new UTILITY	$0	$0	$0	$0	$0	$0	$0	$0
7.	Interest rate	5.625%	5.625%	5.625%	5.625%	5.625%	5.625%	5.625%	5.625%
8.	Capital recovery factor (for 50 years)	0.06015	0.06015	0.06015	0.06015	0.06015	0.06015	0.06015	0.06015
9.	Annual cost of new UTILITY (#1*#8)	$115,918	$115,918	$115,918	$115,918	$115,918	$115,918	$115,918	$115,918
10.	Present worth of annuity factor for extension of UTILITY life (uniform series present worth) (#4 years)	12.44431	12.44431	12.44431	12.44431	12.44431	12.44431	12.44431	12.44431
11.	Benefits in year #3, credited to UTILITY life extension (#9*#10)	$1,442,518	$1,442,518	$1,442,518	$1,442,518	$1,442,518	$1,442,518	$1,442,518	$1,442,518
12.	Single payment present worth factor for years in #3 years (single payment present worth)	0.21604	0.21604	0.21604	0.21604	0.21604	0.21604	0.21604	0.21604
13.	Present worth in year 1 of UTILITY extension (#11*#12)	$311,600	$311,600	$311,600	$311,600	$311,600	$311,600	$311,600	$311,600
14.	Annual O&M savings (#5-#6)	$0	$0	$0	$0	$0	$0	$0	$0
15.	Present worth of annuity factor for #3 years (uniform series present worth)	13.93709	13.93709	13.93709	13.93709	13.93709	13.93709	13.93709	13.93709
16.	Present worth in year 1 of O&M savings (#14*#15)	$0	$0	$0	$0	$0	$0	$0	$0
17.	Present worth of total credit (#13+#16)	$311,600	$311,600	$311,600	$311,600	$311,600	$311,600	$311,600	$311,600
18.	Average annual credit (benefit) (#17*#8)	$18,742	$18,742	$18,742	$18,742	$18,742	$18,742	$18,742	$18,742
	Total average annual benefit =	$18,742	$18,742	$18,742	$18,742	$18,742	$18,742	$18,742	$18,742

Table 17 - Advanced Utility Replacement Calculation for All Depths
54-Inch Sewer Force Main

	Project Depth:	43 ft.	44 ft.	45 ft.	46 ft.	47 ft.	48 ft.	49 ft.	50 ft.
	mob and demob	$102,729	$102,729	$102,729	$102,729	$102,729	$102,729	$102,729	$102,729
	trench excavation	$1,792,266	$1,792,266	$1,792,266	$1,792,266	$1,792,266	$1,792,266	$1,792,266	$1,792,266
	pipeline installation	$342,314	$342,314	$342,314	$342,314	$342,314	$342,314	$342,314	$342,314
	backfill trench	$531,210	$531,210	$531,210	$531,210	$531,210	$531,210	$531,210	$531,210
	test and inspect new line	$2,645	$2,645	$2,645	$2,645	$2,645	$2,645	$2,645	$2,645
	clean and abandon old line	$17,744	$17,744	$17,744	$17,744	$17,744	$17,744	$17,744	$17,744
		$53,466	$53,466	$53,466	$53,466	$53,466	$53,466	$53,466	$53,466
		$53,466	$53,466	$53,466	$53,466	$53,466	$53,466	$53,466	$53,466
1.	Cost of new UTILITY	$2,895,840	$2,895,840	$2,895,840	$2,895,840	$2,895,840	$2,895,840	$2,895,840	$2,895,840
2.	Life of new UTILITY (years)	50	50	50	50	50	50	50	50
3.	Remaining useful life of existing UTILITY (years)	16	16	16	16	16	16	16	16
4.	Extension of UTILITY life (years) (#2-#3)	34	34	34	34	34	34	34	34
5.	Annual O&M of existing UTILITY	$0	$0	$0	$0	$0	$0	$0	$0
6.	Annual O&M of new UTILITY	$0	$0	$0	$0	$0	$0	$0	$0
7.	Interest rate	5.625%	5.625%	5.625%	5.625%	5.625%	5.625%	5.625%	5.625%
8.	Capital recovery factor (for 50 years)	0.06015	0.06015	0.06015	0.06015	0.06015	0.06015	0.06015	0.06015
9.	Annual cost of new UTILITY (#1*#8)	$174,180	$174,180	$174,180	$174,180	$174,180	$174,180	$174,180	$174,180
10.	Present worth of annuity factor for extension of UTILITY life (uniform series present worth) (#4 years)	15.01205	15.01205	15.01205	15.01205	15.01205	15.01205	15.01205	15.01205
11.	Benefits in year #3, credited to UTILITY life extension (#9*#10)	$2,614,802	$2,614,802	$2,614,802	$2,614,802	$2,614,802	$2,614,802	$2,614,802	$2,614,802
12.	Single payment present worth factor for years in #3 years (single payment present worth)	0.41661	0.41661	0.41661	0.41661	0.41661	0.41661	0.41661	0.41661
13.	Present worth in year 1 of UTILITY extension (#11*#12)	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400
14.	Annual O&M savings (#5-#6)	$0	$0	$0	$0	$0	$0	$0	$0
15.	Present worth of annuity factor for #3 years (uniform series present worth)	10.37133	10.37133	10.37133	10.37133	10.37133	10.37133	10.37133	10.37133
16.	Present worth in year 1 of O&M savings (#14*#15)	$0	$0	$0	$0	$0	$0	$0	$0
17.	Present worth of total credit (#13+#16)	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400	$1,089,400
18.	Average annual credit (benefit) (#17*#8)	$65,526	$65,526	$65,526	$65,526	$65,526	$65,526	$65,526	$65,526
	Total average annual benefit =	$65,526	$65,526	$65,526	$65,526	$65,526	$65,526	$65,526	$65,526

NED PLAN OPTIMIZATION

137. The widening features as a proposed project increment, for the entrance channel, access channel widening, and the Fisher Island turning basin extension and widening, are justified incrementally, compared to a no action alternative. The deepening feature has also been addressed as a separate added increment compared to a no action alternative. **Table 18** (reference Table A-90 in Economics – Appendix A) summarizes the NED quantitative analysis process discussed in the Economic Appendix for the determination of the optimal depth alternative. A comparison of the marginal benefits and marginal cost of deepening in one-foot increments demonstrates that the first two feet of deepening from the current depth to 44 feet in the inner channel and 46 feet in the outer channel do not result in a positive net benefit. However, further deepening produces positive net benefits for all deepening projects through 50 feet. The net AAEQ benefits incrementally increase from 45 to 49 feet, then decrease at 50 feet. For deepening without widening the maximum net benefits optimize at 49 feet.

138. As both the widening and Fisher Island turning basin extension features, as well as the deepening features, are justified incrementally as separate elements, the next step is to determine for which alternative, when considering these features as separate elements and combinations, results in maximizing NED benefits. **Table 19** (reference Table A-91 in Economics – Appendix A) shows the comparison of AAEQ total costs and AAEQ total benefits for the deepening as an added increment (in one ft increments from 43 to 50 feet) in comparison to the widening and Fisher Island turning basin features (Alt. Plans B and C) as stand-alone features. Alternative Plan D, which addresses widening features of the channel and turning basin as a combination, is justified within itself. The inclusion of channel deepening as an added increment, Alternative Plan H, results in higher NED benefits than plan D alone commencing at the 45 feet proposed depth. The net NED benefits continue to increase until a project depth of 50 feet (with 52 feet at entrance channel). However, the NED net benefits are maximized to Alternative Plan H, at a channel system depth of 49/51 feet; this system includes widening the channel, and extending the Fisher Island Turning Basin. This combination plan has a BCR of 1.6 and net benefits of $6,091,000.

Table 18 - Costs and Benefits of Deepening Alternatives

Channel Depth	AAEQ Cost	AAEQ Benefits	Net AAEQ Benefits
43 Feet	$3,978,925	$2,453,354	-$1,525,571
44 Feet	$4,706,674	$4,703,914	-$2,761
45 Feet	$5,158,661	$6,777,108	$1,618,446
46 Feet	$5,569,863	$8,363,976	$2,794,112
47 Feet	$6,082,989	$9,655,154	$3,572,165
48 Feet	$6,691,983	$10,878,934	$4,186,951
49 Feet	$7,386,452	$12,007,318	$4,620,866
50 Feet	$7,896,101	$12,037,704	$4,141,604

Table 19 - Costs and Benefits of Alternative Plans

Alternative Plan	AAEQ Total Costs	AAEQ Benefits	Net AAEQ Benefits	Benefit/Cost Ratio
Alternative Plan A: No Action	$0	$0	$0	n/a
Alternative Plan B: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel	$1,455,400	$2,848,000	$1,392,600	1.96
Alternative Plan C: 3B Extend Fisher Island Turning Basin	$237,618	$1,292,000	$1,054,382	5.44
Alternative Plan D: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin	$1,693,018	$4,140,000	$2,446,982	2.45
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 43 Feet	$6,114,057	$6,677,622	$563,565	1.09
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 44 Feet	$6,957,462	$8,928,182	$1,970,720	1.28
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 45 Feet	$7,480,398	$11,001,376	$3,520,977	1.47
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 46 Feet	$7,939,366	$12,588,243	$4,648,878	1.59
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 47 Feet	$8,540,576	$13,879,422	$5,338,846	1.63
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 48 Feet	$9,245,022	$15,103,202	$5,858,180	1.63
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 49 Feet	$10,140,267	$16,231,586	$6,091,320	1.60
Alternative Plan H: 1C Widen Entrance Channel, 2A Widener between Buoys 13 and 15, 5A Widen Fishermans Channel and 3B Extend Fisher Island Turning Basin, and Deepen Channel to 50 Feet	$10,788,596	$16,261,972	$5,473,376	1.51

ITEMIZED COST FOR NED PLAN

139. **Table 20** displays the itemized cost displaying the general navigation features, aids to navigation, lands, easements, rights of way and relocations, and associated costs for the NED plan. The total project cost for the NED plan is $148,821,000 including mitigation features.

Table 20 - Itemization of Cost for NED Plan

Construction Item	Cost
Dredging --	
Mob & Demob	$4,141,921
Alternative 1C (Cuts 1 - 2 & widening)	19,292,394
Alternative 2A (Cut 3 Widener)	455,020
Alternative 3B (Cut 3)	16,069,776
Alternative 5A (Fisherman's Chan'l/Lummus Is. TB)	44,866,262
Disposal Area (Virginia Key)	597,486
Environmental Mitigation	7,791,156
Mitigation Monitoring (Reef Construction)	120,000
Planning, Engineering, and Design	3,380,000
Construction Management (S&I)	9,570,000
Subtotal GNF	**$106,284,015**
Aids to Navigation	165,300
Lands, Easements, Rights of Way, and Relocations	
Real Estate, Administrative (Federal)	**$12,500**
Utility Relocations	$4,617,577
Associated Non-Federal Costs	
Berthing Area Dredging (Alt. 5A)	$14,444,521
Port Bulkhead Construction	22,800,000
Mitigation Monitoring (Post-Const. Seagrass)	235,000
Mitigation Monitoring (Post-Const. Reef)	250,000
Real Estate, Administrative (non-Federal)	12,500
	$37,742,021
Total Project First Cost	**$148,821,413**
Total Project First Cost (Rounded)	**$148,821,000**

THE LOCALLY PREFFERED PLAN

140. Projects may deviate from the National Economic Development Plan if requested by the non-Federal sponsor and approved by the Assistant Secretary of the Army, Civil Works ASA (CW). Plans requested by the non-Federal sponsor that deviate from these plans shall be identified as the Locally Preferred (LP) plan. When the LP plan is clearly of less scope and cost and meet's the Administration's policies for high-priority outputs, an exception for deviation is usually granted by ASA (CW). In such cases the LP plan must have greater net benefits than the smaller scale plans and the maximum net benefits cannot maximize at a smaller plan than the Sponsor's LP plan.

141. If the Sponsor prefers a plan that is more costly than the NED plan, and the increased scope of the plan is not sufficient to warrant full Federal participation, ASA(CW) may grant an exception as long as the Sponsor pays the difference in the cost between the NED plan and the LP plan. The LP plan must then demonstrate output similar in-kind, and equal to or greater than the outputs of the Federal plan. However, the LP plan must meet the criteria of environmental acceptability.

RECOMMENDED PLAN

142. The recommended plan for navigation improvements at Miami Harbor has to be responsive to local needs and desires as well as the economic and environmental criteria established by Federal and State law. To do this the plan must be able to handle current and forecasted vessel traffic safely with minimum impact on the environment and without excessive delays and damage. Subsequent paragraphs outline the plan design, construction, operation and maintenance procedures

143. Decision making for the selection of a recommended plan begins at the district level and continues at the Headquarters level through subsequent reviews and approval. For congressionally authorized projects, the final agency decision maker is the Secretary of the Army through the Assistant Secretary of the Army for Civil Works.

144. The NED plan has been identified as Alternative H, which optimized at a depth of 49 feet. However, the non-Federal Sponsor has requested a locally preferred plan for a channel depth of 50 feet and an entrance channel depth of 52 feet. Post-Panamax container ships, currently deployed in the Far East trade region, have become more numerous. It is anticipated that the Post-Panamax container ships will be deployed in the Atlantic trade region and will call at U.S. East Coast ports, including the Port of Miami.

145. The Locally Preferred (LP) plan is the Recommended Plan and includes components that would widen and deepen the Entrance Channel, deepen Government Cut, deepen and widen Fisher Island Turning Basin, relocate the west end of the Main Channel (no dredging involved), and deepen and widen Fisherman's Channel and the Lummus Island Turning Basin. The LP plan, figure 10, consists of five components that would improve Port transit for the existing and future fleets:

a. **Component: 1C:** Widen seaward portion of Cut-1 from 500 to 800 feet and deepen Cut-1 and Cut-2 from a project depth of 44 to 52 feet;

b. **Component 2A:** Add turn widener at the southern intersection of Cut-3 with Fisherman's Channel and deepen from a project depth of 42 to 50 feet;

c. **Component 3B:** Increase the Fisher Island Turning Basin from 1200 to 1500 feet in Cut 3. Truncate the northeast section of the turning basin to minimize seagrass impacts. Deepen from a project depth of 42 feet to 50 feet;

d. **Component 4:** Realign the western end of the main channel about 250 feet to the south along Cut-4. The project depth remains at 36 feet no additional dredging required; and

e. **Component 5A:** Expand the Sponsor's berthing area by 60 feet and widen the southern edge of Fisherman's Channel (Lummus Island Cut) about 40 feet for a 100-foot increase in total width, reduce the Lummus Island (Middle) Turning Basin to a 1500-foot diameter from the currently authorized 1600-foot diameter, and deepen from a project depth of 42 feet to 50 feet.

ESTIMATED COST FOR THE RECOMMENDED PLAN

146. The first cost features for the LP 50-foot plan are shown on **Table 21.** The total first cost is about $157,295,000. This cost includes associated non-Federal costs for berthing area dredging, port bulkhead construction, and Real Estate administration costs, and mitigation features. Also included are utility relocation costs of about $4,618,000. In addition there are post-construction annual maintenance cost for navigation aids, $15,000. There are no additional operations and maintenance costs expected.

Table 21 - Itemized Cost for the LP Plan

Construction Item	Cost
Dredging --	
Mob & Demob	$4,141,921
Alternative 1C (Cut 1/2 intersection widening)	20,086,432
Alternative 2A (Cut 3 Widener)	480,843
Alternative 3B (Cut 3)	17,800,338
Alternative 5A (Fisherman Channel)	49,513,639
Disposal Area (Virginia Key)	597,486
Environmental Mitigation	7,791,156
Mitigation Monitoring (Reef Construction)	120,000
Planning, Engineering, and Design	3,570,000
Construction Management (S&I)	10,100,000
Subtotal GNF	$114,201,815
Aids to Navigation	165,300
Lands, Easements, Rights of Way, and Relocations	
Real Estate, Administrative (Federal)	**$12,500**
Utility Relocations	**$4,617,577**
Associated Non-Federal Costs	
Berthing Area Dredging (Alt. 5A)	$14,999,907
Port Bulkhead Construction	22,800,000
Mitigation Monitoring (Post-Const. Seagrass)	235,000
Mitigation Monitoring (Post-Const. Reef)	250,000
Real Estate, Administrative (non-Federal)	12,500
Total Non-Federal Costs	**$38,297,407**
Total Project First Cost	**$157,294,599**
Total Project First Cost (Rounded)	**$157,295,000**

CONSTRUCTION METHODS FOR THE RECOMMENDED PLAN

Request For Proposal (RFP) Process to Avoid Impacts

147. The Request for Proposal (RFP) process conducted prior to award of a construction contract will allow for an in-depth evaluation of a potential contractor's proposal. The RFP process as currently planned for this proposed project would rate the technical portion of a contractor's proposal as the most significant. This results in an incentive approach, which will encourage the contractor to avoid impacts to reef and seagrass areas. As a result, the vessel

operational and anchoring plan that best avoids or reduces impacts to reefs or seagrass areas would receive the highest evaluation and the incentives that follow. Measures such as the use of surge buoys to lift anchor cables and restricted anchor placement to minimize impacts would be important factors in determining the best construction methodology to avoid reef and seagrass impacts. Section 2.7 of the EIS contains a detailed discussion of potential construction techniques.

148. Construction methodology of the project would be determined by the contractor selected by the USACE during the RFP bid process. However, certain assumptions for planning and estimating purposes were made regarding various proposed construction techniques that may be used.

149. The removal of the existing utilities crossing the channel impacted by the new project construction will follow the relocation (installation) of the replacement utilities as part of the construction dredging for the new project. The existing utilities are a 54" concrete force main crossing Government Cut-2 and a 20" ductile iron water main crossing Fisherman Channel.

150. The installation of the relocation will include cleaning and inspection of the abandoned lines prior to removal. The excavated/removed pipeline and dredged material will be disposed of in a specified offshore disposal location. The relocation of the replacement pipelines will involve the excavation by hydraulic excavator dredge and scow barges of a 100 foot wide open trench following drilling and blasting for the cover area and a 20 foot wide trench for the pipeline placement. New lines are to be the same type pipeline and construction as the original lines.

151. The new lines will then be placed within the trench and covered and compacted with specified backfill material, which will either consist of a portion of the excavation material along with disposal material already located at Virginia Key upland disposal site if needed. This will be accomplished using a small clamshell crane barge with scow barges. The remaining excavation of material not used for backfilling the trenches will be disposed of in a designated offshore location. The new lines will be pressure tested and inspected.

Potential Dredging Techniques

152. Dredged material from widening and deepening of the channel would most likely be excavated using either a hydraulic cutterhead dredge or mechanical excavator with some or all of the material pretreated using blasting or some other method to break the rock prior to dredging. Dredging of rock material could be accomplished using a hydraulic excavator dredge that loads scow barges. Drilling and blasting will be required of most rock in Cut-3 and Fisherman's channel (Components 2A, 3B, 5 and 5A) prior to dredging with the exception of the majority of Cuts 1 –2 (Component 1C) which might be dredged with a 30-inch

cutterhead pipeline dredge having rock cutting capability. The rock-hardened cutterhead dredge could pump the rock material to the upland confined disposal facility (CDF) on Virginia Key or into spider barges for offshore placement at the ODMDS. The existing channel along the widener at the intersection of Cuts 1 and 2 will require blasting. A hydraulic excavator loading scow barges could then be used to transport the material to the proposed artificial reef locations, figure 9. Dredging of non-rock material could be accomplished using a 30-inch cutter suction pipeline dredge with boosters and placed at the existing upland CDF on Virginia Key.

153. If a mechanical dredge is used, the larger rock material may be removed and segregated for use in constructing the mitigation sites. Larger rock material would be placed on an ocean going bottom-dump barge to be transported to the proposed artificial reef sites for precise placement with an additional clamshell or barge-mounted crane or to the offshore Ocean Dredged Material Disposal Site (ODMDS). Smaller rock material would be placed on a smaller shallow draft barge for placement at the proposed seagrass mitigation site. Disposal of dredged material would be at the proposed seagrass or artificial mitigation sites, the offshore Ocean Dredged Material Disposal Site (ODMDS), or the existing upland CDF on Virginia Key, figure 9.

ENVIRONMENTAL CONSIDERATIONS

154. Along with economic and technical considerations NEPA requires Federal agencies to employ an interdisciplinary approach in the decision-making process to ensure that unquantified environmental values are also given appropriate consideration. In achieving the goals of providing features to improve navigation and national economic benefits, the impacts to the natural system of South Florida's shorelines, estuaries, benthic communities, fisheries, and associated terrestrial and maritime habitat, including but not limited to, Florida Bay, Biscayne Bay and the coral reef tract have been considered in the formulation process.

155. Extensive plan formulation, plan revision, and plan refinement have avoided impacts to the environment, whenever possible, and minimized impacts to the environment to the greatest extent possible while still meeting the project need and purpose. Efforts have been made to include all stakeholders in the planning process to assist the USACE in minimizing environmental impacts. There are several unavoidable environmental impacts of the proposed project to the natural environment with respect to several species of seagrasses located near the Fisher Island Turning Basin and south of the proposed widener for Fisherman's Channel. In addition, there would be some impacts to hardbottom communities within the confines of the Entrance Channel.

156. To compensate for the effects of the action on previously non-dredged habitats, the Corps has proposed the following: (1) mitigate for the removal of 0.2

acres of mixed seagrass beds and indirect losses of 7.7 acres of seagrass from the natural equilibration of the side slopes through the restoration of an approximately 24-acre dredged borrow site in northern Biscayne Bay (2) mitigate for the removal of 2.7 acres of high-relief coral reef habitat at a ratio of 2:1 through the creation of 5.4 acres of high-complexity, high relief artificial reef habitat, and (3) mitigate for the 0.6 acre of impact to low-relief hardbottom habitat by creating .8 acres of low-relief hardbottom at a 1.3:1 ratio. The Corps has not proposed compensation for the removal of the biotic communities, which have colonized the channel walls or channel bottom since the last dredging event.

157. As previously mentioned, the proposed action affects seagrass and hardbottom/reef communities and other waters of the United States subject to Section 404 of the Clean Water Act (CWA). A Section 404(b)(1) Evaluation Report has been completed and is included in the EIS (Appendix C) to comply with the CWA. State approval is required for certification of water quality through Section 401 of the CWA and concurrence. A Coastal Zone Management Consistency Determination was prepared by the USACE and will be submitted to the State for concurrence (Appendix D of the EIS).

158. However, the Fish and Wildlife Service (Service) has provided several recommendations in the Coordination Act Report (CAR) concerning blasting, monitoring, and mitigation to further minimize or avoid possible adverse effects of the action on fish and wildlife resources. "Specifically, for the permanent removal of 6.3 acres of seagrass and 30.7 acres of low-relief hardbottom, including the temporal lag for the recovery of the invertebrate communities and habitats associated with the channel walls and bottom. The following compensatory mitigation is recommended (1) restore approximately 18.6 acres of seagrass habitat (3:1 ratio) (2) creation of 9.74 acres of low-complexity, low-relief artificial hardbottom habitat (1.3:1 ratio), (3) creation of 5.4 acres of high-relief artificial hardbottom habitat (2:1 ratio). In addition, the development of an environmental monitoring program is recommended to verify that project impacts occurred within the levels anticipated and to ensure that the mitigation areas are performing to levels where habitat replacement values are maintained."

159. The Corps has determined that the project "may affect, but is not likely to adversely affect" the federally endangered West Indian manatee, American crocodile, green, Kemp's ridley, hawksbill and leatherback sea turtles, and smalltooth sawfish as well as the threatened loggerhead sea turtle, threatened Johnson's seagrass.

160. In addition, the Corps has determined that the following whale and dolphin species may be affected during blasting activities – bottlenose dolphin, endangered humpback, fin, sei, blue and sperm whales that are known to occur along the Atlantic coast. The Corps has also determined that designated critical habitat for the West Indian manatee and Johnson's seagrass will not be adversely modified by the proposed action. Since the Corps has agreed to

incorporate the *Standard Manatee Protection Construction Conditions* and implement a blasting plan to minimize possible adverse effects to listed marine species using the standard “Navy Diver” protocol, FWS has concurred with the Corps’ determination for the two species which fall under the jurisdiction of the Service - the West Indian manatee and the American crocodile. The Corps also initiated consultation with the National Marine Fisheries Service (NMFS) concerning the remaining listed species by submitting a Biological Assessment. NMFS concurred with the Corps determination of “may affect, not likely to adversely affect” for all species in the project, and issued a biological opinion concerning Johnson’s seagrass critical habitat. The previously mentioned whale and dolphin species are also protected by the Marine Mammal Protection Act of 1972 (MMPA), and the Corps has initiated consultation with NMFS concerning impacts to species protected under the MMPA that are found in the project area.

DISPOSAL OPTIONS

161. A study titled “Preliminary Assessment Miami Harbor, Florida” was completed July 1997 and approved by the Major Subordinate Command, August 1997. The study concluded that the recommended disposal plan for Miami Harbor dredged material is the Miami Ocean Dredged Material Disposal Site (ODMDS). The study indicated that the Miami ODMDS site has capacity for all projected new work and maintenance material for the next 20 years and that past disposal in that site has been approved by EPA. Appendix E updates the July 1997 Dredged Material Management Plan (DMMP) – “Preliminary Assessment Miami Harbor, Florida” with the current recommended plan disposal options which include the confined disposal facility on Virginia Key, the borrow areas north of the Julia Tuttle causeway, proposed artificial reef sites south of the entrance channel, and the existing ODMDS. The ODMDS (figure 9) site will be used for dredged material not designated for beneficial uses (such as filling borrow areas north of the Julia Tuttle causeway for seagrass mitigation or artificial reef mitigation sites).

162. In addition to the ODMDS disposal of dredged materials would occur at three other sites (figures 9, 9A-9C): filling borrow areas north of the Julia Tuttle causeway to provide a seagrass mitigation area, proposed offshore artificial reef areas for impacts to reef habitat, and an existing confined upland disposal area on Virginia Key. The Recommended Plan would impact 0.2 acre of seagrass habitat within the existing channel, 7.7 acres of seagrass habitat outside of the existing channel, 0.6 acre of low relief/hardbottom reef habitat, 28.1 acres of previously dredged low relief/hardbottom reef habitat, 2.7 acres of high relief hardbottom/reef habitat, 18.0 acres of previously dredged high relief hardbottom/reef habitat, 3.0 acres of rock rubble habitat, 120.5 acres of previously dredged rock/rubble habitat, 23.3 acres of unvegetated bottom habitat,

and 213.1 acres of previously dredged unvegetated bottom habitat. Impacts to marine mammals, sea turtles, and fish species may occur due to loss of habitat and blasting activities associated with project construction activities. The Recommended Plan would cause temporary increases in turbidity; however, these levels would not exceed permitted variance levels outside the mixing zone.

ENVIRONMENTAL MITIGATION

163. Mitigation proposed for seagrass impacts would include restoration of a previously dredged borrow area within northern Biscayne Bay, figures 9, 9A-9C. Mitigation proposed to offset new impacts to high and low relief hardbottom/reef habitat, would include creation of artificial reefs within permitted offshore artificial reef sites, if available, or two locations south of the entrance channel shown in figure 9. See EIS paragraph 5.0, Mitigation for Adverse Impacts, for details of the proposed mitigation plan.

164. Mitigation for seagrass and hardbottom/reef impacts would be provided through restoration of seagrass beds and creation of artificial reefs. Based upon the extent of impacts, restoration of approximately 7.9 acres (0.2 direct plus 7.7 indirect) of seagrass beds is proposed as compensation for unavoidable impacts. In order to replace local seagrass functions and values, restoration would be implemented within Biscayne Bay, preferably in areas where seagrass once occurred and is now absent due to past anthropogenic activities such as dredging. Seagrass habitat would be restored by filling approximately 24 acres of old borrow areas located in North Biscayne Bay. The Corps will fill the entire hole to ensure project success.

165. New impacts to low relief hardbottom/reef and high relief hardbottom/reef total 0.6 acre and 2.7 acres, respectively. Based on the Habitat Equivalency Analyses (HEA) calculations, direct impacts to hardbottom/reef habitats would require the creation of artificial reef habitat at an effective mitigation ratio of 2:1 for high relief hardbottom/reef habitat and an effective mitigation ratio of 1.3:1 for low relief hardbottom/reef habitat. Mitigation reefs would be constructed in two different designs, to reflect the differences in the habitat structure of the two types of hardbottom/reef habitat to be impacted. The proposed mitigation would be type-for-type, to reflect the ecological differences between the different reef types impacted. A total of 0.8 acre of low relief-low complexity (LRLC) reef would be required to mitigate for the new low relief hardbottom/reef. A total of 5.4 acres of high relief-high complexity (HRHC) reef would be required to mitigate for the high relief impact. Reefs could be constructed at approved artificial reef sites managed by Miami-Dade County Environmental Resources Management (DERM) or at two locations south of the entrance channel shown on figure 9.

166. Responsibility for operation, maintenance, repair, replacement, and rehabilitation of all mitigation areas for the life of the authorized project rests with

the Sponsor, the Miami-Dade County Seaport Department. After construction of the reef mitigation features monitoring will occur. The Sponsor will coordinate the monitoring process. As described in the EIS, Appendix J, Mitigation Plan, paragraph 4.2.3, Reef Monitoring, the monitoring program for the mitigation reefs will consist of both physical and biological components. Physical monitoring will assess the degree of settling of the reef materials after the first year, and biological monitoring will assess population of algae, invertebrates, and fishes, as compared with concurrent control sampling of natural reefs for three years. Monitoring will be conducted annually in the summer months. In order to provide a permanent record of reef conditions and biota, each sampling effort will include video transects covering representative areas of the mitigation reefs."

167. During the past phase II dredging of the Lummus Island Turning Basin, figure 7, the Port of Miami's contractor dredged outside the permitted area. As a result the State of Florida Department of Environmental Protection and Miami-Dade County entered into a Consent Order on May 7, 2002 to address the damage to low- to moderate-density sea grasses outside of the permitted dredging area. This Order requires the Port of Miami to undertake a mitigation project at the Oleta River State Park in North Miami. The plan includes 1) restoration of 42.5 acres of red mangrove swamp, tidal streams, and tidal pools; 2) enhancement of approximately 20 acres of tidal red mangrove habitat; 3) and creation and installation of bilingual environmental education signs within the Park. This mitigation work addresses the Department of Environmental Resources Management (DERM) Notice of Violation as well.

ECOSYSTEM RESTORATION USING DREDGED MATERIAL (EP-116-2-1)

168. The Planning Guidance Notebook ER 1105-2-100 (USACE, April 2000) page E-69 states that it is Corps policy that studies include an assessment of potential beneficial uses for environmental purposes including fish and wildlife habitat creation, ecosystem restoration and enhancement, and hurricane and storm damage reduction. Three types of beneficial use exist near the project area. Although a majority of dredged material will be disposed of in the ODMDS site as much as possible, the following beneficial use sites will be used:

a. North Biscayne Bay dredge holes provided fill material for previous nearby construction projects such as the Julia Tuttle Causeway. Currently that borrow site has an area of approximately 24 acres which is slated for dredged material disposal. The dredge hole extends to such a depth that anoxic conditions exist, where the hole provides little viable marine habitat. The hole will be filled with 720,000 cy of excavated rock material and capped with 80,000 cy of sandy material as shown in Engineering – Appendix B, plate B-22. Field visits conducted by the Corps, the Port, and resource

agency staff indicated that if the crest of the filled hole could be extended into the photic zone, it would be an ideal site for seagrass recruitment.

b. Planting of the proposed 24-acre mitigation site is expected to follow a pattern demonstrated by a three-acre restoration site in North Biscayne Bay that was prepared by Miami-Dade County DERM. Restoration of three-acre borrow area in North Biscayne Bay was completed in the late 1990s. Although no monitoring has been done by DERM since planting of the site, a visual inspection by an agency team in 2002 revealed that seagrass occurs throughout the site and was dominated by *H. wrightii* and *T. testudinum*. Discussions with DERM staff indicate the old borrow area was filled with rubble and sand and planting units of both *H. wrightii* and *T. testudinum* installed. Based on this evidence of success, it is agreed that seagrass restoration in deep dredge holes is a viable option for mitigating seagrass loss in Biscayne Bay.

c. The existing dredged material disposal site located on the north side of Virginia Key is another “beneficial use site”. It is proposed to place beach quality material into the site where it can be offloaded in the future to provide hurricane and storm damage protection for the easterly shoreline of Virginia Key.

d. The third type of beneficial use involves placement of large blasted rock material into reef creation sites located south of the outer channel. Approximately 250,000 cubic yards of rocky material is expected to be placed in those sites.

INCREMENTAL COST ANALYSIS OF MITIGATION PLAN

169. Restoring seagrass beds is an appropriate mitigation strategy due to its high ecological value and declining abundance. Seagrass restoration adds habitat value to unvegetated sand or mud substrates. The addition of seagrass beds increases the productivity and diversity of the unvegetated bottom, which can directly compensate for the historic loss in productivity and diversity.

170. Alternative plans for seagrass mitigation incorporated choices among construction methods and between planting methods. A cost-effectiveness analysis determined that using rock to close the hole and then allowing the seagrass to naturally recolonize resulted in the lowest Average Annual Equivalent (AAE) cost per AAE acre of seagrass. This is the mitigation component costed out in the MCACES presented in the Engineering Appendix. See Appendix F, *Mitigation Plan - Incremental Cost Analysis,* for a detailed discussion of the cost-effectiveness analysis.

FUTURE OPERATIONS AND MAINTENANCE

171. Proposed improvements of the Miami Harbor Federal navigation project consist of multiple elements: deepening the entrance channel from 44 to 52 feet, constructing a 200-foot widener along the easternmost limit of the entrance channel, and several widening and/or deepening modifications to the interior channels and turning basins.

172. Recent sediment budget studies (Dade County Regional Sediment Budget, Coastal Systems International, January 1997; Dade County Evaluation Report, Jacksonville District, COE, October 2001) have been performed along the length of the Dade County Beach Erosion Control project, which extends along the length of the Dade County Atlantic shoreline from northern Sunny Isles southward to Government Cut. These sediment budget studies indicate that the net littoral transport in the vicinity of Government Cut is about 24,000 cy/yr to the south, which represents the maximum potential sediment transport rate into the channel. The most recently calculated sediment budgets conclude that an average of 15,000 cy/yr is deposited in the interior channels, while 9,000 cy/yr is deposited in shoals along the outer reaches of the channel. These values agree closely with observed shoaling rates as determined from dredging records.

173. The proposed widening and deepening of the entrance channel would tend to further decrease any sediment bypassing, but under the existing conditions the Miami Harbor entrance channel already forms a complete littoral barrier. Examination of the sediment budget for Government Cut shows that the entire volume of southward-directed sediment transport is deposited into the interior and exterior reaches of the channel, and the volume of sediment bypassed across the entrance channel to downdrift beaches is essentially zero. The proposed deepening and widening of the existing project cannot therefore further increase the rate of channel shoaling or decrease the volume of sediment bypassing.

174. Numerical modeling of the proposed channel improvements has been performed, and the results of these simulations show that negligible changes to current velocities and salinity levels will occur throughout the extent of the project as a result of the proposed improvements.

175. Due to the lack of sediment bypassing under the existing conditions, and due to the negligible changes in tidal current velocities as determined by numerical modeling, no significant changes to the existing shoaling rates and patterns of deposition are expected due to construction of the proposed channel improvements at Miami Harbor. There is no additional future operation and maintenance anticipated as part of the proposed project.

INITIAL AND AAEQ COST FOR NED PLAN

176. The initial cost of the NED plan, is about $148,571,000 as explained in **Table A-88** of the Costs Section of the Economics – Appendix A, which does not include $50,000 for five years of post construction mitigation monitoring or annual maintenance costs of $15,000 for USCG navigation aids over the 50 year economic life of the project. The post-construction mitigation monitoring costs of $50,000 per year for the first five years following completion of the project are discounted using the Federal discount rate of 5.625 percent to the base year of the project to obtain the real cost or present worth costs of $213,000 at October 2003 price levels. That present worth cost is then annualized over the 50-year economic life of the project to provide an Average Annual Equivalent (AAEQ) cost of $13,000. The present worth of the Fisher Island bulkhead replacement cost is $291,000 with an AAEQ of $18,000. The itemization of the initial costs has been displayed in **Table 20** of the main report. The interest during construction (IDC) cost is about $19,262,000 from **Table 15**. The total economic costs for plan formulation include construction costs of $148,571,000, present worth costs of $249,000 for USCG maintenance of navigation aids, present worth costs of $213,000 for post construction mitigation monitoring, present worth costs of $291,000 the Fisher Island bulkhead replacement costs, and IDC of $19,262,000 for a total of $168,587,000.

177. The estimated annual costs for the recommended plan are based on the AAEQ of the first cost and interest during construction and, the annualization for post-construction costs for mitigation monitoring, annual maintenance for USCG navigation aides, and annualization of the Fisher Island bulkhead replacement costs. The AAEQ costs total about $10,140,000 (**Table 19**).

ECONOMIC SUMMARY

178. For the NED plan **Table 19** in this report and **Table A-91** in the Economics – Appendix A provide the total AAEQ benefits of $16,231,000 and costs of $10,140,000, which result in net AAEQ benefits of $6,091,000. The benefit to cost ratio for the NED plan is 1.60 to 1.

179. For the Locally Preferred plan **Table 19** in this report and **Table A-91** in the Economics – Appendix A provide the total AAEQ benefits of $16,262,000 and costs of $10,789,000, which result in net AAEQ benefits of $5,473,000. The benefit to cost ratio for the LP plan is 1.51 to 1.

Fisher Island Bulkhead

180. The present worth of the Fisher Island bulkhead mentioned above in paragraph 175 results from an economic analysis of the remaining useful life of

the bulkhead based on a September 5, 2003, report by Shaw Environmental and Infrastructure, Inc. As noted in paragraph 176 the present worth figure of $291,000 is annualized over the 50-year economic life of the project resulting in an average annual equivalent value of about $18,000, which is included as part of the economic costs of the proposed project. A detailed evaluation of the economic analysis, which provided the Fisher Island bulkhead replacement cost is included in the costs section of Economics – Appendix A. During the plan formulation process earlier efforts to avoid potential impacts to the Fisher Island bulkhead from proposed channel widening and deepening resulted in modification of the transition of the 100-foot widener (component 5A) along Fisherman's Channel as shown in figure 6. While Fisher Island representatives acknowledged the work to avoid impacts to the bulkhead by moving component 5A further away from the existing bulkhead, they presented a report by EAS Engineering, Inc. at a May 6, 2003, public meeting which indicates that the side slopes from the proposed deepening and widening could impact the Fisher Island bulkhead. While the EAS Engineering report and the Shaw Environmental and Infrastructure report note different causes for the current condition of the Fisher Island bulkhead, the economic analysis of the remaining useful life of the bulkhead provides a reasonable evaluation for the economic cost of the potential impact. The Shaw Environmental and Infrastructure evaluation of the bulkhead along component 5A also indicates that use of a segment of the bulkhead as a berthing facility may be a significant cause of the current structural deterioration of that segment of the bulkhead.

RISK AND UNCERTAINTY

181. Risk and uncertainty associated with the economic analysis are addressed through sensitivity analyses that modify the values associated with key assumptions and/or input parameters to determine the impact of the change on estimated benefits and costs, as well as project formulation. For this study, cargo growth rates and interest rates were identified for sensitivity tests.

182. The current Federal interest rate is 5 5/8 percent. By policy, the Federal interest rate cannot change more than one-quarter of a percent per year; therefore, to account for a potential annual adjustment in the interest rate, interest rates of 5 3/8 percent and 5 7/8 percent were used. The impacts on benefits and costs resulting from these changes are shown in **Table A-95 and Table A-96** of the Economics Appendix.

183. To determine if future cargo growth is required for project justification, a sensitivity analysis was conducted assuming zero growth from the base year, 2010, to the end of the project life, 2060. The results of this assessment are displayed in **Table A-97** of the Economics Appendix. This assessment shows that growth in cargo traffic is required for benefits to exceed costs. Zero growth

is not a realistic assumption; however, it is an expeditious way to demonstrate whether or not a project is economically justified without growth.

184. A more realistic test of growth assumptions is to assess the impact of modifying an assumption that represents a deviation from the historical average annual rate of growth and that could have a major impact on project benefits. Specifically, in the analysis, future growth rates for European and Far East import cargo were assumed to be less than their historical average annual rates from 1990 to 2000, 7.6 percent compared to 8.14 and 11.66 percent, respectively. The results of assuming the higher rates of growth at least for the near-term, from 2003 to the base year, 2010, are shown in **Table A-98** of the Economics Appendix. As shown in these tables, the NED plan for Miami Harbor remains Alternative H, channel deepening to 49 feet.

FLOOD PLAIN ASSESSMENT

185. Executive Order 11988 requires the Federal Government to avoid, if possible, adverse impacts associated with the occupancy and modification of flood plains as well as direct or indirect support of development in those areas where there is a practical alternative. The existing port facilities at Miami Harbor are already in the 100-year flood plain. Federal improvement of the existing navigation project will encourage continued use of existing facilities on those lands as well as those already planned for future growth in commerce. Port development will occur with or without the proposed improvement.

186. Relocation of cargo facilities such as the gantry cranes, piers, bulkheads, and paved storage areas for containers is not practical for a port serving deep draft ships. The port facilities are about at the 100-year elevation to avoid any serious damages from flooding. Use of alternative Florida ports is impractical as most are in similar flood plain situations. In addition, maintenance dredging activities will cause no flood plain or wetland impacts and consequently no gains or losses of acreages realized in the flood plain or coastal zone. Therefore, the proposed plan is in compliance with the Executive Order calling for enumeration of those possible impacts.

SEA LEVEL RISE

187. Throughout geologic history, global sea level variations, both rise and fall, have occurred. Some authorities have found evidence to indicate that we may be entering a new ice age with a resultant sea level drop. Others argue that increasing atmospheric concentrations of carbon dioxide and other gases are causing the earth to warm, contributing to a sea level rise. Eustatic sea level change is defined as a global change of the oceanic water level. Total relative sea level change is the sum of the eustatic sea level and any local change in land elevation.

188. The National Ocean Service (NOS) has compiled relatively long-term (approximately 50-year duration) records of measured water surface elevations at various locations along United States coastlines. Sea level rise rates based on long-term data gathered at Mayport, Florida, were estimated to be 2.2 mm/yr. This estimated rate should be applicable to the study area.

PLAN IMPLEMENTATION

189. To implement a plan at Miami Harbor, certain conditions and requirements are necessary to meet State, Local, and Federal standards set by law. A discussion of those responsibilities is in the subsequent paragraphs. The Cost Sharing and Recommendations sections contain the Sponsor's cost sharing requirements and related responsibilities. Initial discussion of those responsibilities occurred at the Alternative Formulation Briefing (AFB) on June 20, 2002, at the Port of Miami, Miami-Dade County Seaport Department.

STATE REQUIREMENTS

190. The proposed action affects seagrass and hardbottom/reef communities and other waters of the United States subject to Section 404 of the Clean Water Act (CWA). A Section 404(b)(1) Evaluation Report has been completed and is included in the final Environmental Impact Statement (EIS) – Appendix C to comply with the CWA. State approval is required for certification of water quality through Section 401 of the CWA and concurrence. A Coastal Zone Management Consistency Determination was prepared by the USACE and was be submitted to the State for concurrence during coordination of the draft report. According to a May 14, 2003, letter located in Appendix D of the final EIS the state has determined that at this stage, the proposed project is consistent with the Federal Coastal Management Program (FCMP). The letter adds that the state's continued concurrence will be based, in part, on the adequate resolution of issues identified during review of the draft report and subsequent reviews.

COST SHARING

191. Under the Water Resources Development Act (WRDA) 1986, as amended by Section 201 of WRDA 1996, Federal participation in navigation projects is limited to sharing costs for design and construction of the general navigation features (GNF) consisting of breakwaters and jetties, entrance and primary access channels, widened channels, turning basins, anchorage areas, locks, and dredged material disposal areas with retaining dikes. Non-federal interests are responsible for and bear all costs for acquisition of necessary lands, easements, rights-of-way and relocations; terminal facilities; and dredging berthing areas and interior access channels to those berthing areas.

192. Section 101 of WRDA 1986 as amended, requires the project sponsor to bear a percentage share of harbor construction costs for project components that are cost-shared (general navigation features, mitigation) that varies according to the range of water depths where the work is done. That variable cost share is paid during construction.

193. Section 101 (a)(1)(A) of WRDA 1986 specifies that for commercial navigation projects with a depth up to 20 feet, cost sharing for construction of the project's GNF is 90 percent Federal and 10 percent non-Federal. For a depth in excess of 20 feet but not in excess of 45 feet, cost sharing for construction of the project's GNF is 75 percent Federal and 25 percent non-Federal. This cash contribution is to be paid during construction.

194. Furthermore, Section 101 (a)(2) of WRDA 1986 specifies that non-Federal interests shall pay an additional 10 percent of the cost of the GNF in cash over a period not to exceed 30 years, at an interest rate determined pursuant to Section 106 of WRDA 1986. The value of lands, easements, and rights-of-way necessary for the project shall be credited toward this 30-year cash payment. Aids to navigation (operated and maintained by the U.S. Coast Guard) are a 100 percent Federal cost. Section 103(c)(4) of WRDA 1986 also mandates a non-Federal share equal to 50 percent of joint and separable costs allocated to recreational navigation. That cost share is paid during construction. The recommended plan for Miami Harbor does not include any recreational navigation features.

195. Policy Guidance Letter (PGL) No. 62, "Navigation (Harbors) Cost Sharing Policy Applications" provides guidance on the application of navigation cost sharing as contained in Section 101 of the Water Resources Development Act of 1986, as amended.[2] **Table 22** shows the current Federal cost sharing percentages allocated to specified depth zones.[3] This table is derived from ER 1105-2-100, April 2000 (Table E-12: Navigation, Construction and O&M).

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[2] Policy Where Channel Deepening Is Not Limited To One Depth Zone (for example where a channel is deepened from 40 to 50 feet): Cost sharing is determined as shown in Appendix G to ER 1165-2-131. This approach also applies to GNF features associated with such a project which involve deepening which crosses different depth zones such as widenings, turning basins, and anchorage areas. The existing and improved main channel depths will be used to determine cost sharing. For example, for a channel deepened from 40 to 50 feet, there are two depth zones – one to 45 feet and one to 50 feet – even though widening or other GNF features may be in areas that have natural depths of 20 feet or less. This case is illustrated in the enclosed Figure 2.

[3] Policy Where There Is No Channel Deepening: For navigation projects that involve no deepening, for example a widening-only project or a project involving addition of a breakwater, the entire General Navigation Feature (GNF) costs are shared at either the cost sharing associated with the existing project depth or, if there is no improved depth, the natural controlling depth.

Table 22 - Cost Allocation

Feature	Federal Cost %[1]	Non-Federal Cost % [1]
General Nav. Features (GNF)	• 90% from 0' to 20' • 75% from >20' to 45' • 50% > 45'and deeper	• 10% from 0' to 20' • 25% from > 20' to 45' • 50% > 45' and deeper
GNF's costs for this project include: mobilization/demobilization, all dredging costs, all disposal area construction costs, mitigation costs.		
Associated Costs [2]	• 0%	• 100%
Associated costs for this project are: dredging of Port berthing areas; port infrastructure construction; lands, easements, and rights of way, and acquisition of disposal sites; all utility relocations; costs for features requested by Port in excess of NED.		
Navigation Aids	• 100%	0%
Operation and Maintenance		
GNF	• 100% except cost share 50% costs for maint. > 45 feet	• 0% except cost share 50% for maint. > 45 feet
Port berths, Port , Infrastruc.	• 0%	• 100%
Mitigation	• 0%	• 100%

196. For the increment to depth of 45 feet, the total first cost of construction of the general navigation features is the amount used for cost sharing. From a total first cost and mitigation monitoring cost of $111,783,000 the amount of $74,814,000 is eligible for cost sharing. **Table 23** displays all of the cost features and cost sharing for the increment from that of the without project condition to the 45 feet depth increment.

Table 23 - Cost Apportionment for increment up to 45 feet

Cost Apportionment for increment up to 45 ft.(for NED plan of 49 ft.)

Cost for 45 ft. Plan Construction Item	**Total Cost allocated >20-45 ft.**	**Fedeal Share GNF 75%**	**Non-Fed GNF 25%**
Dredging --			
Mob & Demob	$4,141,921	$3,106,441	$1,035,480
Alternative 1C (Cut 1/2 & intersection widening)	14,014,554	$10,510,916	$3,503,639
Alternative 2A (Cut 3 Widener)	350,015	$262,511	$87,504
Alternative 3B (Cut 3)	10,236,122	$7,677,092	$2,559,031
Alternative 5A (Fisherman Channel)	30,523,070	$22,892,302	$7,630,767
Disposal Area (Virginia Key)	238,994	$179,246	$59,749
Environmental Mitigation	5,489,068	$4,116,801	$1,372,267
Mitigation Monitoring (Reef Construction)	120,000	$90,000	$30,000
Planning, Engineering, and Design	2,530,000	$1,897,500	$632,500
Construction Management (S&I)	7,170,000	$5,377,500	$1,792,500
Subtotal GNF	**$74,813,744**	**$56,110,308**	**$18,703,436**
Aids to Navigation 1/	**$165,300**	$165,300	$0
Lands, Easements, Rights of Way, and Relocations		$0	$0
Real Estate, Administrative (Federal)	**$12,500**	$9,375	$3,125
Utility Relocations 2/	**$4,617,577**	***not applicable.***	
Associated Non-Federal Costs			
Berthing Area Dredging (Alt. 5A)	$11,156,566		$11,156,566
Port Bulkhead Construction	20,520,000		20,520,000
Mitigation Monitoring (Post-Const. Seagrass)	235,000		235,000
Mitigation Monitoring (Post-Const. Reef)	250,000		250,000
Real Estate, Administrative (non-Federal)	12,500		12,500
Total Project First Cost and mitigation monitoring	**$111,783,187**		
Additional 10% of GNF		($7,481,374)	$7,481,374
LERR Adjustment 3/		$12,500	($12,500)
Cost Sharing for deepening to 45 feet		**$48,816,108**	**$58,349,502**

1/ Navigation Aids -- 100% Federal
2/ Utility relocations are not cost shared by the Federal Government
3/ LERR adjustment not to exceed 10% of GNF. Adjusted for administrative real estate relocation and utility relocation

197. The first cost of construction for cost sharing applies to the NED plan depth of 49 feet has an initial cost of $148,336,000. Including mitigation monitoring, the cost-sharing amount is $148,821,000. The additional cost for the general navigation features from that of the 45-foot plan is about $31,470,000 and is displayed in **Table 24**. The GNF is apportioned according to the 50% Federal, 50% non-Federal with the appropriate LERR adjustment against the ten percent cash contribution. For a project depth greater than 45 feet the utility relocations costs is borne 50% by the utility owner and 50% by the non-Federal sponsor in accordance to Section 101(a)(4) of WRDA 1986.

198. The increments from **Tables 23** and **24** are added together to get the total cost sharing for the NED plan presented in **Table 25**.

Table 24 - Incremental Cost Sharing for depth from 45 to 49 feet

Construction Item	Total Cost allocated >45-49 ft.	Fedeal Share GNF 50%	Non-Fed GNF 50%	
Dredging --				
Mob & Demob	0	0	0	
Alternative 1C (Cut 1/2 intersection widening)	5,277,840	$2,638,920	$2,638,920	
Alternative 2A (Cut 3 Widener)	105,005	$52,503	$52,503	
Alternative 3B (Cut 3)	5,833,654	$2,916,827	$2,916,827	
Alternative 5A (Fisherman Channel)	14,343,192	$7,171,596	$7,171,596	
Disposal Area (Virginia Key)	358,492	$179,246	$179,246	
Environmental Mitigation	2,302,088	$1,151,044	$1,151,044	
Mitigation Monitoring (Reef Construction)	0	$0	$0	
Planning, Engineering, and Design	850,000	$425,000	$425,000	
Construction Management (S&I)	2,400,000	$1,200,000	$1,200,000	
Subtotal GNF	**$31,470,271**	$15,735,136	$15,735,136	
Aids to Navigation	**$0**			
Lands, Easements, Rights of Way, and Relocations				
Real Estate, Administrative (Federal)	**$0**			
				Utility owner
Utility Relocations 1/	**$4,617,577**		$2,308,789	$2,308,789
Associated Non-Federal Costs				
Berthing Area Dredging (Alt. 5A)	**$3,287,955**		$3,287,955	
Port Bulkhead Construction	**$2,280,000**		$2,280,000	
Mitigation Monitoring (Post-Const. Seagrass)	**$0**		$0	
Mitigation Monitoring (Post-Const. Reef)	**$0**		$0	
Real Estate, Administrative (non-Federal)	**$0**		$0	
Additional 10% of GNF		($3,147,027)	$3,147,027	
LERR Adjustment 2/		$2,308,789	($2,308,789)	
Incremental Cost Sharing for 45 to 49 ft.		**$14,896,897**	**$24,450,118**	

1/ Utility relocations costs for projects authorized at depths greater than 45 feet, in accordance to Section 101(a)(4) of WRDA 86 is borne as follows: 50% by the the utility owner and 50% by the non-Federal sponsor. Therefore, for this line item total cost is shown -- not incremental.

2/ LERR adjustment not to exceed 10% of GNF. GNF for NED plan = $106,284,015. 10% = $10,628,402. Adjustment is total of Real Estate

administrative cost and Utility Relocation.
Real Estate administrative cost recognized at 45 ft.
increment; no incremental cost at 49 ft.

Table 25 - Total Cost Sharing for NED Plan

Construction Item	Total Cost For 49 ft.	Fedeal Share GNF	Non-Fed GNF	
Dredging --				
Mob & Demob	$4,141,921	$3,055,077	$1,086,845	
Alternative 1C (Cut 1/2 intersection widening)	$19,292,394	$13,149,836	$6,142,559	
Alternative 2A (Cut 3 Widener)	$455,020	$315,014	$140,006	
Alternative 3B (Cut 3)	$16,069,776	$10,593,919	$5,475,858	
Alternative 5A (Fisherman Channel)	$44,866,262	$30,063,898	$14,802,363	
Disposal Area (Virginia Key)	$597,486	$358,492	$238,994	
Environmental Mitigation	$7,791,156	$5,267,845	$2,523,311	
Mitigation Monitoring (Reef Construction)	$120,000	$90,000	$30,000	
Planning, Engineering, and Design	$3,380,000	$2,322,500	$1,057,500	
Construction Management (S&I)	$9,570,000	$6,577,500	$2,992,500	
Subtotal GNF	**$106,284,015**	**$71,845,443**	**$34,438,571**	
Aids to Navigation 1/	**$165,300**	**$165,300**	**$0**	
Lands, Easements, Rights of Way, and Relocations				
Real Estate, Administrative (Federal)	**$12,500**	**$9,375**	**$3,125**	
				Utility Owner
Utility Relocations	**$4,617,577**	**$0**	**$2,308,789**	$2,308,789
Associated Non-Federal Costs				
Berthing Area Dredging (Alt. 5A)	$14,444,521		$14,444,521	
Port Bulkhead Construction	$22,800,000		$22,800,000	
Mitigation Monitoring (Post-Const. Seagrass)	$235,000		$235,000	
Mitigation Monitoring (Post-Const. Reef)	$250,000		$250,000	
Real Estate, Administrative (non-Federal)	$12,500		$12,500	
Subtotal Associated Non-Federal Costs			$37,742,021	
Total Project First Cost	**$148,821,413**	$72,020,118	$74,492,506	$2,308,789
Additional 10% of GNF		($10,628,401)	$10,628,401	
LERR Adjustment 2/		$2,321,289	($2,321,289)	
Cost Sharing for NED Plan		**$63,713,005**	**$82,799,619**	$2,308,789

1/ Navigation Aids -- 100% Federal
2/ LERR adjustment not to exceed 10% of GNF. Adjusted for administrative real estate relocation and utility relocation

199. The Federal and non-Federal shares of the GNF for the NED plan have an estimated cost of $106,284,000, including all environmental mitigation costs. The cost sharing is $71,845,000 Federal, and $34,439,000, non-Federal. The non-Federal portion includes a repayment of 10 percent of the cost to construct the GNF, less allowable credits for the values of lands, easements, rights-of-way and relocations (LERR) necessary for the Federal project. The 10 percent of GNF is $10,628,000; the LERR credit is estimated at $2,321,000. The difference is $8,307,000, which may be paid with interest over a period not to exceed 30 years. The non-Federal interests would also be responsible for all the berthing areas and associated disposal area capacity. Total estimated costs for local service facilities are $37,742,000 (Berthing area dredging for component 5A --$14,445,000; port bulkhead construction --$22,800,000; post construction seagrass mitigation monitoring --$235,000; post construction reef mitigation monitoring --$250,000; and non-Federal Real Estate Cost of $12,500).

200. The cost for the LP plan has been estimated at about $157,295,000 as previously displayed (annual maintenance costs of $15,000 for USCG navigation aids not included). As the LP plan is a larger plan than the NED plan, the non-Federal Sponsor pays for the difference in increased cost. This difference alone is $8,473,000. **Table 26** displays the cost apportionment for the Locally Preferred plan. The federal cost sharing of about $63,713,000 remains the same as per the NED plan, which includes the 10% payments toward GNF and the LERR credit. The portion of the non-Federal cost of the LP plan is $93,582,000, which includes the owner cost of the utility relocation of $2,309,000. With this cost excluded, the amount of $91,273,000 is to be paid by the non-Federal Sponsor.

Table 26 - Cost Apportionment for the Locally Preferred Plan

		Federal	Non-Federal
NED PLAN			
Cost Sharing for deepening to 45 feet		$48,816,108	$58,349,502
Incremental Cost Sharing for 45 to 49 ft.		14,896,897	24,450,118
Total Cost Sharing for NED plan		$63,713,005	$82,799,619
Utility owner expense for relocation			
Cost Sharing Percentage for NED plan		42.8%	55.6%
LOCALLY PREFFERED PLAN			
Locally Prefered Plan is 50'/52'			
First Cost of LPP	$157,294,599		
(less nav. aids. annual maint.)			
NED Plan First Cost	$148,821,413		
Difference from LPP and NED Plan	$8,473,186	100% non-fed	$8,473,186
LOCALLY PREFERRED PLAN			
FEDERAL SHARE		**$63,713,005**	
NONFEDERAL SHARE			**$91,272,805**
Owner Cost for Utility Relocation		-	**$2,308,789**
Cost Sharing of First Cost		$63,713,005	$93,581,594
MCACES RECONCILIATION			
ADD:			
Mitigation Monitoring – Non-Federal			
Annual Navigation Maintenance -- Federal		$15,000	
FEDERAL		$63,728,005	
NONFEDERAL			$93,581,594
TOTAL FEDERAL AND NONFEDERAL	$157,309,599		
Overall First Cost Percentage per LPP:		40.5%	59.5%

SUMMARY OF COORDINATION

201. An environmental scoping letter was sent to interested parties on January 6, 2000 (Draft EIS - Appendices A and B). In addition, all parties were invited to participate in the plan formulation process by identifying any additional concerns on issues, studies needed, alternatives, procedures, and other matters related to the project. A local, state, and Federal resource agency meetings occurred on March 13, 2000, and May 13, 2000, to determine the areas of coverage for an environmental baseline resource survey. A meeting followed on November 1, 2000, with those resource agencies to review preliminary results. An Intent to prepare a Draft Environmental Impact Statement (DEIS) appeared in the Federal Register, Volume 66, No. 167, on August 28,2001. An Alternative Formulation

Briefing occurred on June 20,2002. The Notice of Availability of the Draft EIS appeared in the Federal Register on March 14, 2003. A notice for a public meeting appeared in the *Miami Herald* on April 27, 2003. The public meeting followed on May 6, 2003, at Terminal 12 of the Port of Miami. A two day Blasting Workshop occurred from September 8 – 9, 2003, at the Port of Miami Terminal 12. Compliance with other environmental requirements is included in Section 6.0 of the Environmental Impact Statement.

202. Federal agencies involved included the U.S. Army Corps of Engineers, U.S. Coast Guard, Environmental Protection Agency, U.S. Fish and Wildlife Service, and National Marine Fisheries Service. State agencies include Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, State Historic Preservation Officer, and Florida Department of Transportation. Local agencies include Miami-Dade County Department of Environmental Resources Management, South Florida Regional Planning Council, and the City of Miami. Non-Government Organizations/Institutions include the Biscayne Bay Pilots and Biscayne Bay Regional Coordination Team (Biscayne Bay Partnership Initiative).

CONCLUSIONS

203. Various components received consideration to resolve navigation needs and problems on the existing Federal project. Extensive plan formulation and evaluation was performed in the effort to avoid wherever possible, and minimize impacts to the environment. Refined element design using a ship simulation study and other tools were employed to achieve the minimum project footprint that provided a safe design. The resulting NED plan was determined. The NED plan is the environmentally acceptable plan that maximizes net Federal benefits. However, the Port has requested a Locally Preferred (LP) plan, which is the plan proposed for construction.

204. The total first cost of the LP plan is estimated at $157,295,000, including mitigation costs. The estimated average annual equivalent benefits and costs are $16,262,000 and $10,789,000 respectively. The benefit to cost ratio is 1.51 to 1 with net benefits in the amount of $5,473,000. The total first cost of the NED plan is estimated at $148,821,000, including mitigation costs. The estimated average annual equivalent benefits and costs are $16,231,000 and $10,140,000 respectively. The benefit to cost ratio is 1.60 to 1, with net benefits in the amount of $6,091,000.

RECOMMENDATIONS

205. I recommend that the existing project for deep-draft navigation at Miami Harbor be modified to provide for implementation of a Federal project for deeper

draft commercial vessels, in accordance with the locally preferred plan selected herein, with such further modifications thereto as in the discretion of the Chief of Engineers, may be advisable; at a first cost to the United States presently estimated at $157,295,000, including mitigation costs, cost shared in accordance to PGL No. 62, Navigation (Harbors) Cost Sharing Policy Applications, and ER 1105-2-100, Planning Guidance Notebook. Aids to navigation are to be funded by the United States Coast Guard. There are no additional annual operation, maintenance, repair, rehabilitation and replacement costs to the United States government for the implementation of the locally preferred plan.

206. These recommendations are made with the provision that the exact amount of the non-Federal contribution shall be determined in accordance with the following required items of cooperation to which the non-Federal sponsor (Miami Port Authority) shall agree to perform prior to implementation:

a. Enter into a design agreement which provides, prior to construction, payment of 25 percent of design costs;

b. Provide, during construction, any additional funds needed to cover the non-Federal share of design costs;

c. Provide, during the period of construction, a cash contribution equal to 25 percent of the costs of construction of the general navigation features (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, or maintenance and for which a contract for the facility's construction or improvement was not awarded on or before October 12, 1996) to project increment up to 45 feet; provide during the period of construction, a cash contribution equal to 50 percent of the costs of construction of the general navigation features to project increment above 45 feet, and equal to or below 49 feet (NED plan); and pay 100 percent of the cost of construction of the general navigation features for depths in excess of 49 feet (LP plan);

d. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features up to a depth of 49 feet. The value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this

paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the general navigation features;

e. Provide all lands, easements, and rights-of-way, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project (including all lands, easements, and rights-of-way, and relocations necessary for dredged material disposal facilities); perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, LRR&R – with one-half of the cost of each such relocation borne by the owner of the facility, and one half of the cost of each relocation shall be borne by the non-Federal sponsor;

f. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities; in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government; provide and maintain without cost to the United States depths in berthing areas serving the terminals commensurate with the depths provided to the project identified as the NED plan; these berthing areas are identified as Gantry Crane Berths 99-140;

g. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

h. Grant the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the general navigation features for the purpose of inspection, and if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the general navigation features;

i. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project,

for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

k. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

l. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features;

m. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

o. Comply with all applicable Federal and State laws and regulations, including but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination of the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of Army"; The Non-Federal Sponsor is also required to comply with all applicable federal labor standards requirements including, but not limited to the Davis-Bacon Act (40 USC 276a et seq), the Contract Work Hours and Safety Standards Act (40 USC 327 et seq) and the Copeland Anti-Kickback Act (40 USC 276c);

p. Provide a cash contribution equal to the non-Federal cost share of the project's total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of 1 percent of the total amount authorized to be appropriated for commercial navigation; and

q. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute;

r. Provide and maintain without cost to the United States adequate public terminals, berthing areas, and transfer facilities open to all on equal terms;

s. Provide and maintain without cost to the United States, operation, maintenance, repair, replacement, and rehabilitation of all mitigation areas for the life of the authorized project as described in the recommended plan.

207. The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before proposals are made for authorization

and implementation finding. However, prior to transmittal to the Congress, the non-Federal Sponsor, the State, interested Federal agencies, and other parties will be advised of any changes and will be afforded the opportunity to comment further.

Robert M. Carpenter
Colonel, U.S. Army
District Engineer

NOTES:
1] DRAFT Environmental Baseline Resource Survey (underwater features) provided February 2001, by Dial Cordy & Associates, Jacksonville Beach, FL
2] USACE Survey Number 00-058, March 2000
3] Beacons, aids to navigation, and soundings are in approximate locations based on NOAA Nautical Charts (number 11468, 36th Ed., July 24 1999, and number 11466, 34th Ed., February 6 1999)
4] Elevations in feet and refer to mean lower low water
5] Projection Stateplane Coordinate System, NAD27, Fipszone 0901
6] Background aerial photos taken September 1 1999

LEGEN :

Existing Navigation Channel
Existing Centerline
Existing Channel Edge

Proposed omponents
Cmp1c
Cmp2a
Cmp3b
Cmp4
Cmp5
Cmp5a
Cmp6
Cmp6a

2000 0 2000 4000 6000 Feet

MIAMI HARBOR
ER L R VALUATION
R RT
Proposed Navigation Channel Modifications

N
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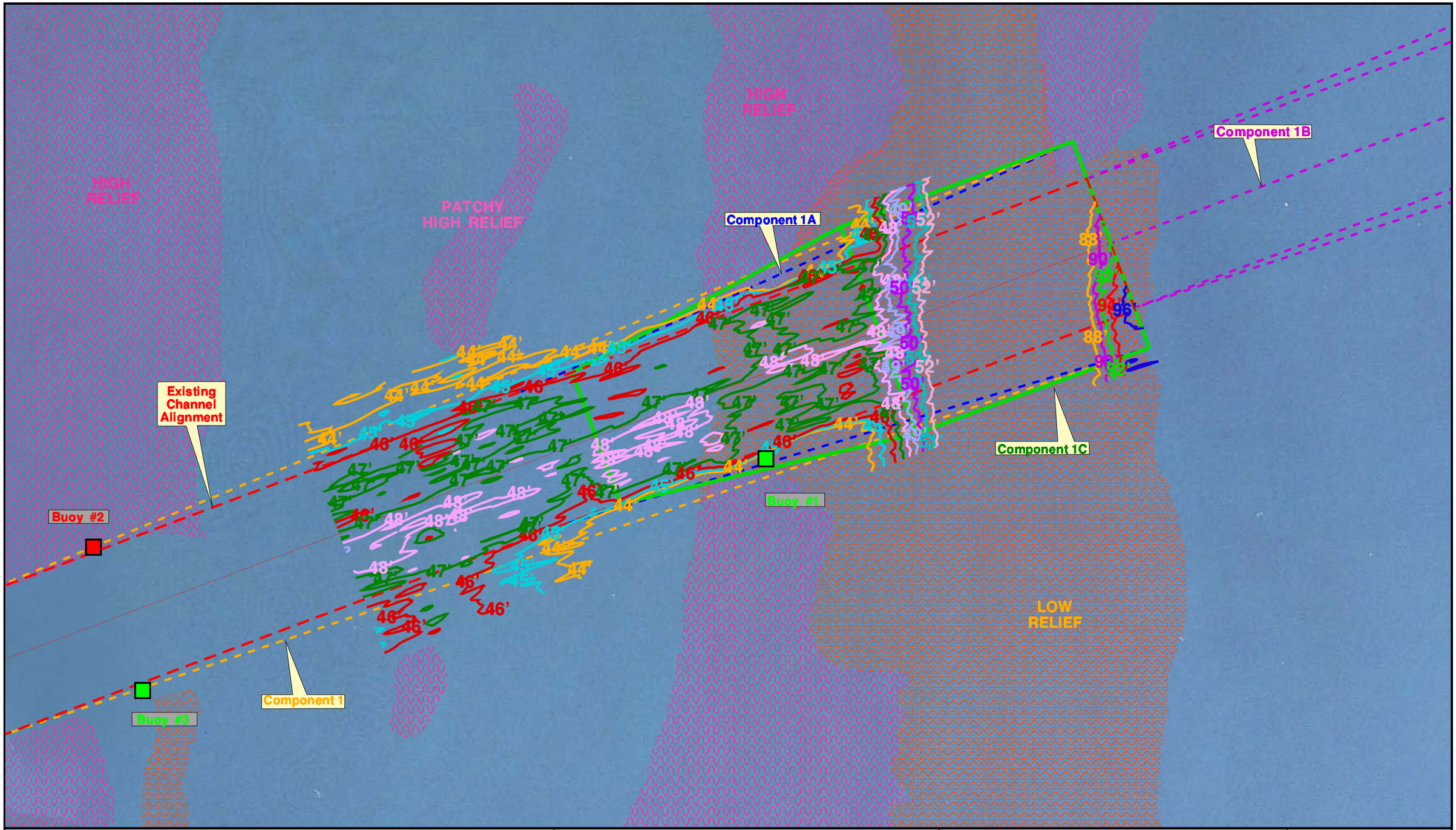
Jacksonville District

Figure 1



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LEGEND:
Navigation Aids

Red Buoy
Green Buoy
Red Beacon
Green Beacon
Red/White Beacon

N

200 0 200 400 600 Feet

MIAMI HARBOR
GENERAL REEVALUATION REPORT
Components 1, 1A 1B, 1C
Entrance Channel Widener

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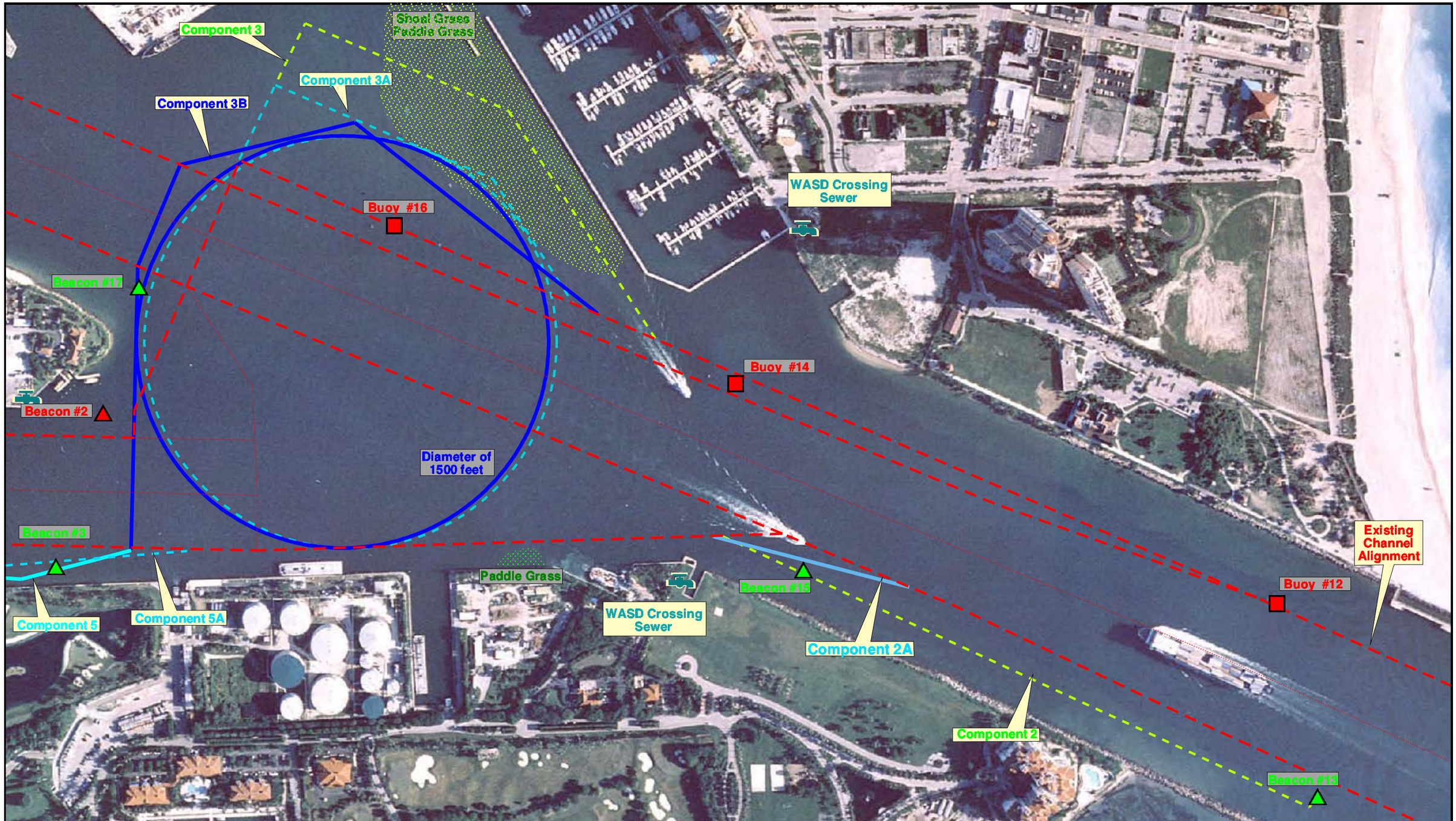
Jacksonville District

Figure 2



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6] Background aerial photos taken September 1 1999

LEGEN :
Navigation ids

Red Buoy
Green Buoy
Red Beacon
Green Beacon
Red/White Beacon

N

200 0 200 400 600 Feet

MIAMI HAR OR
ERAL R VALUATION
R RT
Components 2, 2A Wideners
Components 3, 3A, 3B
Turning Basin Modifications

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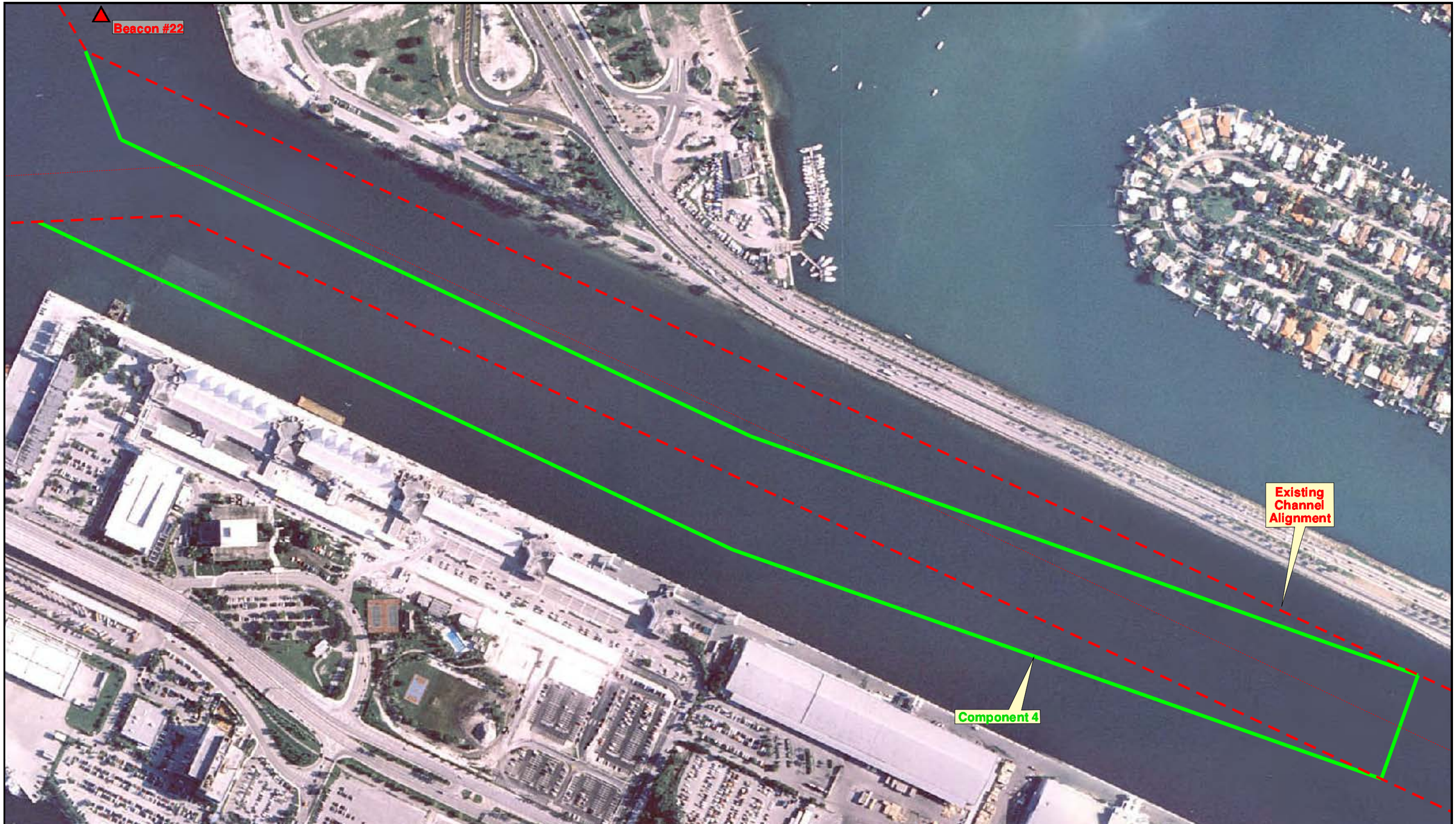
F E G NEERS
Jacksonville District

Figure 3



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6] Background aerial photos taken September 1 1999

LEGEND:
Navigation ids

Red Buoy
Green Buoy
Red Beacon
Green Beacon
Red/White Beacon

N

200 0 200 400 600 Feet

MIAMI HARBOR
GENERAL REEVALUATION
RE RT
Component 4
(Sheet of 2)
Channel Relocation

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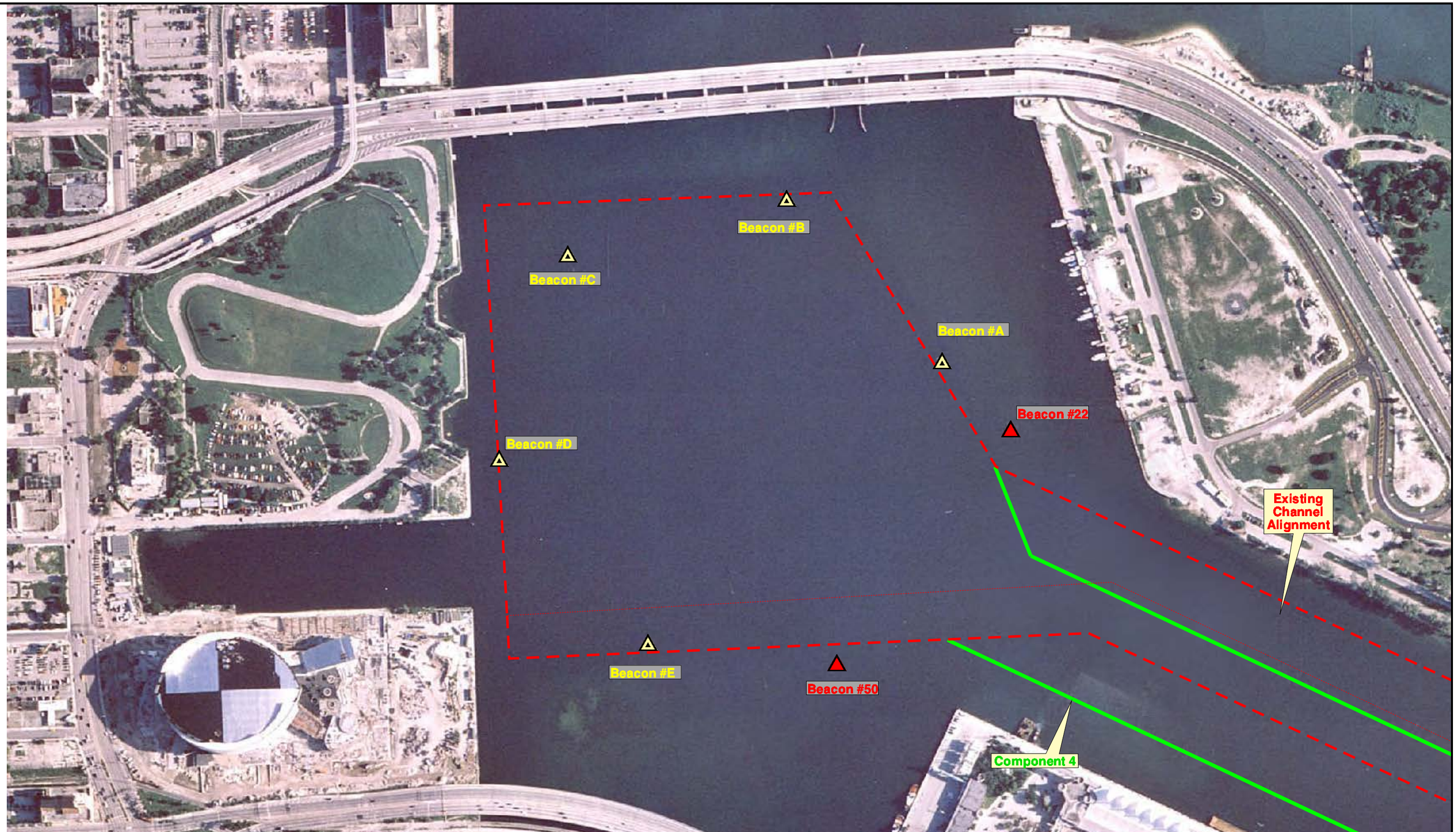
Jacksonville District

Figure 4



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5] Projection Stateplane Coordinate System, NAD27, Fipszone 0901
6] Background aerial photos taken September 1 1999

LEGEN :
Navigation ids

Red Buoy
Green Buoy
Red Beacon
Green Beacon
Red/White Beacon

N

200 0 200 400 600 Feet

MIA I ARBOR
ER L R VALUATION
R RT
Component 4
(Sheet of 2)
Channel Relocation

U.S.AR R S
E EE S
Jacksonville District

Figure 5

NOTES:
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6] Background aerial photos taken September 1 1999

LEGEND:
Navigation Aids

Red Buoy
Green Buoy
Red Beacon
Green Beacon
Red/White Beacon

N

200 0 200 400 600 Feet

MIAMI HARBOR
GENERAL REEVALUATION REPORT
Components 5 and 5A
(Sheet 1 of 2)
Widener

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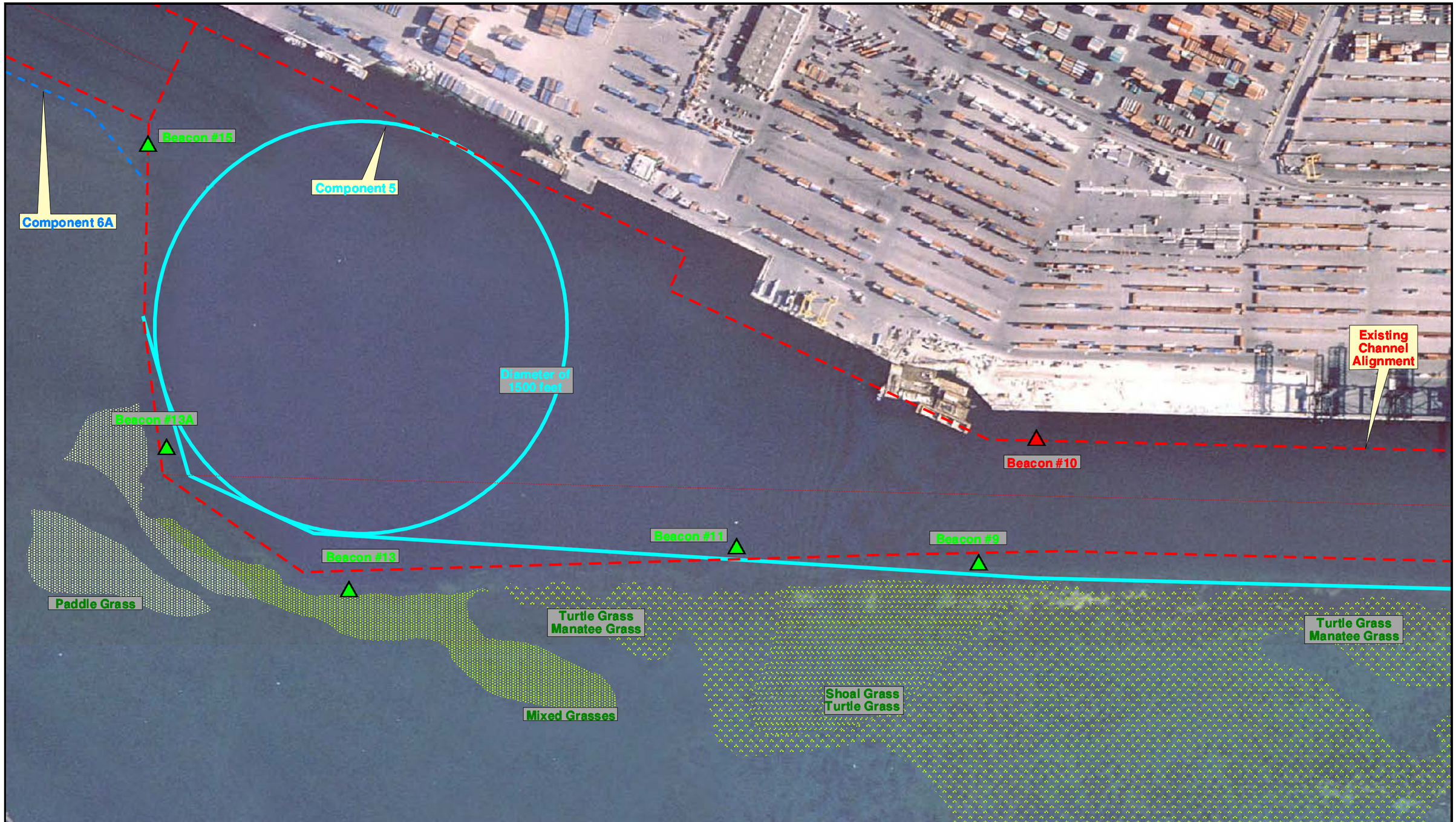
Jacksonville District

Figure 6



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5] Projection Stateplane Coordinate System, NAD27, Fipszone 0901
6] Background aerial photos taken September 1 1999

LEGEND:
Navigation Aids

Red Buoy
Green Buoy
Red Beacon
Green Beacon
Red/White Beacon

N

200 0 200 400 600 Feet

MIAMI HARBOR
GENERAL REEVALUATION
REPORT
Component 5
(Sheet 2 of 2)
Widener

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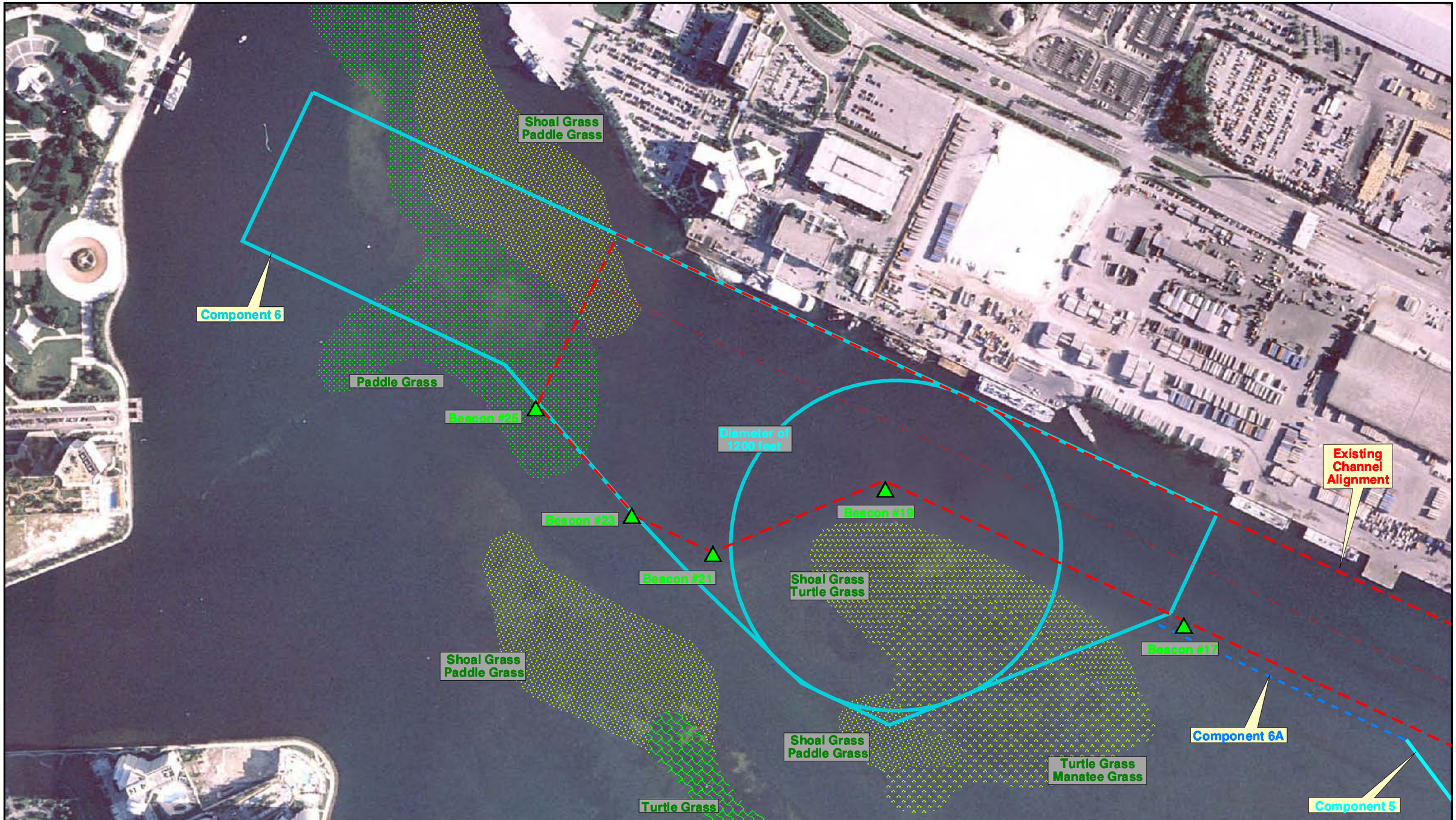
Jacksonville District

Figure 7



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6] Background aerial photos taken September 1 1999

LEGEND:
Navigation Aids

Red Buoy
Green Buoy
Red Beacon
Green Beacon
Red/White Beacon

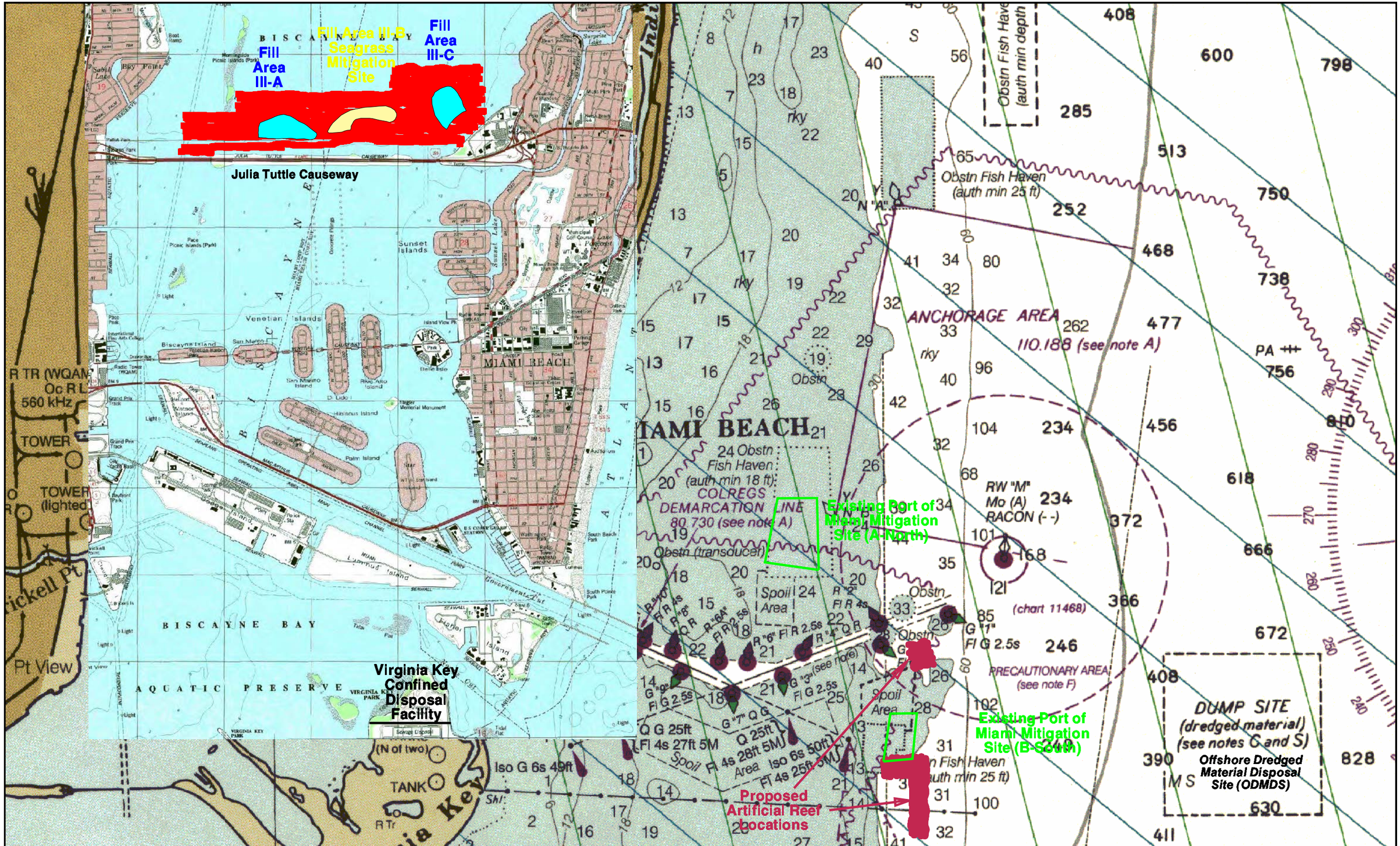
N

200 0 200 400 600 Feet

MIAMI HARBOR
GENERAL REEVALUATION REPORT
Components 6 and 6A
Channel Extension and Turning Basin
Dodge Island

U.S.ARMY CORPS OF ENGINEERS
Jacksonville District

Figure 8



NOTES:
1] Background images combined NOAA navigational charts 11466, 35th Ed. dated June 2000 and 11468, 38th Ed. dated March 2001.
2] Soundings in feet at mean lower low water.
3] Projection Universal Transverse Mercator (UTM), NAD27, units meters, zone 17.

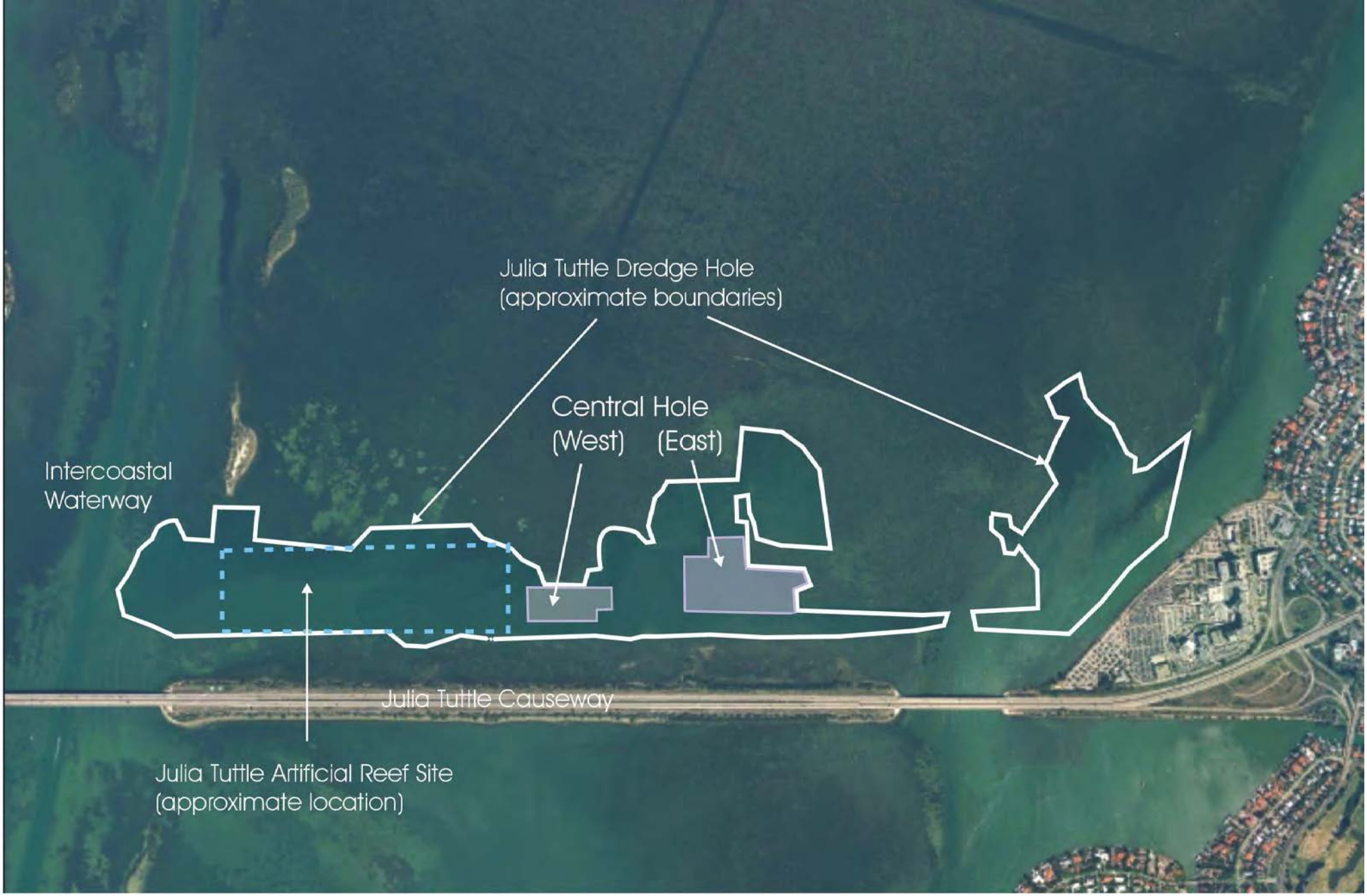
2000 0 2000 4000 6000 Feet

N

OPOSED DR DG D MAT IAL DISPOSAL SITES AND MITIGATION LOCATIONS

U.S.ARMY CORPS OF ENGINEERS
Jacksonville District

Figure 9



Julia Tuttle Dredge Hole
Preferred Seagrass Mitigation Area
Miami Harbor GRR

FILENAME: W/99-01/graphics/GRR/JuliaTuttledredgehole1

Source: The Curtis & Kimball Company; Miami-Dade County Department of Environmental Resource Management (aerial 2001)

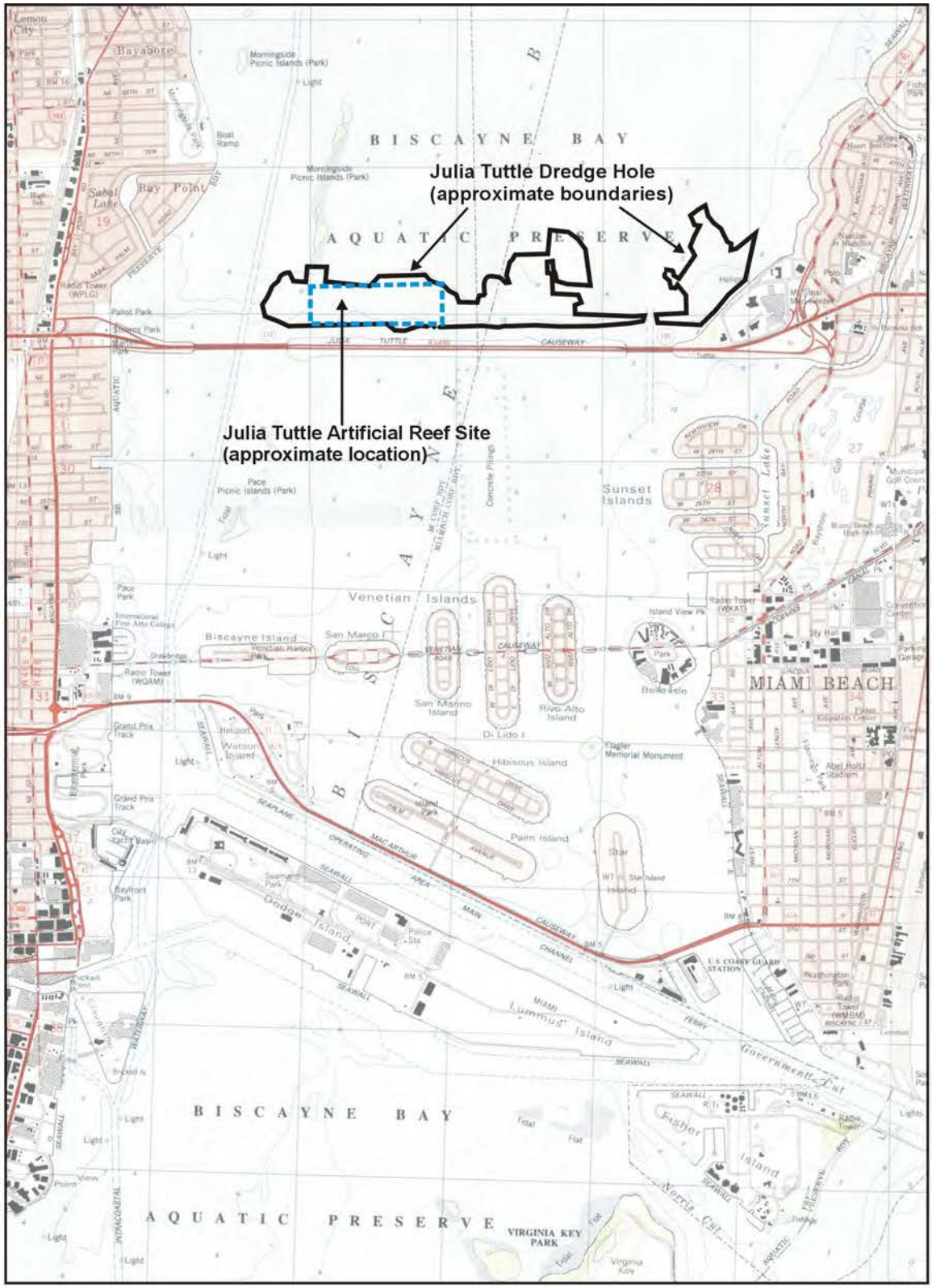
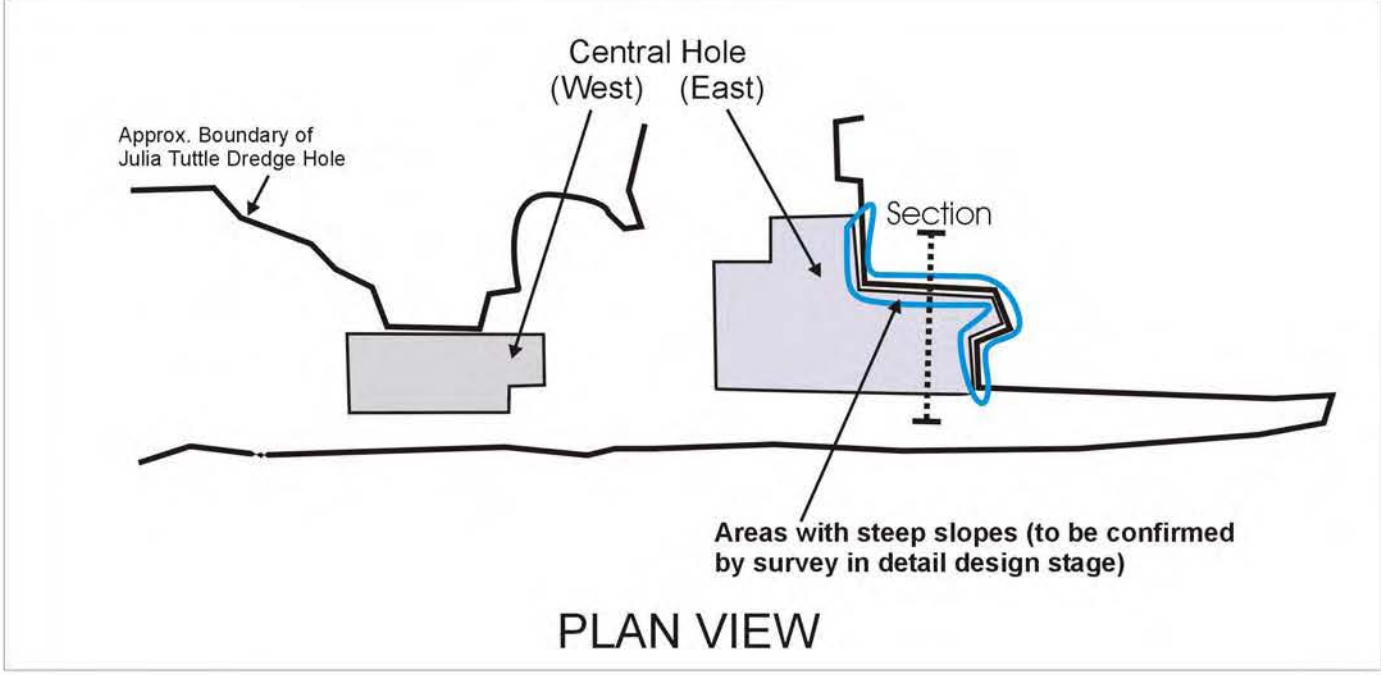
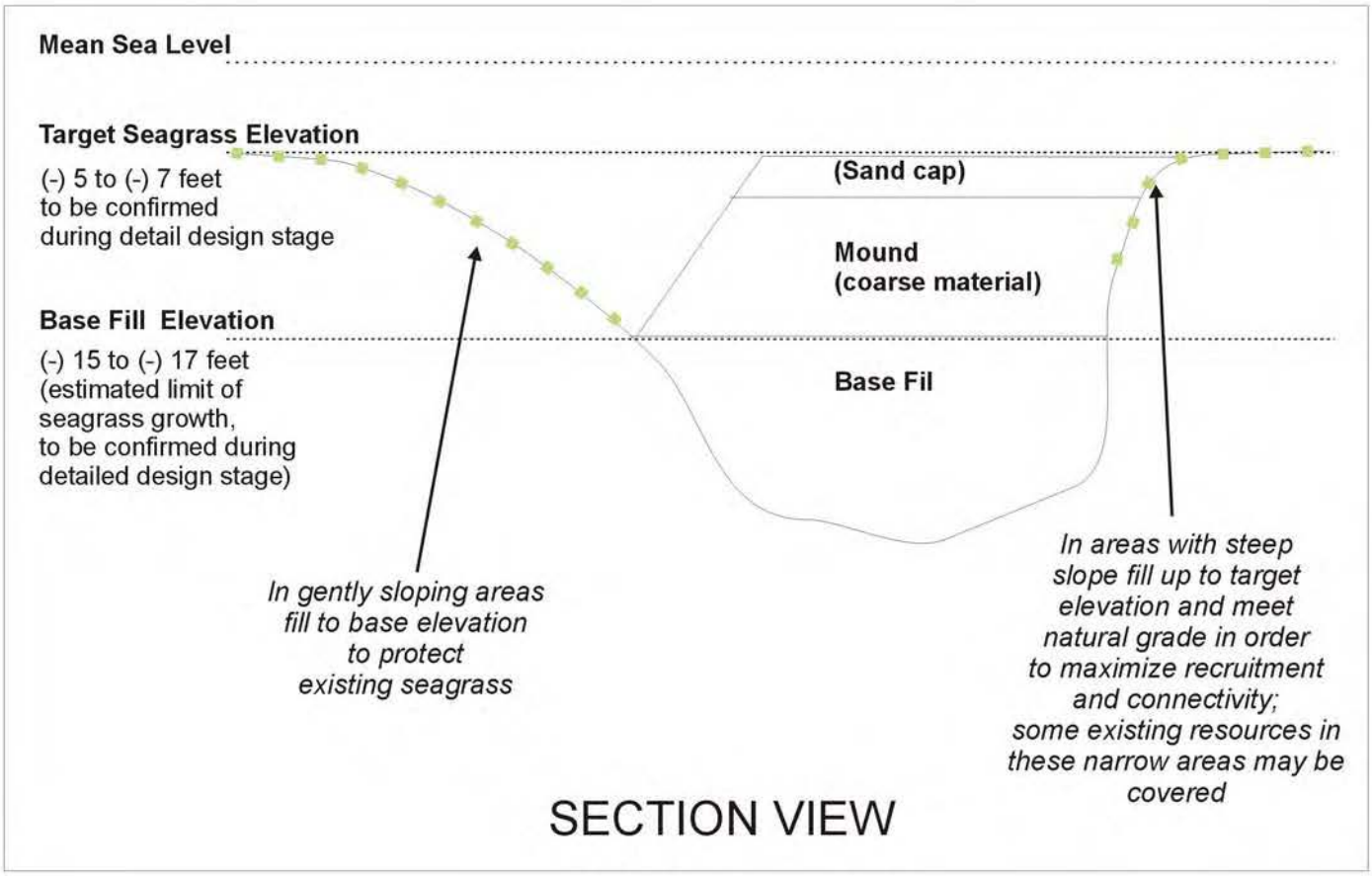


Figure 9b
Location of Julia Tuttle Dredge Hole
Preferred Seagrass Mitigation Area
Miami Harbor GRR

FILENAME: W:/99.01/Graphics/MiamiQuadrangle/JuliaTuttleWithPOM

Source: USGS 1990, The Curtis and Kimball Company





Port of Miami

Not to Scale

Figure 9c

Illustrative Cross-Section of Site Filling Approach
Preferred Seagrass Restoration Site
Miami Harbor GRR

FILENAME: W/99-01/graphics/GRR/crossection1

Source: The Curtis & Kimball Company

NOTES:
1] DRAFT Environmental Baseline Resource Survey (underwater features) provided February 2001, by Dial Cordy & Associates, Jacksonville Beach, FL
2] USACE Survey Number 00-058, March 2000
3] Beacons, aids to navigation, and soundings are in approximate locations based on NOAA Nautical Charts (number 11468, 36th Ed., July 24 1999, and number 11466, 34th Ed., February 6 1999)
4] Elevations in feet and refer to mean lower low water
5] Projection Stateplane Coordinate System, NAD27, Fipszone 0901
6] Background aerial photos taken September 1 1999

LEGEN :

Existing Navigation hannel
Existing Centerline
Existing Channel Edge

Proposed omponents
Cmp1c
Cmp2a
Cmp3b
Cmp4
Cmp5
Cmp5a
Cmp6
Cmp6a

2000 0 2000 4000 6000 Feet

MIAMI RB R
E ER L REEV LU TION
RE RT
Selected Plan
Channel M d fications

N
U.S. Y
E GI E S
Jacksonville District

Figure 10

MIAMI HARBOR
GENERAL REEVALUATION REPORT STUDY

FINAL ENVIRONMENTAL IMPACT STATEMENT

January 2004

Prepared for:
Jacksonville District
U.S. Army Corps of Engineers
701 San Marco Blvd
Jacksonville, FL 32207

Prepared by:
Dial Cordy and Associates Inc.
490 Osceola Avenue
Jacksonville Beach, FL 32250

U.S. Army Corps of Engineers, Jacksonville District
FINAL ENVIRONMENTAL IMPACT STATEMENT
Navigation Improvements Miami Harbor
Miami-Dade County, Florida

ABSTRACT

The Port of Miami requested that the U.S. Army Corps of Engineers study the feasibility of widening and deepening most of the major channels and basins within Miami Harbor. Two major improvement goals were identified to achieve the project purpose of providing greater navigational safety and accommodating larger vessels: 1) widen the Entrance Channel, Fisher Island Turning Basin and Fisherman's Channel; and 2) deepen the Entrance Channel, Government Cut, and Fisher Island Turning Basin. A number of alternatives were originally considered, but in an effort to reduce impacts to the natural environment, many were eliminated from further analysis. Three alternatives were analyzed (two action alternatives and the No-Action Alternative) in the document. The Recommended Plan (Alternative 2) includes components that would widen and deepen the Entrance Channel, deepen Government Cut, deepen and widen Fisher Island Turning Basin, relocate the west end of the Main Channel (no dredging involved), and deepen and widen Fisherman's Channel and the Lummus Island Turning Basin. Disposal of dredged materials would occur at up to four disposal sites (seagrass mitigation area, offshore permitted artificial reef areas, a potential upland disposal area, or the Miami Offshore Dredged Material Disposal Site). The Recommended Plan would impact 0.2 acre of seagrass habitat within the existing channel, 7.7 acres of seagrass habitat outside of the existing channel, 0.6 acre of low relief/hardbottom reef habitat, 28.1 acres of previously dredged low relief/hardbottom reef habitat, 2.7 acres of high relief hardbottom/reef habitat, 18.0 acres of previously dredged high relief hardbottom/reef habitat, 3.0 acres of rock rubble habitat, 120.5 acres of previously dredged rock/rubble habitat, 23.3 acres of unvegetated bottom habitat, and 213.1 acres of previously dredged unvegetated bottom habitat. Impacts to marine mammals, sea turtles, and fish species may occur due to loss of habitat and blasting activities associated with project construction activities. The Recommended Plan would cause temporary increases in turbidity; however, these levels would not exceed permitted variance levels outside the mixing zone. The preferred mitigation plan proposed for seagrass impacts would include restoration of previously dredged borrow areas within northern Biscayne Bay, while the preferred mitigation plan proposed to offset new impacts to high and low relief hardbottom/reef habitat, and rock/rubble habitat, would include creation of artificial reefs within permitted offshore artificial reef sites.

Send your comments to the
District engineer by:

For Information Contact:
Ms. Terri Jordan
U.S. Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, FL 32232-2325
Telephone: 904-232-1817

EXECUTIVE SUMMARY

Background. The Seaport Department of Miami-Dade County requested that the U.S. Army Corps of Engineers, Jacksonville District, study the feasibility of modifying portions of the Port of Miami (Port) to improve the Federal navigation system of channels. The Port is one of the major port complexes along the east coast of the United States. The Port lies in the north side of Biscayne Bay, a shallow, expansive, subtropical lagoon. Land surrounding Port waters is essentially fully developed, except for Virginia Key. Terrestrial and marine habitats in the vicinity include beaches, mangroves, seagrass beds, hardbottom and reef communities, rock/rubble bottom, and unvegetated bottom. The Biscayne Bay Aquatic Preserve and the Bill Sadowski Critical Wildlife Area are located in the vicinity. Manatees, crocodiles, sea turtles, and many important species of managed fishes and invertebrates utilize Biscayne Bay and offshore habitats. Protection of vital habitats is essential to the survival and maintenance of stocks of these and other fish and wildlife resources.

The Port offers the greatest frequency of cargo service, with the largest number of shipping lines, calling at the most destinations, in the world. The Port has more than 35 shipping lines calling on over 100 countries and over 254 ports. In addition to its strength as a cargo port, the Port is also the largest multi-day cruise passenger homeport in the world. The Port's link to important trading and cruise routes, as well as the strength and characteristics of its large and growing hinterland, have positioned the Port as a top performer, and will continue to drive the Port's growth as long as the infrastructure to support marine transportation is in place. The total economic impact of Port operations on the nation is estimated at more than $8 billion per year. More than 45,000 jobs are directly or indirectly attributable to Port operations. Jobs created by Port and trade activity tend to be good jobs: they pay significantly more than other job growth sectors in the local economy, have better long-term opportunities for employees and offer better training programs (particularly for minorities). The Port also utilizes the local, regional, and inter-regional transportation network components consisting of roads, railway lines, and channels to facilitate the efficient movement of goods and passengers.

Improvements including channel deepening and widening are required to ensure navigational safety and allow for more effective handling of the existing and future commercial ship fleet. The recommended improvements would also allow commercial ships with increased draft and cargo tonnage to call at the Port, resulting in transportation cost savings.

Alternatives. Two action alternatives and the No-Action Alternative are evaluated in this document. Modifications under the Recommended Plan (Alternative 2) include (1) deepening all channels except for the Main Channel, (2) widening the east end of the Entrance Channel, (3) widening the intersection of channels at the northeast side of Fisher Island, (4) creation of a turning basin just east of Lummus Island, and (5) widening Fisherman's Channel. The second alternative (Alternative 1) includes all of the components of the Recommended Plan plus (6) deepening and relocating Dodge Island Cut and Dodge Island Turning Basin. The

following table provides detailed descriptions of the components comprising the two action alternatives.

Component 1C*	Flaring the existing 500-foot wide entrance channel to provide an 800-foot wide entrance at Buoy #1. The widener extends from the beginning of the entrance channel about 150 feet parallel to both sides of the existing entrance channel for about 900 feet before tapering back to the existing channel edge over a total distance of about 2,000 feet. Deepening of the entrance channel and proposed widener along the Entrance Channel from an existing depth of 44 feet in one-foot increments to a depth of 52 feet received consideration.
Component 2A*	Widen the southern intersection of Government Cut with Fisherman's Channel at Buoy #15. The length of the widener is about 700 feet with a maximum width of about 75 feet. Depths considered for 2A varied from an existing project depth of 42 feet to 50 feet.
Component 3B*	Extend the existing Fisher Island Turning Basin to the north. A turning notch of about 1,500 feet by 1,200 feet extends approximately 300 feet to the north of the existing channel edge near the West End of Government Cut. Depths from 43 to 50 feet at one-foot increments below the existing depth of 42 feet received consideration in the area of the turning notch.
Component 4*	Relocate the west end of the Main Channel about 250 feet to the south between channel miles 2 and 3 over a two- or three-degree transition to the existing cruise ship turning basin. No dredging is expected for Component 4 since existing depths allow for continuation of the authorized depth of 36 feet.
Component 5A*	Increase the width of Fisherman's Channel about 100 feet to the south of the existing channel. Component 5 includes a 1500-foot diameter turning basin, which would reduce the existing size of the Lummus Island Turning Basin. A widener at the northwest corner of the turning basin helps ease the turn to the Dodge Island Cut. The deepening evaluation examined depths below the existing 42-foot depth at one-foot increments from 43 to 50 feet along the proposed widened channel from Government Cut Station 0+00 to Station 42+00 and within Gantry crane berthing areas 99-140.
Component 6	Deepen Dodge Island Cut and the proposed 1,200-foot turning basin from 32 and 34 feet to 36 feet. It also involves relocating the western end of the Dodge Island Cut to accommodate proposed Port expansion.

***Components of the Recommended Plan.**

Environmental Consequences of the Recommended Plan. The proposed improvements would impact an estimated total surface area of 415.6 acres including 7.9 acres of seagrass habitat,

49.4 acres of hardbottom/reef habitat, 123.5 acres of rock/rubble habitat, and 236.4 acres of unvegetated bottom, and Essential Fish Habitat. Impacts to marine mammals, sea turtles, and fish species may occur due to loss of habitat and blasting activities with project construction. Blasting would be implemented in those areas where the hardness of rock prevents removal by other dredging techniques. The impacts are expected to be temporary, as much of the habitat would either recover or be replaced as demonstrated after previous dredging and construction operations within the Port boundaries. The Recommended Plan could also impact water quality by causing increased turbidity during construction activities, although these impacts would be minor and temporary. Materials dredged from the above components would be deposited at up to four locations: seagrass mitigation site; artificial reef site; Offshore Dredged Materials Disposal Site (ODMDS), or an approved upland disposal site.

Mitigation. The preferred mitigation plans for seagrass and hardbottom/reef impacts would provide restoration of seagrass beds and creation of artificial reefs. Based upon the extent of impacts and ratios discussed, restoration of approximately 24 acres of seagrass beds is proposed as compensation for unavoidable impacts. In order to replace local seagrass functions and values, restoration would be implemented within Biscayne Bay, preferably in areas where seagrass once occurred and is now absent due to past anthropogenic activities such as dredging.

New impacts to low relief hardbottom/reef and high relief hardbottom/reef total 0.6 acre and 2.7 acres, respectively. Based on the Habitat Equivalency Analyses (HEA) calculations, direct impacts to hardbottom/reef habitats would require the creation of artificial reef habitat at an effective mitigation ratio of 2:1 for high relief hardbottom/reef habitat and an effective mitigation ratio of 1.3:1 for low relief hardbottom/reef habitat. Mitigation reefs would be constructed in two different designs, to reflect the differences in the habitat structure of the two types of hardbottom/reef habitat to be impacted. The proposed mitigation would be type-for-type, to reflect the ecological differences between the different reef types impacted. A total of 0.8 acre of low relief-low complexity (LRLC) reef would be required to mitigate for the new low relief hardbottom/reef. A total of 5.4 acres of high relief-high complexity (HRHC) reef would be required to mitigate for the high relief impact. Reefs would be constructed at proposed artificial reef sites to be managed by Miami-Dade County Environmental Resources Management (DERM).

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ACRONYMS/DEFINITION OF TERMS

BSCWA	Bill Sadowski Critical Wildlife Area
CBD	Miami Central Business District
CBRA	Coastal Barrier Resources Act
CBIA	Coastal Barrier Improvement Act
County	Miami-Dade County
CWA	Clean Water Act
DC&A	Dial Cordy and Associates Inc.
DERM	Miami-Dade County Environmental Resources Management
DCMPZ	Miami-Dade Manatee Protection Zone
EFH	Essential Fish Habitat
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EQ	Accounts for non-monetary effects on environmental resources
ESA	Endangered Species Act
FAC	Florida Administrative Code
FCMP	Florida Coastal Management Program
FDEP	Florida Department of Environmental Protection
FDER	Florida Dept of Environmental Regulation (presently FDEP)
FDOT	Florida Department of Transportation
FFWCC	Florida Fish and Wildlife Conservation Commission
FP&L	Florida Power & Light
FWS	U.S. Fish and Wildlife Service
GRR	General Reevaluation Report
HAPC	Habitat Areas of Particular Concern
HEA	Habitat Equivalency Analyses
HRHC	High relief-high complexity
HTRW	Hazardous, Toxic, & Radioactive Waste
LMLW	Local Mean Low Water
LO/LO	Load on/Load off
LRLC	Low relief-low complexity
MIA	Miami International Airport
MLW	Mean Low Water
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NMFS	U.S. National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NTU	Nephelometric Turbidity Units
ODMDS	Offshore Dredged Material Disposal Site
OFW	Outstanding Florida Water
Panamax	Vessels that can navigate the Panama Canal
PCA	Project Cooperation Agreement

Pilots	Biscayne Bay Pilots Association
POMTOC	Port of Miami Terminal Operating Company
Port	Port of Miami
Post-Panamax	Vessels too large to navigate the Panama Canal
ppt	parts per thousand
RO/RO	Roll on/Roll off
RTGS	Rubber Tire Gantries
SAFMC	South Atlantic Fisheries Management Council
SAV	Submerged Aquatic Vegetation
SFRPC	South Florida Regional Planning Council
SHPO	State Historic Preservation Officer
TEU	Twenty-foot equivalent units
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
WASD	Miami-Dade Water and Sewer Department
WRDA	Water Resources Development Act

1.0 PURPOSE AND NEED FOR THE CONSIDERED ACTION

1.1 Project Authorization

The Miami-Dade County Seaport Department of the Port of Miami (Port) requested the U.S. Army Corps of Engineers (USACE), Jacksonville District, to study the feasibility of widening and deepening portions of the Port, Miami-Dade County, Florida. A resolution from the Committee on Transportation and Infrastructure, United States House of Representatives, adopted October 29, 1997, provides the study authority as follows:

> "Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the report of the Chief of Engineers on Miami Harbor published as Senate, Document 90-93, 90th Congress, 2nd Session, and other pertinent reports, with a view to determining the feasibility of providing channel improvements in Miami Harbor and channels."

Additional authorization appeared in a subsequent appropriations bill for Miami Harbor, Florida, which contained the following language:

> "The Committee has provided $25,000,000 to reimburse the Miami-Dade Seaport Department for the Federal share of dredging work which has been accomplished and an additional $300,000 to initiate a General Reevaluation Report (GRR) to determine the feasibility of further Port deepening."

1.2 Project Location

The Port is an island facility consisting of 518 upland acres and is located in the northern portion of Biscayne Bay in South Florida. The City of Miami is located on the west side of Biscayne Bay; the City of Miami Beach is located on an island on the northeast side of the bay, opposite Miami. Both cities are located in Miami-Dade County, Florida, and are connected by several causeways crossing the bay. The Port is the southernmost major Atlantic Coast port. Referenced to other major South Atlantic Region ports, the Port is located 21 nautical miles south of Port Everglades (Fort Lauderdale), Florida; 83 nautical miles south of Palm Beach, Florida; 173 nautical miles south of Port Canaveral, Florida; 306 nautical miles south of Jacksonville, the most northern port on Florida's Atlantic Coast; 386 nautical miles south of Savannah, Georgia; and 420 nautical miles south of Charleston, South Carolina. It is 144 nautical miles north of Key West, the southernmost port in Florida (USACE 2002).

The first modifications to the Port were authorized by Congress to expand the Port in 1902 and several Acts have been authorized since to accommodate larger vessels using the Port. The current study area comprises the Federal Channel from Buoy #1 offshore, Government Cut, areas within and adjacent to the Port from Government Cut to the cruise ship channel turning basin, and Fisherman's Channel to the southwest end of Dodge Island (Figure 1). Areas adjacent to the project area, including protected habitat areas, were also evaluated for indirect project impacts.

1.3 Project Purpose

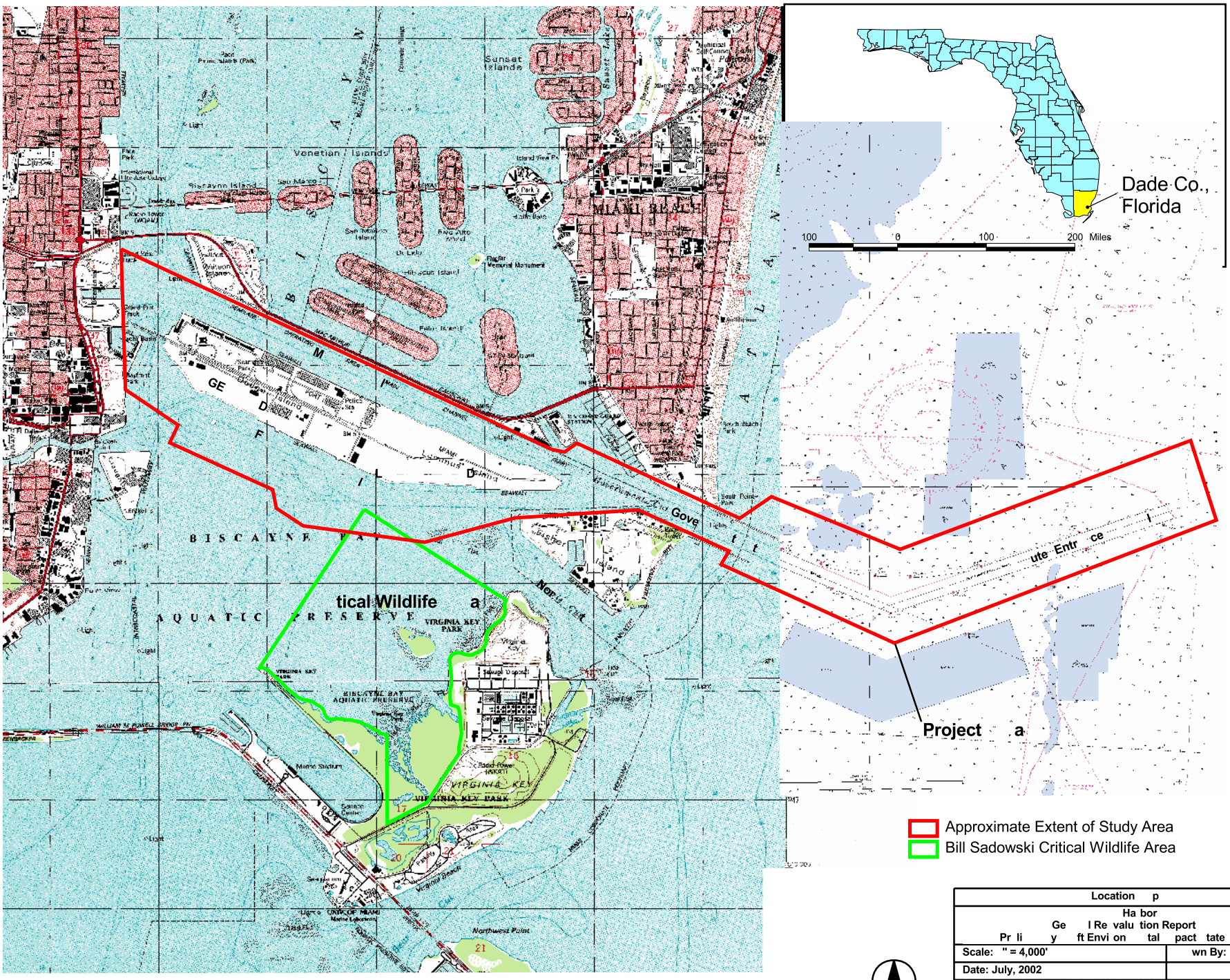
Improvements including channel deepening and widening are required to provide improved navigation and safety within the Federal Channel and Port and to more effectively handle the existing and future commercial ship fleet. The recommended improvements would allow commercial ships with increased draft and cargo tonnage to call at the Port, resulting in transportation cost savings.

The current project features for Government Cut, Fisherman's Channel and the Fisher Island Turning Basin were designed for Panamax container ships; however, the world container ship fleet has significantly changed since these features were authorized in 1989. Since 1989, Post-Panamax container ships, currently deployed in the Far East trade region, have become more numerous. It is anticipated that within the next five years, Post-Panamax container ships will be deployed in the Atlantic trade region and will call at U.S. East Coast ports (USACE 2002).

In addition to assessing the benefits of channel deepening to accommodate larger container ships, this document will also address the need for improvements to remedy navigation and safety problems within the Port that were identified in a letter from the Biscayne Bay Pilots (Pilots) to the Port Authority, dated October 23, 1997 (as discussed below). The improvements recommended by the Pilots call for widening the project channels at three locations.

The first location identified in the letter was the Entrance Channel. According to the Pilots, "The currents in this area are variable and unpredictable, putting large deep draft vessels at risk when making their approach to Miami. Several container ships have already grounded off Buoy #1." The Pilots recommended that the Entrance Channel be flared with an 800-foot wide entrance.

The second area identified by the Pilots as needing improvements was on the south side of Government Cut between Buoy #13 and Buoy #15. In this area, ships are turning from one channel to another (Government Cut and Fisherman's Channel). According to the Pilots, "The strong currents in this area compounded by the necessity for the ship to have as little speed as possible, makes it important for the ship to have as much swinging room as possible. Tugboats assisting ships in this area have grounded and sustained damage." The Pilots recommended widening the channel between Buoys #13 and #15 as much as possible.



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The third area identified in the letter was Fisherman's Channel, just south of the gantry crane area. Ships transiting Fisherman's Channel pass extremely close to vessels docked at the gantry crane berths on Dodge Island. This results in a "surging" effect on the ships at the berths. Moreover, frequently vessels with on-board cranes have their cranes swung outboard 90 degrees, thereby blocking a portion of the channel. According to the Pilots, "Given the variables of wind, current, ship size, draft, etc., this creates an unsafe condition." The Pilots recommended that the southern edge of the Fisherman's Channel be extended 100 feet further to the south.

The number of people taking cruises has been growing, and this growth is expected to continue in the future. In response to this increasing demand, cruise ship companies have been constructing larger cruise ships to carry more passengers. The largest cruise ships in the world include Royal Caribbean International's Voyager-class cruise ships. Two of these Voyager-class vessels, the VOYAGER OF THE SEAS and the EXPLORER OF THE SEAS, currently call at the Port. These cruise ships are 1,019 feet long and carry 3,114 passengers. Because of the increase in size, both length and breadth, of cruise ships, the amount of berthing area at the current cruise ship terminals has been reduced. To provide more berthing area for cruise ships, the Port is berthing small cruise ships at Cruise Terminal 12 located at the southwest corner of Dodge Island.

Because cruise ships will continue to increase in size, Port improvements will be required to accommodate the larger cruise ships. Accordingly, improvements will be needed to extend the current Federal Channel from a point 1,200 feet west of the Lummus Island Turning Basin to the southwest corner of Dodge Island and to construct a separate turning basin within this segment.

In addition, many ships are currently required to wait for other incoming or outward bound ships utilizing the existing turning basins before they are able to continue. These delays of 30 minutes or more reduce the Port's capacity and efficiency to service existing vessel traffic.

1.4 Related Environmental Documents

Two related environmental documents that have been generated for other Miami Harbor Expansion projects are the 1989 USACE Navigation Study for Miami Harbor Channel Feasibility Report and Environmental Impact Statement (EIS) and the 1996 USACE Miami Harbor Channel 10140 General Reevaluation Report (GRR).

1.5 Scoping

In accordance with the National Environmental Policy Act (NEPA), an information letter was sent to interested parties on January 6, 2000. In addition, all parties were invited to participate in the plan formulation process by identifying any additional concerns on issues,

studies needed, alternatives, procedures, and other matters related to the project. A local, state, and Federal resource agency meeting was held on March 13, 2000, to determine the areas of coverage for an environmental baseline resource survey. A meeting followed on November 1, 2000, with those resource agencies to review preliminary results. Appendix A and Appendix B include all documents associated with scoping including comments received from various stakeholders during the scoping process. A Notice of Intent (NOI) was published in the Federal Register (Volume 66, No. 167:45290) on August 28, 2001 informing the public of the USACE's intent to prepare a Draft EIS.

A Notice of Availability (NOA) was published in the Federal Register (Volume 68, No. 80:20386-20387) on April 25, 2003 to advertise the release of the Draft EIS for public review and comment. A public meeting was held on May 6, 2003 at the Port of Miami to present the results of the Draft GRR and Draft EIS and to give the public an opportunity to express their views and furnish specific data to support their views for consideration in preparing the final report. Written comments from commenting federal, state, and local government agencies, various private and non-profit organizations and individuals are included in Appendix N along with the official responses from the USACE.

Federal agencies invited to attend meetings and provide comments throughout the scoping and public involvement process included the USACE, the U.S. Coast Guard (USCG), the Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), and the National Marine Fisheries Service (NMFS). State agencies included the Florida Department of Environmental Protection (FDEP), Florida Fish and Wildlife Conservation Commission (FFWCC), State Historic Preservation Office (SHPO), and the Florida Department of Transportation (FDOT). Local agencies included Miami-Dade County Department of Environmental Resources Management (DERM), South Florida Regional Planning Council (SFRPC), and the City of Miami. Non-Government Organizations/Institutions included the Pilots and the Biscayne Bay Regional Coordination Team (formerly the Biscayne Bay Partnership Initiative).

1.6 Permits, Licenses, and Entitlements

The proposed action affects seagrass and hardbottom/reef communities and other waters of the United States subject to Section 404 of the Clean Water Act (CWA). A Section 404(b)(1) Evaluation Report has been completed and is included in this document (Appendix C) to comply with the CWA. State approval is required for certification of water quality through Section 401 of the CWA and concurrence. A Coastal Zone Management Consistency Determination was prepared by the USACE and received concurrence from State during the Draft EIS review process (Appendix D).

2.0 ALTERNATIVES

2.1 Background

The Port is a 518-acre island facility created from two spoil islands, Dodge Island and Lummus Island. The western end is Dodge Island, and the eastern end is Lummus Island. The Port is connected to the Miami mainland by two bridges, a 65-foot high, fixed span vehicular bridge and a road and a rail bridge linking to the Florida East Coast Railroad Company's main line track (USACE 2002).

The Port is a "clean port," the designation of a seaport that does not handle bulk cargoes or potentially dangerous or hazardous cargoes such as fuel oil. The Port handles only palletized, roll-on/roll-off (RO/RO), and containerized cargo. In addition to cargo traffic, the Port is also the world's largest cruise ship homeport. It is the year-round homeport of one of the largest cruise ship in the world, the VOYAGER OF THE SEAS. As reported in the 1999 Port Master Development Plan (Miami-Dade County 1999c), the Port consists of 518 acres of actual landmass. Of the 518 acres, 372.5 acres (71.9 percent) is devoted to cargo operations, mainly on Lummus Island, and 52 acres (10.0 percent) is devoted to cruise operations on Dodge Island.

The Port is a landlord port, owned by Miami-Dade County, Florida and managed by the Miami-Dade County Seaport Department. The Port Director reports to the County Manager. Facilities are leased to Port users and operators. There are three principal terminal operators at the Port: Seaboard Marine, the Port Terminal Operating Company (POMTOC), and Universal Maritime/Maersk. Seaboard Marine's container terminal and storage areas are located along the southern portion of Dodge Island and the southwest corner of Lummus Island. POMTOC's container terminal is located exclusively on Lummus Island, as is Universal Maritime/Maersk's (northeastern portion).

Currently there are three Panamax and seven Post-Panamax gantry cranes. Two additional Super-Post-Panamax gantry cranes are scheduled to arrive in late 2004. Panamax, Post-Panamax, and Super-Post-Panamax gantry cranes are designed to reach across 13 containers (each approximately 8 feet wide), 17 containers, and 22 containers, respectively.

In addition to gantry cranes, the Port's cargo handling equipment includes forklifts, toploaders, and mobile truck cranes including three Mi-Jack 850-P Rubber Tire Gantries (RTGs), which allow containers to be stacked 6-wide and 4-high.

There are eleven passenger terminals that accommodated 3.4 million passengers in Fiscal Year 2001. The Port's passenger terminals are designated Terminals 1 through 5, Terminal 6/7, Terminal 8/9, Terminal 10, and Terminal 12.

As identified in the Port's 1999 Master Plan, approximately 47.5 acres of the Port's land area is utilized by support facilities: parking, 17.0 acres; circulation and open space, 10.5 acres; office – Federal Government, 8.5 acres; recreation, 7.5 acres; office-miscellaneous and office-Seaport Department, 1.7 acres.

CSX Transportation, Inc. serves the Port. The Port owns 2.1 miles of trackage at the Port on Dodge Island, which consists of a main line track extending the length of the island and a four-track, closed-end intermodal rail yard. The main track on Dodge Island connects with the Florida East Coast Railway via a rail bridge. A connection with CSX Transportation, Inc. is effected through an interchange in the west part of the City of Miami. Moreover, the Port is less than one mile from major highways: Interstate 95 and Federal Route 1 via Interstate 395, and Interstate 75 via Dolphin and Palmetto Expressways.

There is a private petroleum facility at Fisher Island. This facility receives Number 6 fuel oil and diesel fuel by tankers and barge (integrated tug and barge units). The fuel is used solely for bunkering the Port's cargo and cruise ships, which are bunkered at the berth by tank truck or by bunkering barge. This facility has an 800-foot long berth with a depth of 36 feet and 12 storage tanks having a total capacity of 667,190 barrels.

As reported in the USACE Port Series No. 16 document (revised 1999), 12 companies operate warehouses having a total of over 1,000,000 square feet of dry storage space and over 6,000,000 cubic feet of cooler and freezer space within Metropolitan Miami-Dade County. All except three of the warehouses have railroad connections, and each is accessible to arterial highways.

Anchorage for deep-draft cargo vessels lies north of the Entrance Channel to the Port. There are no bridges crossing the shipping channels for Dodge and Lummus Islands.

2.2 Description of the Alternatives

2.2.1 No-Action Alternative

The Port would continue operations under existing conditions. Currently, there are two options available for moving cargo to terminal facilities in those areas. One is to use vessels with drafts that enable access over existing depths and widths. The second is to use another terminal at the Port and move the cargo to the facilities (USACE 1996b). Current dimensions of the channels and turning basins are described below in Table 1.

Table 1 Current Channel and Turning Basin Dimensions

Entrance Channel	500 feet wide and 44-foot depth
Government Cut	500 feet wide and 42-foot depth
Fisher Island Turning Basin	Triangular-shaped bottom with a 42-foot depth
Main Channel	400 feet wide and 36-foot depth
Fisherman's Channel and Lummus Island Turning Basin	The channel is 400 feet wide and 42-foot depth. The turning basin has a turning diameter of 1,500 feet and 42-foot depth.
Dodge Island Cut and Turning Basin	400 feet wide and 34-foot depth

2.2.2 Alternative 1

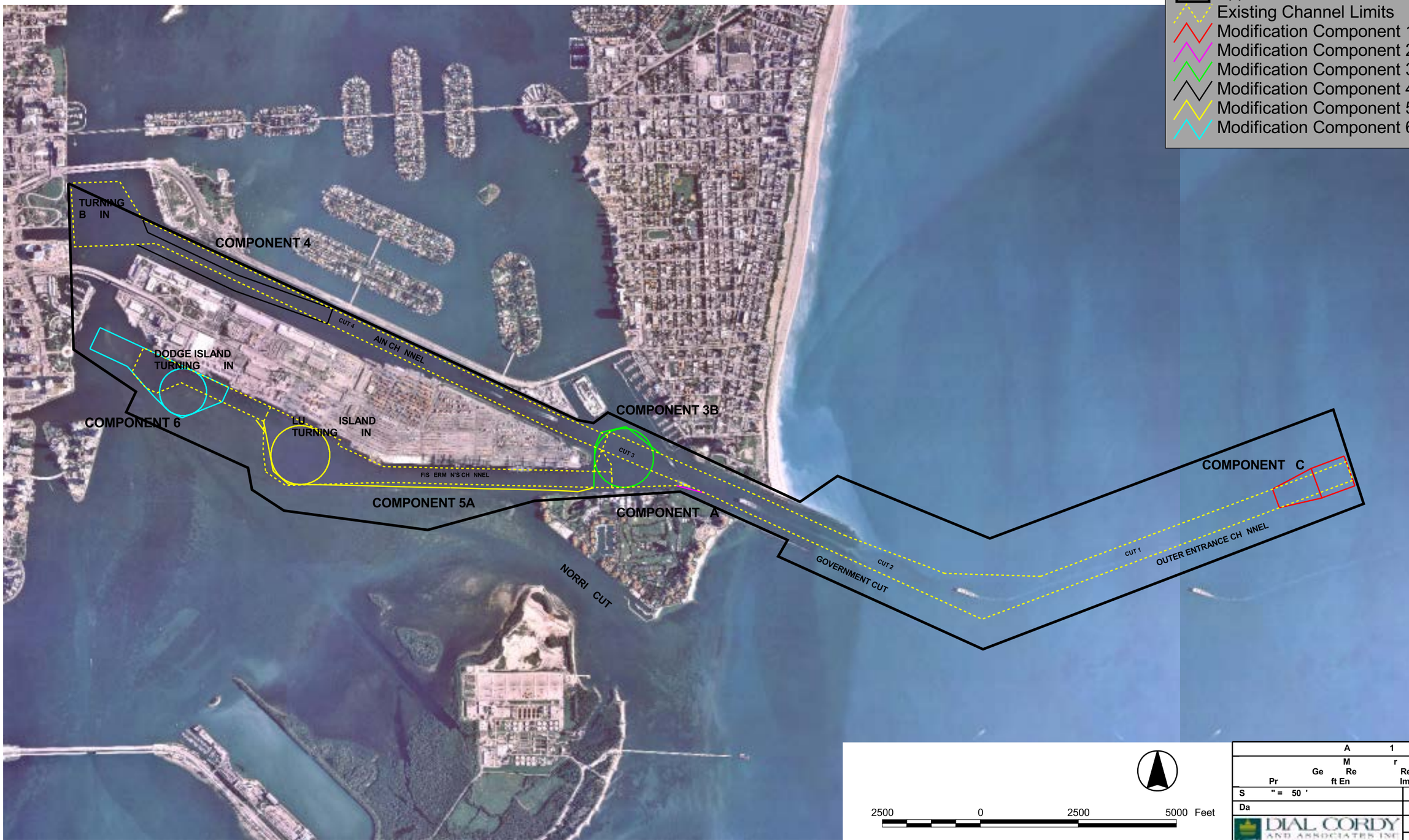
Alternative 1 consists of six components that will improve Port transit for the existing and future fleets (Figure 2). It represents a combination of Components 1 through 6.

Component 1C — Flare the existing 500-foot wide Entrance Channel to provide an 800-foot wide entrance at Buoy #1. The widener would extend from the beginning of the Entrance Channel approximately 150 feet parallel to both sides of the existing Entrance Channel for approximately 900 feet before tapering back to the existing channel edge over a total distance of approximately 2,000 feet. Deepen the Entrance Channel and proposed widener along Government Cut from an existing depth of 44 feet to a depth of 52 feet.

Component 2A — Widen the southern intersection of Government Cut near Buoy #15. The length of the widener would be approximately 700 feet with a maximum width of approximately 75 feet. Deepen from existing project depth of 42 feet to 50 feet.

Component 3B — Extend the existing Fisher Island Turning Basin 300 feet to the north of the existing channel edge near the west end of Government Cut. Widen the basin to 1,500 feet by 1,200 feet. Deepen channel below existing project depth~~s~~ of 42 feet to 50 feet.

Component 4 — Relocate the west end of the Main Channel approximately 250 feet to the south between channel miles 2 and 3 over a two- or three-degree transition to the existing cruise ship turning basin. No dredging is expected for this component since existing depths allow for continuation of the authorized depth of 36 feet.



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Component 5A — Increase the width of the Fisherman's Channel approximately 100 feet to the south of the existing channel. This component also includes a 1,500-foot diameter turning basin, which would reduce the existing size of the Lummus Island Turning Basin. This widener at the northwest corner of the turning basin eases the turn to the Dodge Island Cut. Deepen channel and Gantry crane berthing areas 99-140 from the current authorized depth of 42 feet to 50 feet along the proposed widener of Fisherman's Channel from Station 0+00 to the Lummus Island Turning Basin.

Component 6 — Deepen Dodge Island Cut and the proposed 1,200-foot turning basin from 32 and 34 feet to 36 feet. Relocate the western end of the Dodge Island Cut to accommodate proposed Port expansion.

2.2.3 Alternative 2 (Recommended Plan)

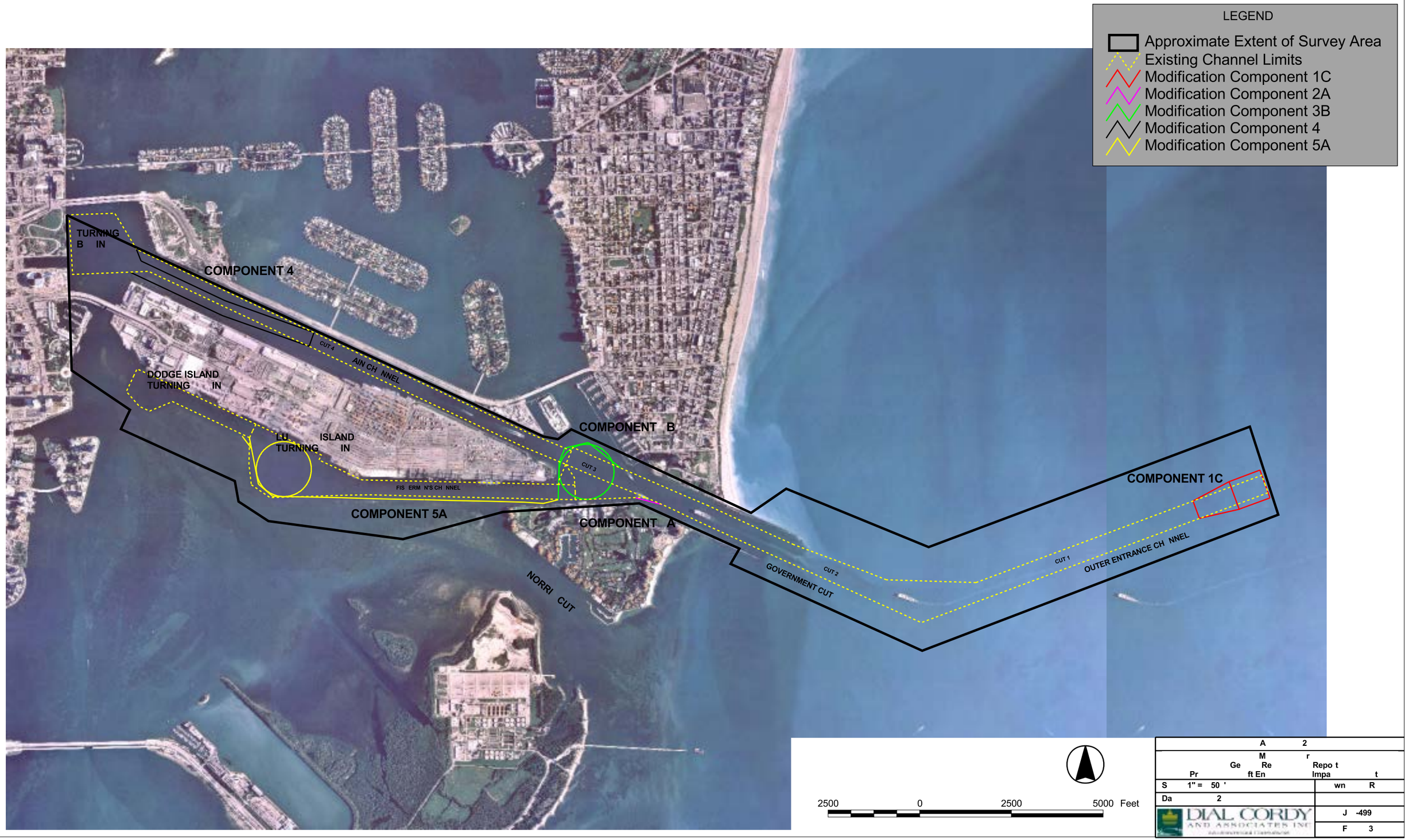
Alternative 2 is the Recommended Plan and the Locally Preferred Plan. It consists of five components that would improve Port transit for the existing and future fleets (Figure 3).

Component 1C — Flare the existing 500-foot wide Entrance Channel to provide an 800-foot wide entrance at Buoy #1. The widener would extend from the beginning of the Entrance Channel approximately 150 feet parallel to both sides of the existing Entrance Channel for approximately 900 feet before tapering back to the existing channel edge over a total distance of approximately 2,000 feet. Deepen the Entrance Channel and proposed widener along Government Cut from an existing depth of 44 feet to a depth of 52 feet.

Component 2A — Widen the southern intersection of Government Cut near Buoy #15. The length of the widener would be approximately 700 feet with a maximum width of approximately 75 feet. Deepen from existing project depth of 42 feet to 50 feet.

Component 3B — Extend the existing Fisher Island Turning Basin 300 feet to the north of the existing channel edge near the west end of Government Cut. Widen the basin to 1,500 feet by 1,200 feet. Deepen channel below existing project depth of 42 feet to 50 feet.

Component 4 — Relocate the west end of the Main Channel approximately 250 feet to the south between channel miles 2 and 3 over a two- or three-degree transition to the existing cruise ship turning basin. No dredging is expected for this component since existing depths allow for continuation of the authorized depth of 36 feet.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Component 5A Increase the width of the Fisherman's Channel approximately 100 feet to the south of the existing channel. This component also includes a 1,500-foot diameter turning basin, which would reduce the existing size of the Lummus Island Turning Basin. This widener at the northwest corner of the turning basin eases the turn to the Dodge Island Cut. Deepen channel and Gantry crane berthing areas 99-140 from the current authorized depth of 42 feet to 50 feet along the proposed widener of Fisherman's Channel from Station 0+00 to the Lummus Island Turning Basin.

2.3 Alternatives Eliminated from Detailed Evaluation

The USACE developed preliminary designs to meet the goals of the study and needs of the Port. In accordance with NEPA procedures to avoid and minimize impacts to environmental resources, the various components of the preliminary designs considered for this project have been revised several times to minimize cost and reduce or eliminate impacts to the environment. The Plan Formulation Appendix of the GRR describes the complete evaluation process. Brief descriptions of the previous versions of each project component are listed below, and a comparison of the preliminary design with the current components evaluated in this document is included in Table 2.

Component 1

Four different versions of Component 1 received consideration during the plan formulation process. Receipt of the Environmental Baseline Resource Study and ship simulation results allowed additional evaluations of the Entrance Channel alternatives based on the location of environmental resources and ship transits.

Further discussions with the Pilots resulted in two additional modifications of Component 1, which completely avoids one reef area (Component 1C). Component 1A avoided one reef location, but did not provide sufficient widening in the area where currents impact vessel transits. Component 1B avoided both reef areas, but did not provide widening in the area of the difficult north and south currents.

Component 2

Two different orientations for the widener received consideration, which included Component 2 and Component 2A. The first recommended by the Pilots (Component 2) extended from the southern edge of Fisherman's Channel parallel to Government Cut between Buoys #13 and #15 over a distance of approximately 2,400 feet.

Ship simulation testing of Component 2 indicated the Pilots did not use the widener during any of the simulation exercises. Subsequent discussions on May 16, 2001 with the Pilots resulted in a reduction of the widener from 2,400 to 700 feet. During a later simulation of the revised Component 2A at the pilot station, a ship grounded at the location of the proposed widener.

Table 2 Avoidance and Minimization of Impacts of the Preliminary Design Plan and Recommended Plan

Habitat Type	Component													
	1[1]	**1C**[2]	[1]	**2A**[2]	[1]	**3B**[2]	[2]	[1]	**5A**[2]	[1]	**6A**[3]		**Previous Total**	**Revised Total**
Seagrass beds (ac)	0	0 [2]	0	0 [3]	**0.7**	**0.1** [4]	0 [5]	**1.7**	**7.8**[4] [6]	**22.8**	NA		**25.2**	**7.9**
Low relief hardbottom/reef (ac)	**35.1**	**28.7**	0	0	0	0	0	0	0	0	NA		**35.1**	**28.7**
High relief hardbottom/reef (ac)	**21.1**	**20.7**	0	0	0	0	0	0	0	0	NA		**21.1**	**20.7**
Rock/rubble w/ live bottom (ac)	**51.7**	**51.7**	0	0	0	0	0	0	0	0	NA		**51.7**	**51.7**
Rock/rubble w/ algae/sponges (ac)	**41.3**	**41.3**	**3.9**	**0.6**	**5.4**	**26.1**	0	**59.4**	**3.8**	0	NA		**136.2**	**71.8**
Unvegetated (ac)	**70.1**	**68.2**	**1.7**	**0**	**9.4**	**24.4**	**0**	**166.8**	**143.8**	**55.4**	**NA**		**333.5**	**236.4**
Total Project Footprint (ac)	**227.8**	**210.6**	**5.6**	**0.6**	**15.5**	**50.5**	**0**	**228.9**	**147.8**	**78.2**	**0**		**612.3**	**409.5**

[1]Original Proposed Impacts
[2]Recommended Plan Impacts
[3]Not Evaluated
[4]Includes 7.6 acres of impacts due to side slope equilibration

Component 3

Component 3 proposed a 1,600-foot diameter turning basin. Following review of the Environmental Baseline Survey and ship simulation tests, Component 3A was identified which reduced the turning basin to a turning notch of approximately 1,500 by 1,450 feet. Since ship simulation testing indicated the Pilots did not use the northernmost section of Component 3, Component 3A was identified since it avoided impacts to most of the seagrass beds to the north.

Later discussions on May 16, 2001 resulted in the Pilots' proposal to completely avoid the seagrass area to the north by truncating the northeast section of the turning basin (Component 3B).

Component 4

No alternative design was considered for Component 4.

Component 5

During the ship simulation exercise, Component 5 provided additional room for vessels passing berthed ships along the container terminals. The Pilots used the additional width during almost every proposed condition test in the Fisherman's Channel.

Component 5A resulted from coordination with Fisher Island's engineering representatives to improve clearance between the proposed widener and a proposed new bulkhead in that area.

Component 6

Component 6 includes deepening of Dodge Island Cut and the proposed 1200-foot turning basin from 32 and 34 feet to 36 feet. It also involves relocating the western end of the Dodge Island Cut to accommodate proposed Port expansion.

Component 6A proposed widening about 1,200 feet of the Dodge Island Cut an additional 50 feet to the south as a result of ship simulation testing. During the ship simulation testing a number of ships left the south side of the channel segment between Lummus Island Turning Basin and Dodge Island Turning Basin. The Engineering Research and Development Center (Waterways Experiment Station) of the USACE recommended Component 6 on the condition that the southern edge of that segment is widened 50 feet, which resulted in Component 6A.

2.4 Recommended Plan

The Recommended Plan (Alternative 2) consists of five components that are designed to improve the Port transit for the existing and future fleets.

Component 1C — Flare the existing 500-foot wide Entrance Channel to provide an 800-foot wide entrance at Buoy #1. The widener would extend from the beginning of the Entrance Channel approximately 150 feet parallel to both sides of the existing Entrance Channel for approximately 900 feet before tapering back to the existing channel edge over a total distance of approximately

2,000 feet. Deepen the Entrance Channel and proposed widener along Government Cut from an existing depth of 44 feet in one-foot increments to a depth of 52 feet.

Component 2A — Widen the southern intersection of Government Cut and Fisherman's Channel at Buoy #15. The length of the widener would be approximately 700 feet with a maximum width of approximately 75 feet. Deepen from existing project depth of 42 feet to 50 feet.

Component 3B — Extend the existing Fisher Island Turning Basin 300 feet to the north of the existing channel edge near the west end of Government Cut. This would widen the basin to 1,500 feet by 1,200. Deepen at one-foot increments below existing depths of 42 feet to 50 feet.

Component 4 — Relocate the west end of the Main Channel approximately 250 feet to the south between channel miles 2 and 3 over a two- or three-degree transition to the existing cruise ship turning basin. No dredging is expected for this component since existing depths allow for continuation of the authorized depth of 36 feet.

Component 5A — Increase the width of the Fisherman's Channel approximately 100 feet to the south of the existing channel. This component also includes a 1,500-foot diameter turning basin, which would reduce the existing size of the Lummus Island Turning Basin. This widener at the northwest corner of the turning basin would ease the turn to the Dodge Island Cut. Deepen at one-foot increments from the existing 42-foot depth to 50 feet along the proposed widened Government Cut channel from Station 0+00 to Station 42+00 and Gantry crane berthing areas 99-140.

2.5 Comparison of Alternatives

The following table (Table 3) provides a comparison of the No-Action Alternative, Alternative 1, and Alternative 2 (Recommended Plan) with regards to costs and potential impacts to natural resources and human environment. A more thorough analysis of potential impacts is included in Section 4.0, Environmental Consequences.

Table 3 Comparison of Alternatives

Resource	No-Action Alternative	Alternative 1	Alternative 2 (Recommended Plan)
Coastal Environment	No significant impact.	No significant impact.	No significant impact.
Geology and Sediments	No significant impact.	Additional sediment or material removal would occur.	Sediment or material removal would occur.
Water Quality	No significant impact.	Temporary increases in turbidity during dredging events may cause increased turbidity at the point of discharge from the disposal sites.	Temporary increases in turbidity during dredging events may cause increased turbidity at the point of discharge from the disposal sites.
Seagrass Communities	No significant impact.	Significant direct impacts would include the removal of seagrass habitat due to widening of the channel and equilibration of the channel side slopes once widening has been completed.	Impacts would include the removal of seagrass habitat due to widening of the channel and equilibration of the channel side slopes once widening has been completed.
Hardbottom and Reef Communities	No significant impact.	Widening and deepening would result in both direct and indirect impacts to hardbottom and reef communities within the Entrance Channel. Additional impacts could occur with cutterhead dredging is used for work on the Entrance Channel.	Widening and deepening would result in both direct and indirect impacts to hardbottom and reef communities within the Entrance Channel. Additional impacts could occur with cutterhead dredging is used for work on the Entrance Channel.
Rock/ Rubble Communities	No significant impact.	Proposed impacts to rock/rubble habitats are principally in areas that have already been dredged.	Proposed impacts to rock/rubble habitats are principally in areas that have already been dredged.
Unvegetated Bottom	No significant impact.	Direct impacts to unvegetated bottom communities would include the impacts to both benthic epifauna and infauna but other direct effects and indirect effects would differ based on the general location of the impacts.	Direct impacts to unvegetated bottom communities would include the impacts to both benthic epifauna and infauna but other direct effects and indirect effects would differ based on the general location of the impacts.
Essential Fish Habitat (EFH)	No significant impact.	EFH would be impacted.	EFH would be impacted.

Table 3 Continued

Resource	No-Action Alternative	Alternative 1	Alternative 2 (Recommended Plan)
Protected Species	No significant impact.	Potential impacts due to blasting and loss of habitat may occur during dredging and construction activities.	Potential impacts due to blasting and loss of habitat may occur during dredging and construction activities.
Other Areas of Special Concern	No significant impact.	No significant impacts.	No significant impacts.
Air Quality	No significant impact.	Short-term impacts from dredge emissions and other construction equipment would not significantly impact air quality.	Short-term impacts from dredge emissions and other construction equipment would not significantly impact air quality.
Noise	No significant impact.	None of the project components are expected to have a significant impact to noise levels.	None of the project components are expected to have a significant impact to noise levels.
Utilities	No significant impact.	Four utility crossings would be impacted.	Four utility crossings would be impacted.
Hazardous, Toxic, and Radioactive Waste (HTRW)	No significant impact.	No significant impacts to HTRW within the project area would occur.	No significant impacts to HTRW within the project area would occur.
Economic Factors	Significant loss of cargo business would occur at the Port due to the inability to handle new industry standard deep draft cargo vessels.	Cargo business would be retained and may increase.	Cargo business would be retained and may increase.
Land Use	No significant impacts.	No significant impacts.	No significant impacts
Recreation	No significant impacts.	No significant impacts.	No significant impacts.
Aesthetic Resources	No significant impacts.	No significant impacts.	No significant impacts.
Cultural Resources	No significant impacts.	No significant impacts.	No significant impacts.

2.6 Disposal Sites

Materials dredged from the above components would be deposited at up to four locations (Figure 4). Rock from the Entrance Channel (Component 1C), Government Cut (Component 2A) and Fisher Island Turning Basin (Component 3B) may be placed in the permitted artificial reef sites as mitigation for impacts to hardbottom and reef communities. Materials that cannot be utilized for artificial reef site placement would be transported to the Offshore Dredged Materials

Disposal Site (ODMDS), the seagrass mitigation site in North Biscayne Bay, or an approved upland disposal area.

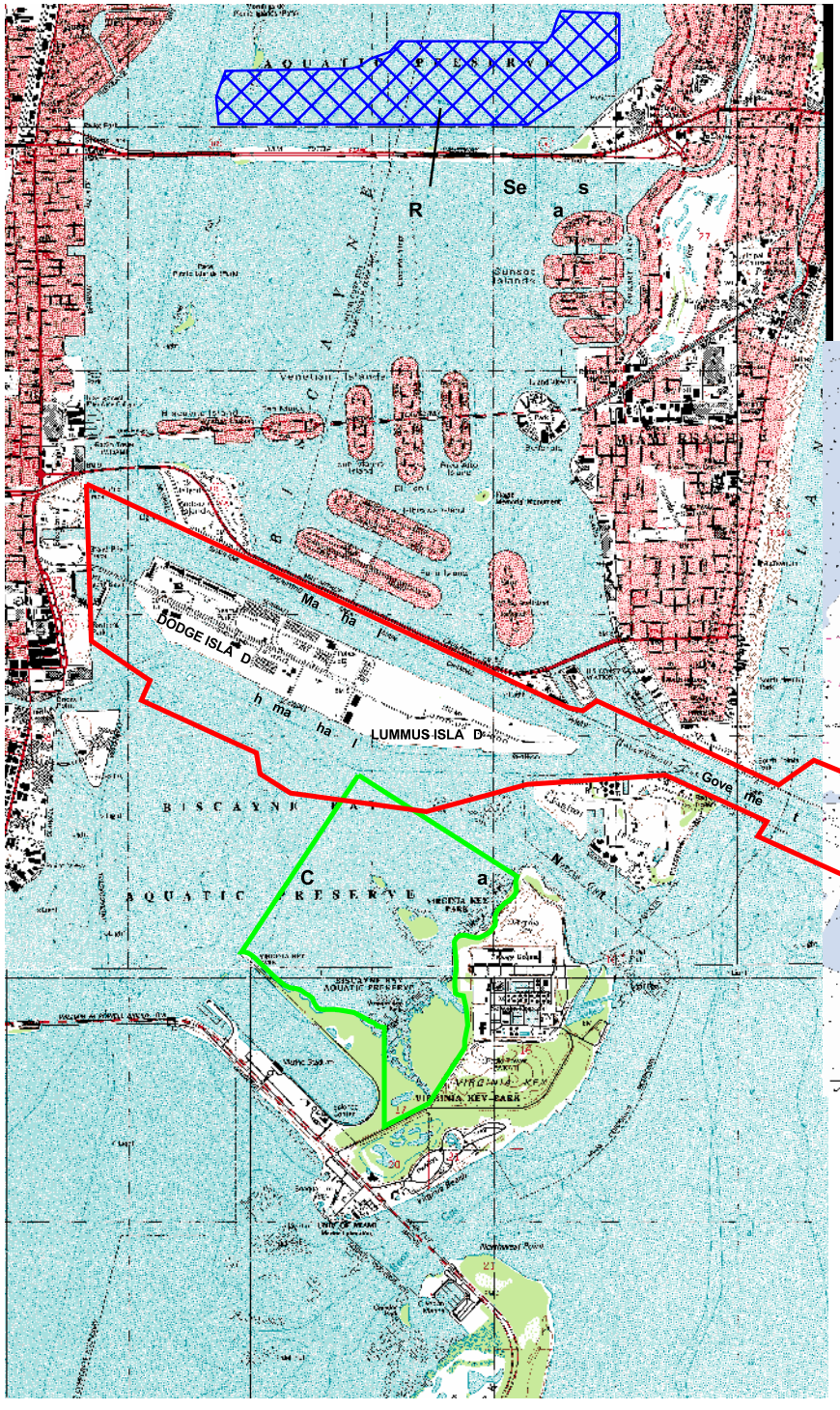
2.7 Construction Techniques

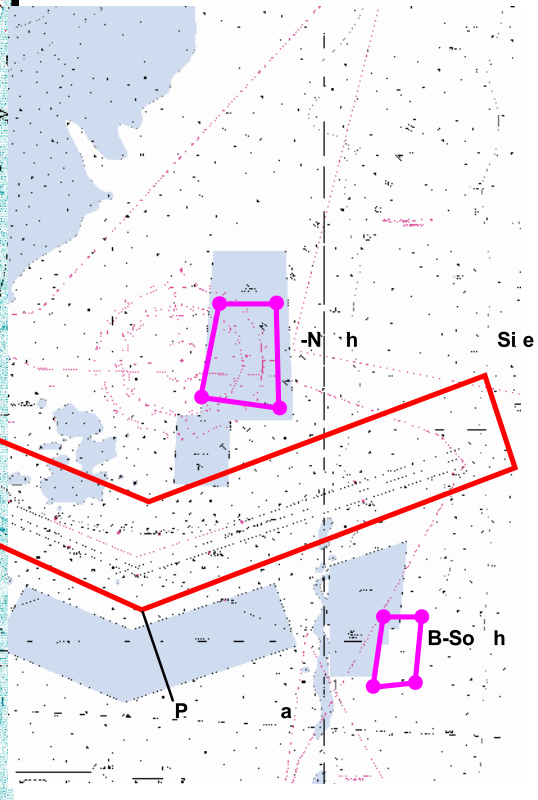
Construction methodology of the project would be determined by the contractor selected by the USACE during the bid process. However, certain assumptions can be made regarding various techniques that may be needed to complete construction. Dredged material would most likely be excavated using either a hydraulic cutterhead dredge or mechanical excavator with some or all of the material pretreated using blasting or some other method to break the rock prior to dredging. If a mechanical dredge is used, the larger dredged material may be removed and segregated at the construction site for use in constructing the mitigation sites. Larger rock material would be placed on one barge to be transported to the artificial reef site, while other materials would be placed on a separate barge for placement at either the seagrass mitigation site or the offshore disposal site. In any event, disposal of all dredged material would be at the proposed mitigation sites, the offshore disposal site, or an approved upland disposal site.

2.7.1 Dredging

Dredging equipment is classified as either hydraulic or mechanical based upon the means of transporting the dredged material from the bottom surface. Hydraulic dredges use water to pump the dredged material as slurry to the surface and mechanical dredges use some form of bucket to excavate and raise the material from the channel bottom. The most common hydraulic dredges include suction, cutter-suction, and hopper dredges and the most common mechanical dredges in the United States (U.S.) include clamshells, backhoes, and marine excavator dredges. U.S. law requires that dredges working on U.S. projects have U.S. built hulls and no large scale dipper or bucket ladder dredges are currently available for U.S. work.

Various project elements influence the selection of the dredge type and size. These factors include the type of material (rock, clay, sand, silt, or combination); the water depth; the dredge cut thickness, length, and width; the sea or wave conditions, vessel traffic conditions, environmental restrictions, other operating restrictions; and the required completion time. All of these factors impact dredge production and as a result costs. Multiple dredges of the same or different types may be used on projects where conditions vary between dredging locations or to expedite the work.





LEGEND

- Approximate Extent of Study Area
- Bill Sadowski Critical Wildlife Area
- DERM Permitted Artificial Reef Site (Corners)

Dredge Material Disposal

- Offshore Dredge Material Disposal Site (ODMDS)
- Proposed Seagrass Restoration Area

5000 0 5000 10000 Feet

ODMDS

Di Si s	
Miami Harbor Ge va t mi y Dr Envi me Imp St me t	
Sc : 1" = 5,000'	Dr wn By: MR
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The following discussion of dredges and their associated impacts will be limited to potential dredging equipment suitable for the Miami Harbor deepening project. The key project elements for this deepening project include the following:

- Material is primarily rock, much of which is classified as hard to very hard and may require pretreatment (such as blasting or other fracturing technique) prior to dredging.
- The widening areas include an overburden of silt, sand, and soft rock over the hard rock areas.
- Significant environmental resources, including reefs and seagrass meadows, are located adjacent to project.
- Project includes both open water and protected water dredging.
- Project depth is -50/52 feet MLW + 1 foot overdepth.
- Dredging volume is 4.1 million CY.

The project scale limits potential equipment to large-scale hydraulic or mechanical dredges. Potential equipment must be able to reach 55 to 60 feet depending upon wave and tide conditions as well as excavate large material volume. In some areas the rock may require some type of pretreatment prior to dredging such as blasting or fracturing with large cutterhead dredges.

Mechanical Dredging

Mechanical dredges are classified by how the bucket is connected to the dredge. The three standard classifications are structurally connected (backhoe), wire rope connected (clamshell), and chain and structurally connected (bucket ladder). The advantage of mechanical dredging systems is that very little water is added by the dredging process to the dredged material and the dredging unit is not used to transport the dredged material. This is important when the disposal location is remote from the dredging site. The disadvantage is that mechanical dredges require sufficient dredge cut thickness to fill the bucket to be efficient and greater re-suspended sediment is possible when the bucket impacts the bottom and as fine-grained sediment washes from the bucket as it travels through the water column to the surface. Clamshell or backhoe marine excavators may be used on the Miami Harbor project.

Clamshell Dredge

Clamshell dredges are the most common of the mechanical dredges. Grab dredges use a number of different bucket types for mud, gravel, rock, or boulders. Clamshell is a type of bucket on a grabber dredge. The clamshell dredging operation cycle is to lower bucket in open position to bottom surface, close bucket penetrating material with weight of bucket, raise bucket above hopper level, swing, dump, swing and repeat. The dredging depth is limited by the length of the wire to lower the bucket and production depends upon the bucket size, dredging depth, and type of material. Clamshell dredges are able to work in confined areas, can pick up large particles, and are less sensitive to sea (wave) conditions than other dredges. However, their capacity is low and they are unable to dig in firm or consolidated materials. Clamshell dredges could be used to remove the unconsolidated overburden in Miami Harbor.

Clamshell dredging environmental impacts in unconsolidated sediment include resuspension of sediments when the clamshell drops into on the bottom and as material washes from the bucket as it rises through the water column. Operational controls such as reducing the bucket speed as it drops to the bottom and as it rises through the water column will reduce impacts, as will use of a closed bucket system. Silt curtains may be deployed around the dredge if water quality standards cannot be met using operational controls.

Backhoe Marine Excavator

A backhoe dredge is a *back-acting* excavating machine that is usually mounted on pontoons or a barge. The backhoe digs toward the machine with the bucket penetrating from the top of the cut face. The operation cycle is similar to the clamshell dredge, as are the factors affecting production. Backhoe marine excavators have accurate positioning ability and are able to excavate firm or consolidated materials. However, they are susceptible to swells and have low to moderate production. Backhoe marine excavators could be used to excavate unconsolidated overburden, fractured rock, and possibly some unfractured rock. It should be noted that one of the largest backhoe marine excavators in the U.S. was unsuccessful in dredging Miami Harbor rock to -42 feet MLW in some locations without a pretreatment fracturing technology.

Backhoe marine excavator dredging environmental impacts in unconsolidated sediment are similar to those of a clamshell dredge, as are the operation controls to reduce that impact. The key is slowing the movement of the bucket through the water. Silt curtains may be deployed around the dredge if water quality standards cannot be met using operational controls. Environmental impacts are significantly less for a backhoe marine excavator dredge removing fractured (blasted) rock as the volume of fine grained sediment is significantly less in fractured rock than unconsolidated sediment and as a result the potential for sediment resuspension is reduced. The same operational controls can be applied to fractured rock as unconsolidated sediment, basically slowing the bucket's speed in the water.

Both types of mechanical dredges require transport barges to move the dredged material from the dredge to the disposal site. The type and size of barges will depend upon the distance to the disposal site and the production rate of the dredge. Barges are less expensive than dredges, therefore, the operation is generally designed so that the dredge is always working and does not experience down time waiting for a barge to be available to load. There are three general types of transport barges that could be used on the Miami Harbor project depending upon the disposal requirements. Barges may be used to transport dredged material to the ODMDS for disposal or to an in-water mitigation site as construction material for the site.

Potential barge environmental impacts could occur as the barge is loaded if material is allowed to spill over the sides, during transport if the barge leaks material, and during disposal if the material escapes from the disposal area. Operational controls eliminate spilling material during loading by monitoring the dredge operator to make sure that the dredge bucket swings completely over the barge prior to opening the bucket. Requiring barges in good repair with new seals minimizes leaking during transport. Hauling rock is often damaging to transport barges, so intermediate inspection and repairs may be required during the project to maintain the barges in good working condition. Seals may require replacement. Proper use of the ODMDS minimizes

the environmental impacts during disposal. The barges will be required to use positioning equipment to place dredged material within the designated ODMDS and inspectors may be required to monitor disposal activity. NOAA has real-time monitoring of prevailing currents in this area and no disposal is allowed when suspended sediment could be carried onto adjacent resources. Use of silt curtains, interior barrier berms or other barriers may be installed as required for construction of mitigation site(s) within Biscayne Bay.

Split Hull Barge

A split hull barge has two hulls connected with hinges at the front and back. This allows the hulls to swing apart, opening at the bottom to allow dredged material to fall from the barge. This provides a rapid disposal of dredged material which as a result is placed within a small area. The rapid descent of material through the water column reduces the potential for resuspension of sediments into the water column during disposal. This barge may be used either for ODMDS disposal or construction of mitigation site.

Bottom Dump Barge

A bottom dump barge has doors on the bottom of the hopper which open at the disposal site to allow the dredged material to fall to the bottom. This type of barge has slower disposal than split hull dump barges and material spreads over a larger area. This barge may be used either for ODMDS disposal or construction of mitigation site.

Flat Top Barge

A flat top barge transports dredged material stacked on a barge deck and must be unloaded mechanically at the disposal site. As a result disposal time is slow but it is possible to drain dredged material with filters prior to disposal. This type of barge generally has a shallower draft requirement than the other two barge types and may be used for construction of mitigation site during final filling stages or when access is limited by depth of water.

Hydraulic Dredging

Hydraulic dredges mix dredged material into a sediment-water slurry and pump the mixture from the bottom surface to a temporary location such as a barge or re-handling site, or to a permanent location such as a confined or unconfined upland or aquatic site. The advantage of hydraulic dredges is that there is less turbidity (re-suspended sediments) at the dredge than with mechanical dredges. The disadvantage of hydraulic dredges is that a large quantity of water is added to the dredged material and this excess water must be dealt with at the disposal location.

Hopper Dredge

Hopper dredges are self-propelled ocean going vessels that hydraulically lift dredged material from the bottom surface and deposit it into an open hopper within the ship. The draghead(s) operates like a vacuum cleaner being dragged along the bottom. When the hopper is full, the dredge transits to a disposal location and releases the dredged material into an underwater disposal site by opening doors on the hopper bottom or in some cases the vessel is designed to split open longitudinally. Hopper dredges can also be designed to hydraulically pump the material from the hopper to an upland location. This is often used for beach nourishment projects. Hopper dredges are not efficient in removing blasted or unblasted rock, however, this

equipment could be used to remove overburden material or accumulated maintenance material above the rock, especially on the entrance channel. Since hopper dredges are self-propelled, they are more maneuverable than dredges that rely upon tug boats to move. However, they require numerous passes over the same area to remove the required material, they are inefficient in small confined dredging areas and are most effective in removing sand and other unconsolidated materials. Hopper dredges could be used to remove unconsolidated overburden material from the Miami Harbor entrance channel, however; only a small volume of this material is present which may reduce the efficiency of this method. The dredge would transport material to the ODMDS for disposal.

Environmental impacts from hopper dredges include localized suspended sediment along the bottom around the draghead and fine-grained sediment turbidity plumes from hopper overflow. This could impact both water quality and the local reef system. The turbidity can be reduced or eliminated by restricting the amount of hopper overflow time, eliminating hopper overflow, or directing the hopper overflow toward the channel bottom through tubes. Suspended sediment is expected to settle quickly because overburden in the entrance channel is mostly sand.

Large Cutter-Suction Dredge

Large cutter-suction dredges, or cutterhead dredges, are mounted on barges. The key parts of a cutter suction dredge include the following:

- The cutter suction head that resembles an egg beater with teeth that break up the dredged material as it rotates. The broken material is hydraulically moved into the suction pipe for transport.
- The cutter suction head is located at the end of a ladder structure that raises and lowers it to and from the bottom surface.
- The cutter suction dredge moves by means of a series of anchors, wires, and spuds. The cutter suction dredges as it moves across the dredge area in an arc as the dredge barge swings on the anchor wires. One corner of the dredge barge is held in place by a spud and the dredge rotates around that spud. The dredge requires workboat or tug assistance to move the anchors and a tug is required to move the dredge to and from a location.
- The discharge pipeline connects the cutter suction dredge to the disposal area. The dredged material is hydraulically pumped from the bottom, through the dredge, and through the discharge pipeline to the disposal location. This is generally an upland site, but can be a barge for transport to a remote location or an in-water site.
- Dredge pumps are located on the barge with additional pump(s) often located on the ladder, especially for deep water dredging projects such as the Port of Miami. Booster pumps can also be added along the discharge pipeline to move the material greater distances.

Depending upon their design, cutterhead dredges can be used to remove blasted or unblasted rock and unconsolidated material. Cutterhead dredges are more limited than hopper dredges to the size of waves.

A large cutterhead dredge could be used for the entire Miami Harbor deepening project. Some pretreatment may be required for portions of the rock prior to dredging. Disposal options

include direct placement of the dredged material on Virginia Key via pipeline or transport by barges to the ODMDS.

Environmental impacts from cutterhead dredges include localized suspended sediment along the bottom around the cutterhead and fine-grained sediment turbidity plumes from barge overflow or pipeline leaks. This can be reduced or eliminated by restricting the amount of overflow time, eliminating barge overflow, and performing regular inspections of the pipeline. Locating barges the furthest possible distance from resources can further reduce environmental impacts. If booster pumps are used, noise impacts may be possible.

Anchors are placed to both sides of the dredge to provide the ability to swing the dredge. The anchors are placed using a crane on a workboat. Implementation of an anchoring and vessel operation plan to effectively minimize anchor and cable impacts to hardbottom habitat would occur through the Request for Proposal (RFP) process and would include incentives to encourage potential contractors to avoid reef impacts. The evaluation criteria in the RFP would consider the technical aspects of the contractor's proposal as the most significant factor. As a result, the vessel operational and anchoring plan that best avoids or reduces impacts to reefs would receive the highest evaluation and the incentives that follow. Potential ideas provided by coordination with DERM, dredging companies, and other consultants that would probably appear in contractor proposals for evaluation during the RFP process include:

- Use of surge buoys along the anchor cable to help lift it up off the reef areas during dredging operations to minimize the area impacted by the anchor cable;

- Restricted anchor placement, which restricts placement of the anchors for the cutter-suction dredge to within the channel edge limits. That method reduces impacts but almost doubles dredging time since only half of the channel can effectively be dredged at a time.

Pre-Treatment Techniques

There are two primary pre-treatment alternatives: blasting or mechanical such as use of spudding or a hydrohammer. Blasting is the most likely pre-treatment for the Miami Harbor Project.

Spudding or Hydrohammer

Spudding is the process of fracturing the rock by dropping an array of chisels or spuds onto the rock causing a fracture. A hydrohammer is a jackhammer mounted on a backhoe. A dredge (hydraulic or mechanical) then follows this process and excavates the rock. This is a slow process and can be relatively expensive. The primary environmental impact of spudding or hydrohammer is noise and vibration.

The USACE investigated methods to remove the rock in the Port of Miami without blasting using a punchbarge. It was determined that the punchbarge, which would work for 12-hour periods, strikes the rock below approximately once every 30-seconds. This constant pounding would serve to disrupt manatee behavior in the area, as well as impact other marine animals in the area. Using the punchbarge will also extend the length of the project temporally, thus increasing any potential impacts to all fish and wildlife resources in the area.

2.7.2 Blasting

To achieve the deepening of the Port from the existing depth of -42 feet to project depth of -50 feet, pretreatment of the rock areas may be required. Blasting is anticipated as that pretreatment for some or all of the deepening of the project. The total volume with the project to be removed is up to 6 million cubic yards. The work may be completed in the following manner:

- *Contour dredging* with either bucket, hydraulic or excavator dredges may be used to remove material that can be dredged conventionally and to determine what areas cannot be dredged by conventional methods.
- *Pre-treating (blasting) the remaining above grade rock*, drilling and blasting the "Site Specific" areas where rock could not be conventionally removed by the dredges. The decision regarding what rock requires blasting may be made based upon contour dredging or based upon analysis of geotechnical data.

- Excavating with bucket, hydraulic or excavator dredges to remove the *pre-treated* rock areas to grade.

All drilling and blasting would be conducted in strict accordance with local, state, and Federal safety procedures. *Marine Wildlife Protection, Protection of Existing Structures, and Blasting Programs* would be coordinated with Federal and state agencies.

Based upon industry standards and USACE, Safety & Health Regulations, the blasting program may consist of the following:

- The lowest poundage (~90 lbs. or less) of explosives that can adequately break the rock.
- Up to three blasts per day, preparing for removal of approximately 1,500 cubic yards per blast. If the entire project required the use of blasting, and assuming three blasts per day, this would equate to approximately 1,333 blast days to complete the project (based on one drillboat, assuming all rock).
- Drill patterns a minimum of 8 feet separation from a loaded hole.
- Hours of blasting from 2 hours after sunrise to 1 hour before sunset.
- Selection of explosive products and their practical application addressing vibration and air blast (overpressure) control for protection of existing structures and marine wildlife.
- Loaded blast holes would be individually delayed to reduce the maximum pounds per delay at point detonation, which in turn would reduce the mortality radius.
- Matching the energy in the “work effort” of the borehole to the rock mass or target for minimizing excess energy vented into the water column or hydraulic shock.

Because of the potential duration of the blasting and the proximity of the blasting to a Critical Wildlife Area, a number of issues would need to be addressed. One of the key issues is the extent of a safety radius for the protection of marine wildlife. This is the distance from the blast site which any protected species must be in order to commence blasting operations. Ideally the safety radius is large enough to offer a wide buffer of protection for marine animals while still remaining small enough that the area can be intensely surveyed.

It is crucial to balance the demands of the blasting operations with the overall safety of the species. A radius that is excessively large would result in significant delays that prolong the blasting, construction, traffic and overall disturbance to the area. A radius that is too small puts the animals at too great of a risk should one go undetected by the observers and move into the blast area. Because of these factors, the goal is to establish the smallest radius possible without compromising animal safety and provide adequate observer coverage for whatever radius is agreed upon. The USACE has completed coordination with the FWS and NMFS through the Endangered Species Act (ESA) regarding an appropriate safety radius (Appendix H).

In an urban environment such as the Port, which is surrounded by commercial properties, utilities, historic structures, and high-end residential communities, protection of structures must be considered. Once the blasting area(s) have been identified, critical structures within the blast zones would be identified. Where vibration damage may occur, energy ratios and peak particle velocities shall be limited in accordance with state or county requirements, whichever is more stringent.

The USACE Safety and Health Requirements Manual (EM 385-1-1 3, Sept/96) 29.E.06 limit of "air blast pressure exerted on structures resulting from blasting shall not exceed 133 dB (0.013 psi)" and industry standard vibration limitations would be incorporated into the design process. A conservative regression analysis of similar projects may be used to develop the design and then continually updated with calibration of the environment.

Vibration-monitoring devices would be installed to ensure that established vibration limits are not exceeded. If the energy ratio or peak particle velocity limits are exceeded, blasting would be stopped until the probable cause has been determined and corrective measures taken. Critical monitoring locations may include structures such as bulkheads, hazardous materials storage areas, and buried utilities.

The USACE believes that blasting is actually the least environmentally impactful method for removing the rock in the Port. Each blast will last no longer than 25 seconds in duration, and may even be as short as 2 seconds, and will be spaced out twelve hours apart. Additionally, the blasts are confined in the rock substrate. Boreholes are drilled into the rock below, the blasting charge is set and then the chain of explosives is detonated. Because the blasts are confined within the rock structure, the distance of the blast effects are reduced as compared to an unconfined blast.

2.7.3 Miami Harbor Project Construction Method

The most likely dredging methodology alternatives for the Miami Harbor project are listed below in order of estimated costs:

1. Blasting all of the channel, followed by mechanical dredge cleanup, and barge transport of dredged material either to ODMDS or to mitigation site.

2. Blasting of all of the channel except for Cuts 1 and 2 (entrance channel) exclusive of the widening at the elbow (which would also be blasted), followed by mechanical dredge cleanup of the blasted areas, and transport to either ODMDS or to Mitigation site. The non-blasted portions of the channel would be excavated with large cutterhead dredge with no restrictions on anchor placement.

3. Same as alternative 2 above but with restricted anchor placement (i.e., within the limits of the channel).

The USACE investigated methods to remove the rock in the Port of Miami without blasting using a punchbarge. It was determined that the punchbarge, which would work for 12-hour periods, strikes the rock below approximately once every 30-seconds. This constant pounding would serve to disrupt manatee behavior in the area, as well as impact other marine animals in the area. Using the punchbarge will also extend the length of the project temporally, thus increasing any potential impacts to all fish and wildlife resources in the area.

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3.0 AFFECTED ENVIRONMENT

Miami Harbor lies in the north side of Biscayne Bay, a shallow subtropical lagoon that extends from the City of North Miami (Miami-Dade County, Florida) south to the northern end of Key Largo (at the juncture of Miami-Dade and Monroe Counties). Biscayne Bay is a long, narrow, water body approximately thirty-eight miles long, and three to nine miles wide. Average depth is six to ten feet (USACE 1989). Biscayne Bay is bordered on the west by the mainland of peninsular Florida and on the east by both the Atlantic Ocean and a series of barrier islands consisting of sand and carbonate deposits over limestone bedrock (Hoffmeister 1974).

A thin layer of sediment less than six inches in depth characterizes the bay bottom over most of its area. Sediment thickness is increased up to 40 inches in the northern part of Biscayne Bay near Miami Beach. Two major natural communities inhabit the bay bottom: seagrass communities and hardbottom communities. In the Atlantic Ocean, waterward of Biscayne Bay and barrier islands, similar communities occur. Nearshore seagrass beds give way to mixed seagrass and hardbottom, deeper channels and, finally, the Florida Reef Tract, which runs from Soldier Key south through the Florida Keys.

3.1 Coastal Environment

Tides within the Miami area are semi-diurnal having two high and two low tides each day. The mean range at Miami Beach is 2.5 feet (3.0 feet in spring). The lowest tide is 1.4 feet below mean low water (USACE 1989).

The Florida Gulf Stream current off the east coast of Florida flows north and varies in velocity from 17 miles per day in November to 37 miles per day in July. Maximum tidal current velocities through Government Cut are approximately 5.5 feet per second on average tide, but occasional velocities of approximately 6.2 feet per second have been recorded during spring tide (USACE 1989). Flood tidal currents are often oriented perpendicular to the Entrance Channel centerline in the vicinity of the seaward ends of the jetties. This affects vessel handling especially inbound when speed is being reduced approaching docks and wharves.

During the months of September through February the prevailing winds and predominant waves approach from the northeast to east. During March, April, and May winds and waves usually approach from an easterly direction. June through August the winds and waves prevail from the southeast. Waves and swells generally have no effect on deep draft navigation due to their amplitude and short period.

3.2 Geology and Sediments

Due to previous dredging projects of the Port and Entrance Channel, the majority of the project area is exposed rock and rubble. A few localized areas are mantled by a few feet of sand due to shoaling. The sand is usually tan or gray, contains some fines and also fills solution holes in the

underlying rock. A portion of the Entrance Channel, between the hardbottom/reefs is sand with no rock. In areas not previously dredged, yellow to white massive limestone and sandstone units of the Miami Oolite Formation are overlain by sand and silt. The Miami Oolite Formation has many solution channels and is very permeable. It has a maximum thickness of 30 feet in the project area and has its base at an approximate elevation of –35.0 feet MLW. The presence of a hard basal conglomerate at this elevation signifies the unconformable contact with the older Fort Thompson Formation. The Fort Thompson consists of tan colors, sandy limestone, calcareous sandstone, and seams of sand. With deeper depths, the sand seams increase in size and are thicker than the rock strata in some places. Many solution holes are present and are either open or filled with sand or secondary limestone. In both the Miami Oolite and the Fort Thompson Formations solution activity and re-crystallization have created zones of different rock strength that cause the rock to fragment into large pieces that makes excavation difficult (USACE 2001).

3.3 Water Quality

The Biscayne Bay area, including Miami Harbor is located within State of Florida Class III waters. Class III is the standard designation covering most open marine waters of the state. Biscayne Bay is also classified as Outstanding Florida Waters (OFW) under Section 62-302.700 of the Florida Administrative Code. The OFW designation carries with it the requirement that ambient water quality cannot be degraded below its existing level. Federal navigation channels at the Port are excluded from the OFW designation. Overall, Biscayne Bay has good water quality probably due primarily to its configuration as an open system that readily flushes out pollutants. Some localized water quality problems are present, primarily in the northern Biscayne Bay where circulation is more restricted and where previous dredge and fill activity has resulted in the loss of most natural submerged and shoreline habitat.

The study area itself is significantly altered from its original natural state. Extensive fill activities on Miami Beach, Fisher Island, Virginia Key and the mainland resulted in the loss of seagrass and mangrove shorelines and restricted flushing to Government Cut and Norris Cut. Much of the remaining bay bottom was channelized, and the Port island was created from spoil islands left from earlier dredging. The main sources of water quality degradation in the area today include stormwater discharges and runoff, particularly from the Miami River, and developed upland areas. Sediments within the study area are frequently suspended by tides, currents, and wind, as well as by vessel transits in and adjacent to the channel by a variety of recreational and commercial watercraft. Due to the high volume of water moving through the deep-water channels on each tidal cycle, the area remains well flushed; however, other contributing sources of sediment, including stormwater discharge and extensive shallow flats to the south, provide continuous material for suspension in the water column.

3.4 Seagrass Communities

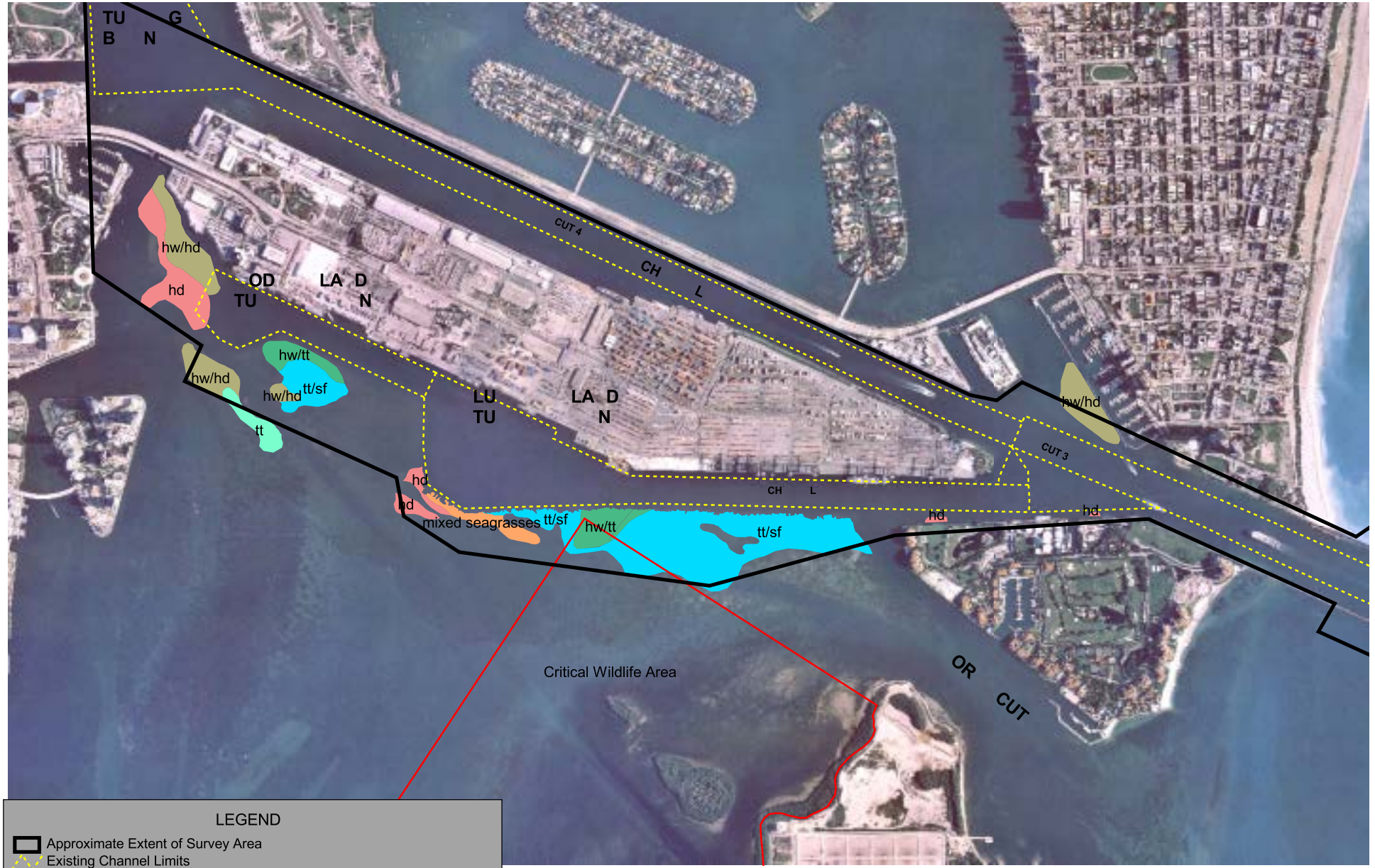
Seagrass distribution and occurrence within the study area were surveyed from approximately 400 feet south of Fisherman's Channel, including the area of the Bill Sadowski Critical Wildlife

Area (BSCWA), and the area adjacent to the Coast Guard Station north of the Entrance Channel at the southern tip of Miami Beach (Figure 5).

Marine seagrass species observed within the study area included *Halodule wrightii*, *Halophila decipiens*, *Syringodium filiforme*, and *Thalassia testudinum*. Seagrass occurrence in these areas consisted of mixed beds of *H. decipiens* and *H. wrightii*, mixed beds of *H. wrightii*, and *T. testudinum*, mixed beds of *T. testudinum and S. filiforme*, mixed beds of all species, and monospecific beds of *T. testudinum* and *H. decipiens*. No *Halophila johnsonii* was observed during the survey (DC&A 2001, Appendix E), nor has any been reported in the study area by resource agencies or other sources (Craig Grossenbacher, DERM 2002, personal communication).

Review of historic aerial photography over an approximate ten-year period (1989 to 1998) shows that major seagrass coverage patterns have essentially remained the same in the Port and BSCWA. Site-specific coverage patterns along Fisherman's Channel revealed that the "colonizing" species, especially *H. wrightii* and *H. decipiens* tended to occur along the turning basins and nearshore areas in softer sediments with higher chronic turbidity (see Figure 5). During seagrass surveys, some *H. decipiens* beds near the turning basins were covered with heavy silt loads. These colonizing species may predominate closer to shore because they can better withstand daily fluctuations in water quality. Mixed beds of the more climactic species, *T. testudinum* and *S. filiforme*, were predominant in silty sand substrate along Fisherman's Channel. This area may experience more flushing by high tides and a more stable substrate with less chronic resuspension. All seagrass beds were patchy and interspersed with bare substrate and the density of individual beds decreased from east to west. The seagrass communities located directly along the channel edge were of moderate quality when compared to the seagrasses in the surrounding area, especially to the south. Daily water quality perturbations from runoff, river flushing, shipping activities and propeller dredging by recreational boaters create a less stable, less diverse habitat although nutrient loads are probably exploited by some marine species at times.

The FWS noted in 1989 that seagrasses might be declining in the vicinity of the mouth of the Miami River because of the deleterious effects of sediments transported into Biscayne Bay (USFWS 1989). An introduction of sediments from the Miami River has reportedly changed areas of the northern part of Biscayne Bay from a turtle grass climax community to an early successional stage, with paddle grass (*H. decipiens*) and shoal grass (*H. wrightii*) as the predominant species. The U.S. Department of the Interior, National Park Service reported that pollutants from the Miami River might have contributed to the loss of large areas of seagrasses adjacent to the Biscayne National Park.



LEGEND

- Approximate Extent of Survey Area
- Existing Channel Limits
- Bill Sadowski Critical Wildlife Area
- Seagrass Cover Classes
  - Halophila decipiens (paddle grass) - hd
  - Thalassia testudinum (turtle grass) - tt
  - Halodule wrightii (shoal grass) w/ Halophila decipiens - hw/hd
  - Halophila wrightii w/ Thalassia testudinum - hw/tt
  - Thalassia testudinum w/ Syringodinum filiforme (manatee grass) - tt/sf
  - Mixed Seagrasses

2000 0 2000 4000 Feet

S n	
M r	
G t	
P t	
Sc '	D R
Da 2	
DIAL CORDY AND ASSOCIATES INC	J 9
	F 5

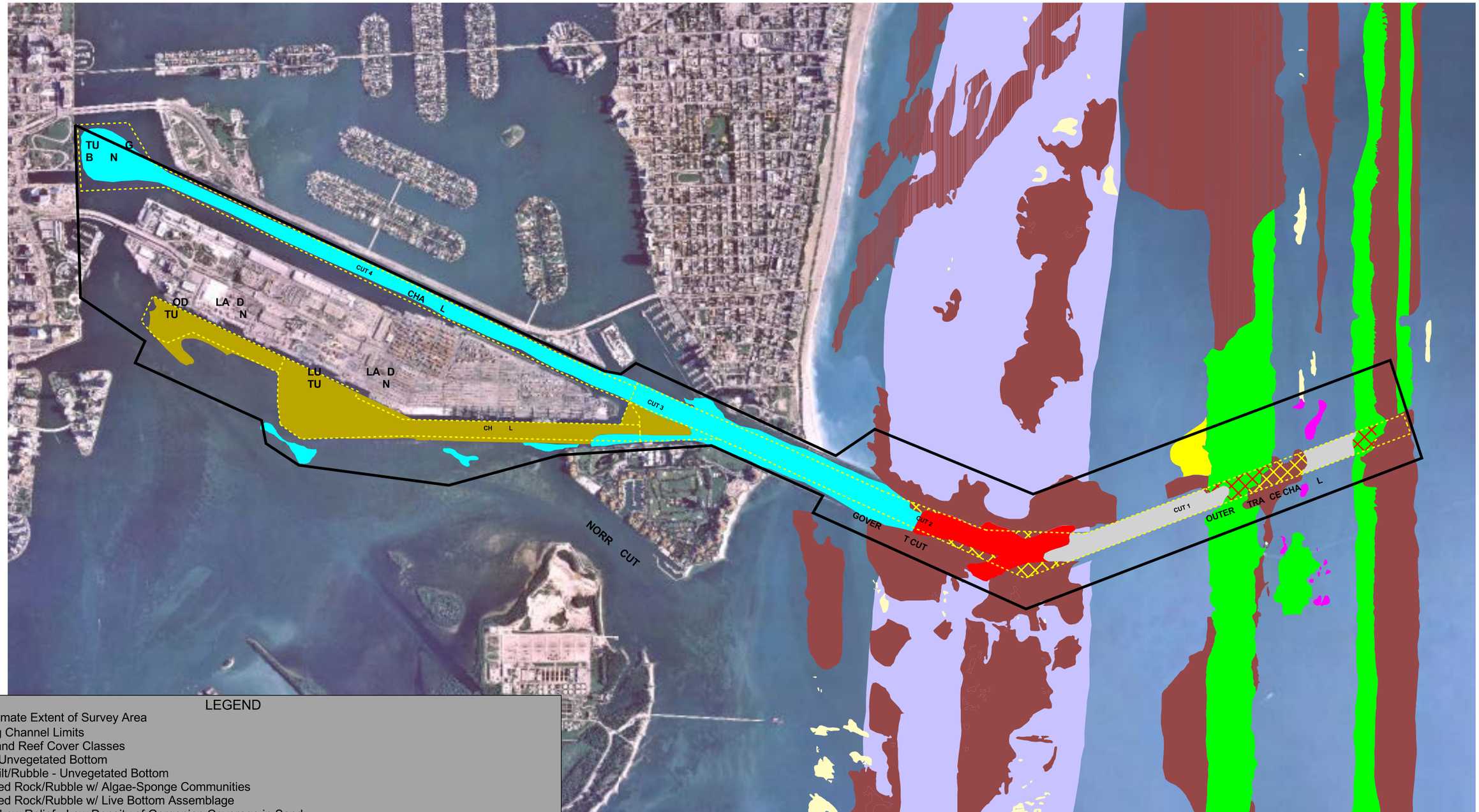
3.4.1 Flora and Fauna Associated with Seagrasses

Seagrass communities provide important habitat for many different species of flora and fauna. *Caulerpa prolifera* was observed in video transects associated with *H. wrightii*, and algae of the genera *Udotea*, and *Penicillus* were also observed in the field along the channel edge. Many invertebrate species also utilize seagrass communities. There is a prevalence of bottom feeders in the beds directly along the channel edge including the queen conch (*Strombus gigas*), urchins such as the sea biscuit (*Clypeaster* spp.), bivalve mollusks, and crustaceans including the spiny lobster (*Panulirus argus*). These species are typical of areas experiencing stress due to existing turbidity and coastal processes. Filter feeders such as soft corals and sponges were observed scattered within adjacent seagrass beds further away from the channel, especially in the BSCWA where increased water clarity appeared to allow a more diverse and higher quality habitat. Many fish species have also been shown to have life cycles dependent on seagrass beds. Of particular importance are the mullet (*Mugil cephalus*), snook (*Centropomis undecimalis*), and many prey species including mojarras (*Eucinostomus* sp.) and pinfish (*Lagodon rhomboides)*. Seagrass beds are also important nurseries for many of the fish associated with the South Atlantic Fisheries Management Council (SAFMC) Snapper-Grouper Complex (SAFMC 1998a).

3.5 Hardbottom and Reef Communities

Hardbottom/reefs associated with the study area include a nearshore hardbottom area and two parallel reef tracts that run generally north/south (Figure 6). The hardbottom zone nearest to shore exists in a physically stressed environment (DC&A 2001, Appendix E), and involves the Miami Oolite Formation (Hoffmeister et al. 1967). Offshore from this nearshore hardbottom area, there are two parallel reef tracts (Duane and Meisburger 1969), both of which are in the study area (Figure 6). The hardbottom environment occurs from approximately 400 to 7,500 feet offshore from Miami Beach. The inner reef tract occurs approximately 2 miles from shore, and the outer reef tract is located approximately 2.5 miles offshore. There is an extensive sand area located between the reef lines. The area between the inner and second outer reef lines is characterized by small isolated hermatypic coral heads and interspersed coral rubble with areas of open sand.

The hardbottom/reef habitat classifications used for characterizing resources within the study area and more specifically within the existing and proposed channel limits are shown in Figure 6 and defined below:



LEGEND

- Approximate Extent of Survey Area
- Existing Channel Limits

Hardbottom and Reef Cover Classes

- Sand - Unvegetated Bottom
- Sand/Silt/Rubble - Unvegetated Bottom
- Scattered Rock/Rubble w/ Algae-Sponge Communities
- Scattered Rock/Rubble w/ Live Bottom Assemblage
- Patchy Low Relief - Low Density of Gorgonian Coverage in Sand
- Patchy High Relief - Moderate Density of Gorgonian and Sponge Coverage in Sand
- Low Relief - Low/Moderate Density of Gorgonian Coverage w/ Scattered Patches of Sand
- High Relief - Moderate/High Density of Gorgonian and Sponge Coverage
- Low Relief (Previously Dredged) - Low/Moderate Density of Gorgonian Coverage w/ Scattered Patches of Sand
- High Relief (Previously Dredged) - Moderate/High Density of Gorgonian and Sponge Coverage

Underlying Substrate

- Oolitic Limestone Bedrock w/ Variable Sand Veneer Coverage

2500 0 2500 5000 Feet

H n
M r
W G t n
P P t t

Sc '
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Da
DIAL CORDY AND ASSOCIATES INC
J 9
F 6

Patchy Low Relief Hardbottom/Reef
This habitat type occurred north of the Entrance Channel and is characterized by a low density of gorgonians with a sand veneer cover.

Patchy High Relief Hardbottom/Reef
This habitat type occurred both north and south of the Entrance Channel and is generally characterized by a moderate density of gorgonians and sponges with a sand cover.

Low Relief Hardbottom/Reef
This habitat type occurred both north and south of the existing channel, with a vertical relief of less than 3 feet and was characterized by a low to moderate density of gorgonians with shallow patches of sand.

High Relief Hardbottom/Reef
This habitat type comprises most of the "inner first reef tract" and the landward portion of the “outer second reef tract," and is located both north and south of the Entrance Channel. The vertical relief of the reef ranges from 3 to 5 feet and is dominated by a moderate to high density of gorgonians and sponges.

Low Relief Hardbottom/Reef - Previously Dredged
This habitat type is the remnant of the hardbottom/reef system that was left following dredging of the Entrance Channel. Structural relief is less than three feet and gorgonians and sponges with scattered patches of sand dominate the habitat.

High Relief Hardbottom/Reef - Previously Dredged
This habitat type is the dredged portion of the inner and outer reefs tracts, with little similarity in structure to the natural reef, but with structural complexity and 3 to 4 feet vertical relief amongst the rock features and is dominated by moderate to high density of gorgonians and sponges.

3.5.1 Hardbottom Within the Channel Zone

The existing dredged Entrance Channel traverses the nearshore hardbottom and inner and outer reef tracts (Figure 6). Resources found within the Main Channel included scattered low relief and high relief hardbottom/reef, with characteristic biota, but are largely comprised of unvegetated sand/silt/rubble and rock/rubble habitats, all of which have been previously dredged. The areas of scattered rock/rubble within the channel and channel walls do exhibit some sponge and coral growth, although this habitat is not of the same quality as areas of hardbottom outside of the channel. The channel hardbottom is rock/rubble exposed and colonized following prior dredging events.

3.5.2 Dominant Biota of Hardbottom/Reef Habitats

Hardbottom and reef communities in the offshore areas of the study area are predictably speciose and have been characterized several times (Seaman 1985; Blair and Flynn 1989; and USACE 1989). The dominant feature of the reefs (low and high relief habitats) off Miami-Dade County is the high density and diversity of gorgonian corals (USACE 1989; USACE 1996a). Observed gorgonians (soft corals) during a recent video survey were primarily of the genera *Eunicea* (e.g., *E. palmeri)*, *Plexaura* (e.g., *P. homomalla)*, and *Pseudopterogorgia* spp. (DC&A 2001, Appendix E). Other observed genera included *Gorgonia*, *Plexaurella* (*P. dichotoma)*, and *Pterogorgia* (*P. citrina* and *P. anceps*), and *Pseudoplexaura* spp. Hard coral species also make up a significant part of the reef assemblages in this area. They include *Porites asteroides, Diploria clivosa, Siderastrea siderea,* and *Montastrea cavernosa* (Blair and Flynn 1989). All four of these dominant species, and a fifth, *Montastrea annularis*, were observed during the 2000 survey (DC&A 2001, Appendix E). Sponges observed within the project area's hardbottom and reefs during the survey included *Ircinia campana*, *Callyspongia vaginalis*, *Cliona* sp., *Iotrochota* sp. (*I. birotulata*), *Geodia* spp. (*G. gibberosa* and *G. neptuni*) and *Amphimedon compresa*. The biota of the two outer reef tracts are consistent with the overall assemblage of stony corals, sponges, and gorgonians found offshore of Miami-Dade, Broward, and Palm Beach Counties (USACE 2000). Colonizing taxa such as sponges and certain gorgonians were more prevalent in the channel's hardbottom areas than were hard corals. Observed algal species in channel and offshore areas included *Caulerpa* spp., *Laurencia* spp., *Cladophora* spp., and *Halimeda* spp. Flynn, et al. (1991) noted the additional presence of *Dictyota* spp. and *Jania* spp. in the area. Hardbottom/reef habitat where these marine algal species cover large areas are indicative of a stressful environment and represent less than ideal conditions to support more than a low to moderate quality habitat. In general, the hardbottom habitats found in the existing channel have been previously dredged, are chronically impacted by localized disturbances and have less structural complexity than those found outside of the channel.

3.5.3 Fishes Associated with Hardbottom/Reef Habitats

A total of 27 species of fish were observed on the offshore reef sites (DC&A 2001, Appendix E). A summary of the species observed is shown in Table 4. The most abundant species encountered were cocoa damselfish (*Pomacentrus variabilis*), bicolor damselfish (*Pomacentrus partitus)*, barjack (*Caranx ruber*), and bluehead wrasse (*Thalasomma bifasciatum*). Many other fishes were commonly encountered within the study area. These included members of the families Chaetodontidae (butterflyfishes), Acanthuridae (surgeonfishes), Scaridae (parrotfishes), Labridae (wrasses), Haemulidae (grunts), Lutjanidae (snappers), and Pomacanthidae (angelfishes). Other species encountered in lesser numbers included hogfish (*Lachnolaimus maximus*), rock hind (*Epinephelus adsecnsionis*), and Spanish hogfish (*Bodianus rufus*). These results are similar to fish species observed by Bohnsack et al. (1992; 1999).

Table 4 Relative Abundance of Fish Species Observed During Visual Survey, Miami Harbor, Florida

Common Name	Scientific Name	South Transects	North Transects
Bar jack	*Caranx ruber*	*A*	--
Beaugregory	*Pomacentrus partitus*	*A*	*A*
Bluehead wrasse	*Thalassoma bifasciatum*	*A*	*C*
Bluestripe grunt	*Haemulon sciurus*	-	*C*
Cocoa damselfish	*Pomacentrus variabilis*	*A*	*A*
Foureye butterflyfish	*Chaetodon capistratus*	*C*	*C*
French angelfish	*Pomacanthus paru*	*O*	*O*
Gray snapper	*Lutjanus griseus*	*O*	*C*
Grey angelfish	*Pomacanthus arcuatus*	*O*	*O*
Hogfish	*Lachnolaimus maximus*	*O*	*O*
Ocean sturgeon	*Acanthurus bahianus*	-	*C*
Pearly razorfish	*Hemipteronotus novacula*	-	*O*
Pigfish	*Orthoprisits chysoptera*	*C*	*C*
Porkfish	*Anisotremus virginicus*	*C*	*C*
Princess parrotfish	*Scarus guacamaia*	*O*	*O*
Rainbow parrotfish	*Scarus guacamaia*	*O*	*O*
Redlip blenny	*Opioblennius atlanticus*	*O*	*O*
Reef butterflyfish	*Chaetodon sedentarius*	*C*	*C*
Rock beauty	*Holocanthus tricolor*	-	*C*
Seaweed blenny	*Parablennius marmoreus*	*O*	*O*
Slippery dick	*Halichores bivittatus*	*C*	*C*
Spanish hogfish	*Bodianus rufus*	-	*R*
Spotted scorpionfish	*Scorpaena plumieri*	*O*	*O*
Stoplight parrotfish	*Sparisoma viride*	*O*	*O*
Tomtate	*Haemulon aurolineatum*	*C*	*C*
Townsend angelfish	*Holocanthus* sp.	*R*	-
Yellowtail snapper	*Ocyurus chysurus*	*C*	*C*

Source: DC&A 2001

Key A = abundant
C = common
O = occasional
R = rare

3.6 Unvegetated Bottom

Unvegetated bottom habitat within the study area has been classified as either sand bottom habitat or sand/silt/rubble habitat (Figure 6). Off of Miami-Dade County, unvegetated sand bottom habitats fall between the inner and outer reef tracts within the study area (Figure 6) and hence may provide a corridor for reef species to travel between reef lines. They may also be an important foraging area for some fish species (Jones et al. 1991). Other unvegetated sand bottom habitats are located between scattered reef patches and rock/rubble habitats both within and adjacent to the channel and between seagrass beds that occur outside the channel. Areas surveyed along the channel edge in the Port (within 400 feet perpendicular) were classified as unvegetated bottom if no seagrass/algae beds were recorded and mapped (see Figure 5). The unvegetated sand bottom just west of the Lummus Island Turning Basin is an example (DC&A 2001, Appendix E). The unvegetated-sand/silt/rubble habitat is found within Fisherman's Channel, and occurs as a patchy mosaic of each of these components.

Softer silty-sand substrates occurred mainly inshore, while unvegetated habitats offshore included some bare sand substrate over rock with sparse algae. During the summer months, the most abundant of these algal species found in the study area belong to the green algae genera *Caulerpa*, *Halimeda*, and *Codium* (USACE 1989; USACE 1996b). The former two taxa were observed during summer 2000 surveys (DC&A 2001, Appendix E). In winter months, brown algae (*Dictyota* spp. and *Sargassum* spp.) dominate (USACE 1989; USACE 1996b). In addition, several species of sponges (e.g., *I. campana*, *C. vaginalis*, and *Iotrochota* sp.) and gorgonians (e.g., *Eunicia* spp. and *Gorgonia* sp.) were observed along transects through unvegetated habitats. Individual colonies of algae, soft corals, and sponges that occasionally occur in these areas where little structure is available may serve to provide temporary refugia for small, motile species. Invertebrate fauna utilizing sand bottom areas include the Florida fighting conch (*Strombus alatus*), milk conch (*Strombus costatus*), king helmet (*Cassia tuberosa*), and the queen helmet (*Cassia madagascariensis*) (USACE 1996b).

The most ubiquitous infauna of inshore softer sand/silt/rubble communities include polychaete and sipunculan worms, oligochaetes, platyhelminthes, nemerteans, mollusks, and peracarid crustaceans. Compared to shallow sand flats, seagrass communities, and areas adjacent to reef tracts, the deeper, dredged areas of the channel and Port likely support a less diverse infaunal species assemblage and are a lower quality habitat.

3.7 Rock/Rubble Communities

Within the project area there are both naturally occurring rock outcrops and rock/rubble material that have been left from prior dredging events (Figure 6). For mapping purposes the rock/rubble communities have been classified as either scattered rock-rubble with algae-sponge communities or scattered rock/rubble with live bottom assemblage. The most obvious biological features of most of the rock/rubble-based habitats are resident sponges and macroalgae, which occurs throughout the Main Channel, portions of the inner Entrance Channel and isolated areas south of Fisherman’s Channel. The remainder of the rock/rubble habitat serves as raw material for reef-

building species. The latter case was apparent in the channel zone adjacent to the existing hardbottom in Government Cut. Observed sponge species included *Ircinia campana*, *Callyspongia vaginalis*, and *I. birotulata*. Observed soft corals were similar to those of adjacent reefs, and included the genera *Eunicea*, *Plexaura* and *Pseudopterogorgia*. Habitats provided by rock and rubble and associated sponges, algae, and soft corals provide significant refugia for many species of juvenile fish. These habitats are quite resilient and have successfully recovered from past dredging.

3.8 Essential Fish Habitat

The SAFMC (SAFMC 1998b) has designated seagrass, nearshore hardbottom, and offshore reef areas within the study area as Essential Fish Habitat (EFH) (Table 5). In southeastern Florida these habitats have also been designated as EFH-Habitat of Particular Concern (HAPC) (SAFMC 1998b). Managed species that commonly inhabit the study area include penaid shrimp and spiny lobster (*Panulirus argus*). These shellfish utilize both the inshore and offshore habitats within the study area (DC&A 2001). Several managed finfish species may also be present (see Appendix F).

Table 5 Essential Fish Habitat Areas in the Study Area

Estuarine Areas (Fisher Island, Main Channel, Inner Entrance Channel)	
	Seagrass
	Estuarine Water Column
	Algae
Marine Areas (Entrance Channel, Nearshore, and Offshore Areas)	
	Live/Hardbottom
	Coral and Coral Reef
	Artificial Reefs
	Algae
	Water Column

Source: South Atlantic Fisheries Management Council 1998b

Members of the 73 species Snapper-Grouper Complex that commonly use the inshore habitats for part of their life cycle include blue stripe grunts (*Haemulon sciurus*), French grunts (*Haemulon flavolineatum*), mahogany snapper (*Lutjanus mahogoni*), yellowtail snapper (*Ocyurus chysurus*), and Nassau grouper (*Epinephelus striatus*). These species utilize the inshore habitats as juveniles and sub-adults. As adults, they utilize the hardbottom and reef communities offshore. In the offshore habitats, the number of species within the Snapper-Grouper Complex that may be encountered increases. Other species of the Snapper-Grouper Complex commonly seen offshore in the study area include gray triggerfish (*Balistes capriscus*) and hogfish (*Lachnolaimus maximus*). Coastal migratory pelagic species also commonly utilize the offshore area adjacent to the study area. In particular, the king mackerel (*Scomberomorus cavalla*), and the Spanish mackerel (*Scomberomorus maculatus*) are the most common. As many as 60 coral species have been documented off the coast of Florida. Those observed in the

study area are described in Section 3.5.2. All coral species fall under the protection of the South Atlantic Fishery Management Plan (SAFMC 1998b).

3.9 Protected Species

3.9.1 Marine Vegetation

3.9.1.1 Johnson's Seagrass

Johnson's seagrass (*H. johnsonii*) was listed as a threatened species by NMFS on September 14, 1998 (63 FR 49035) and a re-proposal to designate critical habitat pursuant to Section 4 of the ESA was published on December 2, 1998 (64 FR 64231). The final rule for critical habitat designation for *H. johnsonii* was published April 5, 2000 (65 FR 17786). Federal navigation channel boundaries existing at the time of designation, including the Port project are excluded from the critical habitat designation. *H. johnsonii* has one of the most limited geographic ranges of all seagrass species. It is only known to occur between Sebastian Inlet and northern Biscayne Bay on the east coast of Florida (Kenworthy 1997). Although *H. johnsonii* has been reported to occur in north Biscayne Bay, no *H. johnsonii* was encountered within the study area (DC&A 2001, Appendix E). Further, past field surveys conducted by resource agency personnel and for other studies of the Port have failed to identify *H. johnsonii* within the study area (Craig Grossenbacher, DERM, 2002, personal communication). However, concerns were raised by a NOAA representative that *H. johnsonii* may occur within the project area. This was partially due to an un-confirmed specimen observed during an interagency site visit on March 20, 2002. An additional site visit in May 2003 did not result in identification of the species, and the interagency team of biologists (representatives from USACE, FWS, NMFS, FDEP, and DERM) expressed the opinion that the high energy conditions found along Fisherman's Channel probably do not favor recruitment of *H. johnsonii*.

3.9.2 Marine Mammals

3.9.2.1 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) has been listed as a protected mammal in Florida since 1893. Federal law, specifically the Marine Mammal Protection Act of 1972 (MMPA) and the Endangered Species Act of 1973 (ESA) protects manatees. Florida provided further protection in 1978 by passing the Florida Marine Sanctuary Act designating the state as a manatee sanctuary and providing signage and speed zones in Florida's waterways.

Within Miami-Dade County there exist both permanent and transient populations of manatees. Surveys show that during the winter months when temperatures drop, manatees from north

Florida and also Miami-Dade County will migrate to the Florida Power and Light (FP&L) power plant at Port Everglades (USGS 2000). During the spring months when the water warms, manatees return to the counties to the north and south to forage and reproduce. Telemetry and aerial surveys (Figure 7) confirm manatees are present within Miami-Dade County all year (Miami-Dade County 1999a, USGS 2000). The surveys also confirm that they frequent the waters in and adjacent to the study area in the Port, especially in the BSCWA, and near the Miami River and Intracoastal Waterway (ICWW). There are fewer sightings documented in the habitats directly along the channel edge east of the Lummus Island Turning Basin (Miami-Dade County 1999a).

3.9.2.2 North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is a Federally listed endangered species and is also listed as a depleted stock under the MMPA. The minimum estimated population within the north Atlantic Region is 291 animals (NMFS 2001). North Atlantic right whales are highly migratory, summering in feeding and nursery grounds in New England waters and northward to the Bay of Fundy and the Scotian Shelf (NMFS 2001). They migrate southward in winter to the northeastern coast of Florida. The breeding and calving grounds for the right whale occur off of the coast of southern Georgia and north Florida and have been designated as critical habitat under the ESA in 1994 (59 FR 28793). During these winter months, right whales are routinely seen close to shore. While North Atlantic right whales have been historically reported in south Florida and the Gulf of Mexico, these sightings are extremely rare (Dan O'Dell, Hubbs-Sea World Research Institute, 2002, personal communication; North American Right Whale Consortium database, University of Rhode Island, accessed September 2003).

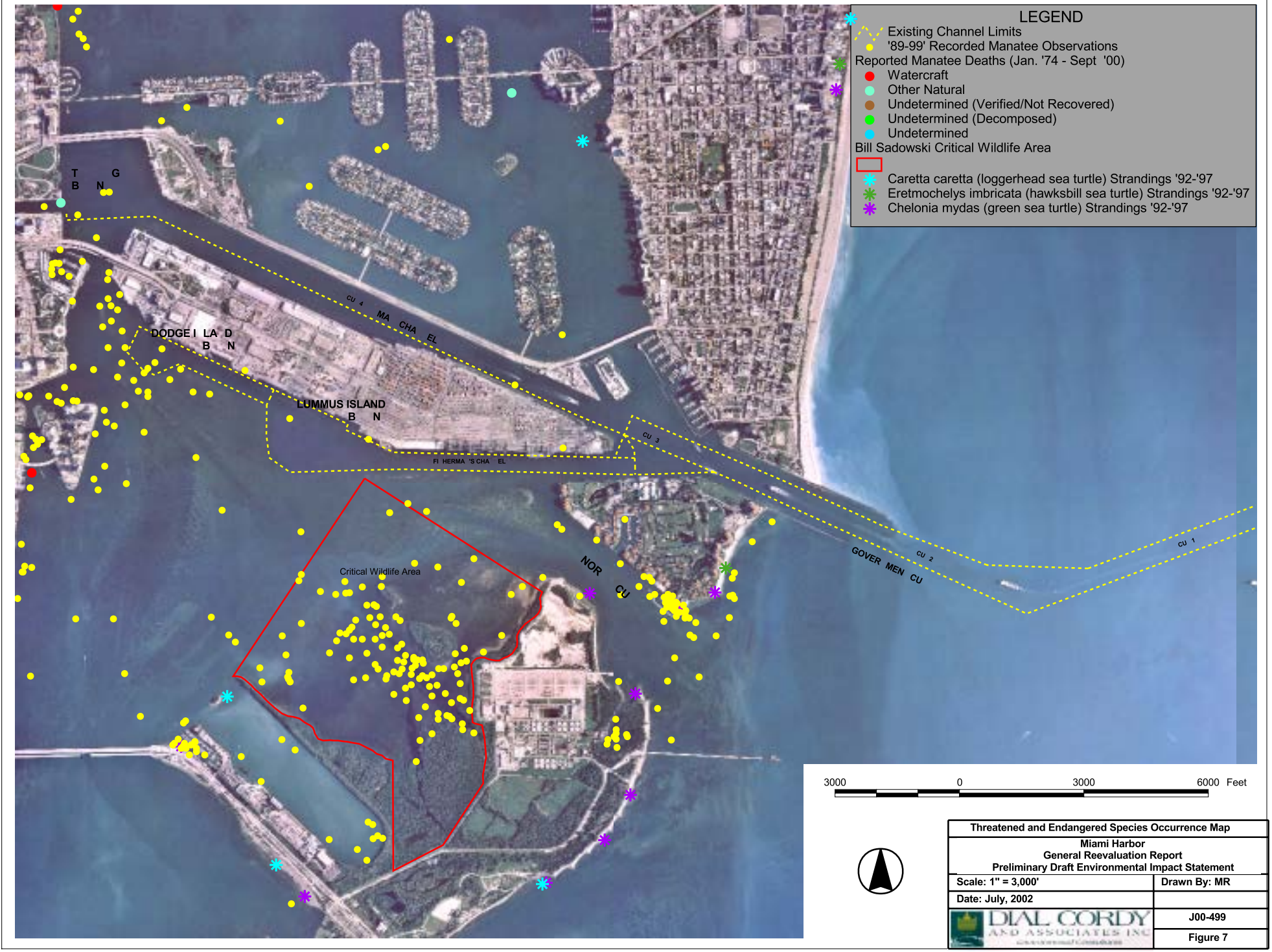
3.9.2.3 Bottlenose Dolphin

The USACE expects to find bottlenose dolphins (*Tursiops truncatus*) in the activity area. The National Marine Fisheries Service – Southeast Fisheries Science Center-Miami Laboratory has been conducting a photo-identification survey of the dolphins in Biscayne Bay since 1990. The study area encompasses an area of approximately 200 square miles. The study area ranged from Haulover Inlet south to the Card Sound Bridge behind Key Largo.

The study has identified 159 individual animals residing in Biscayne Bay, 146 of which have been resighted on at least one additional time. Many of these animals have been sighted within or transiting through the Port of Miami.

There is not currently a stock assessment available from NMFS concerning the status of bottlenose dolphins in the inshore and nearshore waters off of south Florida (Emily Menashes, pers.com 2002). Additionally, no status reviews or published reports of status of the Biscayne Bay dolphins have been published (although NMFS-SEFSC is currently working on one – Contillo, in press). The stocks of bottlenose dolphins that reside closest to the project area, that have a completed stock assessment report available for review is the western North Atlantic

coastal stock and offshore stock of bottlenose dolphins. The assessment for these groups was completed in November 2001 and September 2000, respectively.



Threatened and Endangered Species Occurrence Map	
Miami Harbor General Reevaluation Report Preliminary Draft Environmental Impact Statement	
Scale: 1" = 3,000'	Drawn By: MR
Date: July, 2002	
DIAL CORDY AND ASSOCIATES INC	J00-499
	Figure 7

3.9.2.4 Sperm Whale

There are estimated to be approximately two million sperm whales worldwide with a population of 130,000 or more thought to occur in the North Atlantic (IWC 1983). In the western North Atlantic they range from Greenland to the GOM and the Caribbean. The sperm whales that occur in the eastern US EEZ are believed to represent only a portion of the total stock (Blaylock, et al. 1995). Sperm whales generally occur in waters greater than 180 meters in depth. While they may be encountered almost anywhere on the high seas their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Waring, et al. (1993) suggest sperm whale distribution is closely correlated with the Gulf Stream edge. Like swordfish, which feed on similar prey, sperm whales migrate to higher latitudes during summer months, when they are concentrated east and northeast of Cape Hatteras. Bull sperm whales migrate much farther poleward than the cows, calves, and young males. Because most of the breeding herds are confined almost exclusively to warmer waters many of the larger mature males return in the winter to the lower latitudes to breed.

3.9.2.5 Humpback Whale

Humpback whales feed in the northwestern Atlantic during the summer months and migrate to calving and mating areas in the Caribbean. Five separate feeding areas are utilized in northern waters after their return; one of which, the Gulf of Maine feeding population, lies within U.S. waters and is within the action area of this consultation. Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod bays. Sightings are most frequent from mid-March through November between 41°N and 43°N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982), and peak in May and August. Small numbers of individuals may be present in this area year-round, including the waters of Stellwagen Bank.

Barlow and Clapham (1997) note an apparent increasing trend in the Gulf of Maine feeding population; whereas the western Greenland feeding population appears small and is perhaps static. It is not yet known which feeding populations the mid-Atlantic animals belong to. The current rate of increase of the North Atlantic humpback whale population overall has been estimated at 9.0 percent (CV=0.25) by Katona and Beard (1990) and at 6.5 percent by Barlow and Clapham (1997). Palsboll, et al. (1997) studied humpback whales through genetic markers to identify individual humpback whales in the northern Atlantic Ocean. Using breeding ground samples from 1992–1993, Palsboll, et al. (1997) estimated the North Atlantic humpback whale population at 4,894 (95% confidence interval 3,374 - 7,123) males and 2,804 females (95% confidence interval 1,776 -4,463), for a total of 7,698 whales. However, since the sex ratio in this population is known to be 1:1 (Palsboll, et al. 1997), the lower figure for females is presumed to be a result of sampling bias or some other cause for partitioning of the sampling. Photographic mark-recapture analyses from the YONAH (Years of the North Atlantic Humpback) project gave

an ocean-basin-wide estimate of 10,600 (95% c.i. = 9,300 - 12,100) and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 (95% c.i. = 8,000 - 13,600) (Smith, et al. 1999). The estimate of 10,600 is regarded as the best available estimate for this population. The minimum population estimate for the North Atlantic humpback whale population is 10,019 animals (CV=0.067) (Waring, et al. 1999).

Humpback whales pass close to the south Florida coast while migrating from northern feeding waters to mating and calving locations in the Caribbean in the fall and on the return to the north in the spring.

3.9.2.6 Fin Whale

The fin whale is ubiquitous in the North Atlantic and occurs from the GOM and Mediterranean Sea northward to the edges of the Arctic ice pack (Waring, et al. 1999). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, however, Clark (1995) reported a general southward "flow pattern" of fin whales in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. The overall distribution may be based on prey availability. This species preys opportunistically on both invertebrates and fish. As with humpback whales, they feed by filtering large volumes of water for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments. Due to these traits, fin whales are less prone to entanglements than are right and humpback whales, but because they do occur in many of the same areas, the potential exists.

Hain et al. (1992) estimated that about 5,000 fin whales inhabit the northeastern United States continental shelf waters. Shipboard surveys of the northern Gulf of Maine and lower Bay of Fundy targeting harbor porpoise for abundance estimation provided an imprecise estimate of 2,700 (CV=0.59) fin whales (Waring et al. 1997).

3.9.2.7 Sei Whale

Indications are that, at least during the feeding season, a major portion of the sei whale population is centered in Northerly waters, perhaps on the Scotian Shelf (Mitchell and Chapman 1977). The southern portion of the species' range during spring and summer includes the northern portions of the U.S. Atlantic Exclusive Economic Zone (EEZ) — the Gulf of Maine and Georges Bank. The period of greatest abundance there is in spring, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (CETAP 1982). The sei whale is generally found in the deeper waters characteristic of the continental shelf edge region. Mitchell (1975) similarly reported that sei whales off Nova Scotia were often distributed closer to the 2,000 m depth contour than were fin whales.

This general offshore pattern of sei whale distribution is disrupted during episodic incursions into more shallow and inshore waters. The sei whale, like the right whale, is largely planktivorous — feeding primarily on euphausiids and copepods. In years of reduced predation on copepods by other predators, and thus greater abundance of this prey source, sei whales are reported in more inshore locations, such as the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986) areas (R.D. Kenney, pers. comm.; Payne, et al. 1990). An influx of sei whales into the southern Gulf of Maine occurred in the summer of 1986 (Schilling, et al. 1992). Such episodes, often punctuated by years or even decades of absence from an area, have been reported for sei whales from various places worldwide.

3.9.2.8 Blue Whale

The blue whale is best considered as an occasional visitor in USA Atlantic Exclusive Economic Zone (EEZ) waters, which may represent the current southern limit of its feeding range (CETAP 1982; Wenzel, et al. 1988). All of the five sightings described in the foregoing two references were in August. Yochem and Leatherwood (1985) summarized records that suggested an occurrence of this species south to Florida and the Gulf of Mexico, although the actual southern limit of the species' range is unknown.

Using the U.S. Navy's SOSUS program, blue whales have been detected and tracked acoustically in much of the North Atlantic, including in subtropical waters north of the West Indies and in deep water east of the USA EEZ (Clark 1995). Most of the acoustic detections were around the Grand Banks area of Newfoundland and west of the British Isles. Sigurjónsson and Gunnlaugsson (1990) note that North Atlantic blue whales appear to have been depleted by commercial whaling to such an extent that they remain rare in some formerly important habitats, notably in the northern and northeastern North Atlantic.

3.9.3 Sea Turtles

Miami-Dade County is within the normal nesting range of three species of sea turtles; the loggerhead (*Caretta caretta*), the green sea turtle (*Chelonia mydas*), and the leatherback (*Dermochelys coriacea*). The green and leatherback sea turtles are both listed as endangered under the ESA and Chapter 370, F.S. The loggerhead sea turtle is listed as a threatened species. Within the 21 miles of beach along Miami-Dade County, a total of 319 sea turtle nests were found in 1999 (Miami-Dade County 1999b). From 1980 through 2000, an average of 183 sea turtle nests were per year discovered on Miami-Dade County beaches. On Fisher Island, a total of 24 sea turtle nests were observed during 2000. The majority of sea turtle nesting activity involved loggerhead sea turtles and occurred during the summer months of June, July, and August, with nesting activity occurring as early as March and as late as September (Miami-Dade County 2000).

The waters offshore of Miami-Dade County and those of Biscayne Bay are also used for foraging and shelter for the three species listed above, the hawksbill sea turtle (*Eretmochelys*

imbricata) and the possibly Kemp's ridley sea turtle (*Lepidochelys kempii*), and Olive ridley sea turtle (*Lepidochelys oliveacea)* (DC&A 2001; Foley, et al 2003). During the summer months, adult turtles tend to congregate just offshore during mating and nesting activities and between nesting events. During the fall northward migration along the Keys and South Florida, there may be a greater tendency for individuals to wander into harbors and inland waterways in search of food, foraging for a day or two and then moving on.

A total of 23 stranded sea turtle carcasses were recovered from the vicinity of the Port (7 loggerheads, 10 green, 1 leatherback, 2 hawksbills, and 3 unidentified species). Stranding data is recorded at the location where a dead or injured turtle was retrieved which is usually where the carcass has washed up on shore after mortality has occurred in some other location, or it is where the injured or sick turtle has crawled ashore. If the animal is dead, an attempt to determine the cause of death is made. Strandings occur for many reasons, including collisions with watercraft, drowning/suffocation from entanglement, ingestion of debris, and disease. In addition to the 23 stranded turtles that have been recovered, there is one record of a loggerhead sea turtle being incidentally captured on hook and line (Wendy Teas, NMFS - SEFSC Miami Laboratory, 2002, personal communication).

3.9.4 American Crocodile

The American crocodile is a state and Federally listed endangered species. It is distributed along coastal and estuarine shores of the extreme southern Florida peninsula. Crocodiles primarily nest from Florida Bay to Turkey Point and on northern Key Largo. In Biscayne Bay they have been observed nesting as far north as Crandon Park, Bill Baggs State Recreation Area and Snapper Creek (USFWS 1999; Mazzotti 2000). Nesting for the crocodile begins in March and extends until late April or early May until the eggs are laid. They build their nests in well-drained soil at sites adjacent to deep-water. Adult crocodiles feed at night on schooling fish in creeks, open water, and deep channels (FP&L 1987). Crocodiles are shy animals and prefer quiet, inland ponds and creeks and protected coves. They also prefer natural, undisturbed areas for nesting, resting and feeding (USFWS 1999).

3.9.5 Piping Plover

The piping plover is a state and Federally listed threatened species. The piping plover is a migratory shore bird that also is protected under the Migratory Bird Treaty Act. Piping plovers migrate to the Florida coast in September and are found through March (USFWS 1995). Foraging areas include intertidal beaches, mudflats, sandflats, lagoons, and salt marshes, where they feed on invertebrates such as marine worms, insect larvae, crustaceans, and mollusks. Although the piping plover overwinters in South Florida, there are no records of the species in the project area.

3.9.6 Least Tern

The least tern (*Sterna antillarum*) is a small member of the gull family (Laridae). It is listed by the State of Florida as a threatened species (FFWCC 1997) and is protected Federally under the Migratory Bird Treaty Act. Least terns breed along the east coast of the United States from Maine to Florida (AOU 1998) with the Florida populations returning each year in April. The breeding season lasts through the summer. Least terns traditionally choose open sandy substrates to form breeding colonies. Least terns forage along coastal areas feeding on small fishes, as well as some crustaceans and insects. Although the species is found in South Florida, there are no records of the species occurring within the project area.

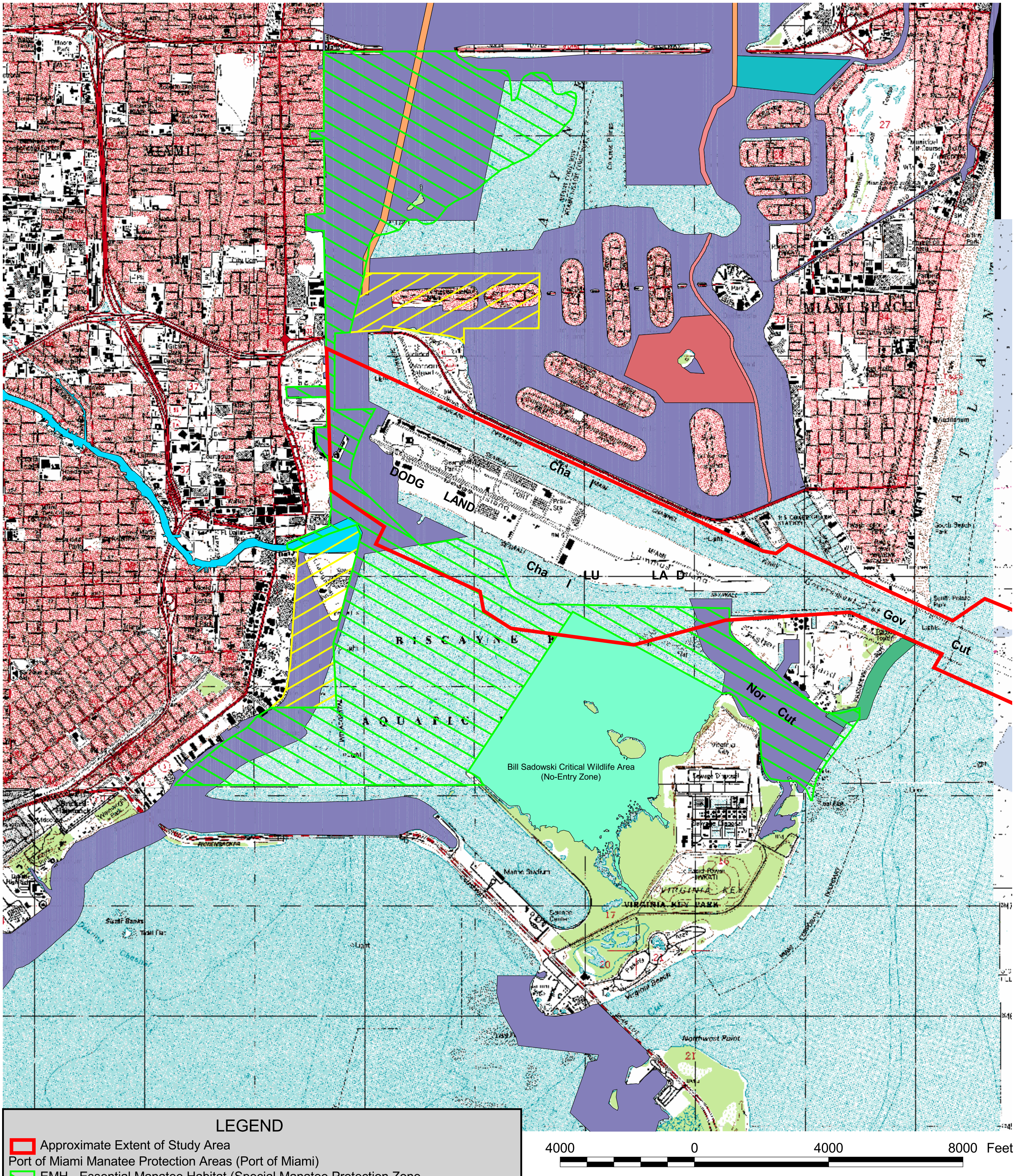
3.10 Other Areas of Special Concern

3.10.1 Manatee Protection Areas

Fisherman's Channel of the Port and its vicinity have been designated as essential manatee habitat under the 1995 Miami-Dade County Manatee Protection Plan (DERM 1995). Three manatee protection zones designated by DERM (Figure 8) are located in the vicinity of the Port. A Miami-Dade County designated Manatee Protection Zone (DCMPZ) Limited Marine Construction Area is located along the western portion of the Venetian Causeway, and an Essential Manatee Habitat designated area is located south and west of Dodge Island and Lummus Island which extends into the Port boundary. The existing BSCWA has also been designated as a No-Entry Manatee Protection Zone. Additionally, all of the waters in Miami-Dade County were designated critical habitat for the manatee under the ESA in 1976 (50 CFR 17.95(a)).

3.10.2 Bill Sadowski Critical Wildlife Area

Located south of the Port, BSCWA was established in 1990 by the Florida Game and Fresh Water Fish Commission (now called the Florida Fish and Wildlife Conservation Commission). This area of about 700 acres was designated to protect the shallow submerged seagrass and hardbottom habitats, intertidal mudflats, and coastal mangrove wetlands in the Biscayne Bay area west of Virginia Key (Figure 8). When first established, the area was protected primarily as a refuge for shorebirds and wading birds, but the boundary was later expanded to include important manatee habitat including calving grounds. Buoys mark the BSCWA boundary on-site and the area is closed to boating year-round.



LEGEND

- Approximate Extent of Study Area
- Port of Miami Manatee Protection Areas (Port of Miami)
  - EMH - Essential Manatee Habitat (Special Manatee Protection Zone
  - MDCMPZ - Dade County Manatee Protection Zone (Limited Marine Construction
- Dade County Manatee Protection Zones (DERM)
  - NO ENTRY
  - NO ENTRY NOV 15 THROUGH APR 30, IDLE SPEED REMAINDER OF YEAR
  - MOTOR BOAT EXCLUSION
  - IDLE SPEED
  - SLOW SPEED
  - SLOW NOV 15 - APR 30; 30 MPH REMAINDER OF THE YEAR
  - SLOW NOV 15 - APR 30; 35 MPH REMAINDER OF THE YEAR
  - 30 MPH
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3.10.3 Biscayne Bay Aquatic Preserve

The Port is located within the Biscayne Bay Aquatic Preserve. The preserve, which includes all of the waters of Biscayne Bay south to Biscayne National Park, was established in 1980 under Ch. 18-18, F.A.C. and is considered to be State-Owned Submerged Land under the jurisdictional authority of FDEP. All aquatic preserves in Florida are designated OFW. Authorized channels within the Port are excluded from the aquatic preserve due to their status as Federal navigation channels. New construction or other marine activities cannot result in a degradation of water quality outside of specially designated mixing zones (Miami-Dade County 1999c).

3.10.4 Biscayne National Park

The northernmost boundary of the Biscayne National Park lies approximately seven miles south of the Port and covers the widest part of Biscayne Bay down to its southern limit where it meets Card Sound.

3.11 Air Quality

Miami-Dade County is classified by FDEP as an attainment/maintenance area for the pollutant ozone. Ambient air quality data is also collected for four additional pollutants (carbon monoxide, nitrogen dioxide, particulate matter and sulfur dioxide) in Miami-Dade County. Air quality along the Miami-Dade County coastline is relatively good due to the presence of either on or off shore breezes. Ozone levels are slightly higher than ambient air quality standards (FDEP 1999).

FDEP does not regulate marine or mobile emission sources (dredge and construction equipment) within Miami-Dade County.

3.12 Noise

The urban setting of the Port produces noise not necessarily related to the operation of the Port. Sources of noise within the boundaries of the Port are related to the transportation trucks associated with the movement of containerized cargo and private vessels. The Port is located within the flight path of air traffic from Miami International Airport, and additional noise sources include automobiles and trucks associated with the major highways near the Port.

There is little to no noise produced as a result of vessel traffic except for the engine noise associated with vessel transit and tug operations. Port tariff restricts the blowing of whistles and horns by vessels while in Port and the only intermittent whistle blowing are signals between tugs while assisting vessels in their movement within the Port.

3.13 Utilities

Eight underwater lines consisting of four FP&L electric cables, three Miami-Dade County water and sewer lines, and one Bellsouth line are present within or adjacent to the project area (Figure 9). In addition, a wastewater treatment facility is located on Virginia Key, and an existing force main crosses Biscayne Bay from Virginia Key. The abandoned force main that was replaced also crosses Biscayne Bay from Virginia Key to the mainland.

The Miami-Dade Water and Sewer Department (WASD) owns a force sewer main in a submarine crossing within the project area leading from Miami Beach to its Fisher Island treatment plant. The crossing consists of a 54-inch ductile iron pipe running under the channel with top of pipe elevation at elevation –50 feet.

Additionally, WASD also owns a water main in the submarine crossing leading from Fisher Island to Lummus Island. This crossing consists of a 20-inch ductile iron pipe running under the channel with top of pipe elevation at elevation –53.8 feet.

FP&L owns two transmission lines in a submarine crossing leading from its Fisher Island plant to Lummus Island. The crossing consists of one 69 kV circuit and one 138 kV circuit each inside 24-inch pipe conduits with top of pipe elevation at elevation –45.8 feet and -45.6 feet Local Mean Low Water (LMLW).

3.14 Hazardous, Toxic, and Radioactive Materials

There are no hazardous, toxic, or radioactive materials located within the Port study area. The sediments within the Port channels and turning basins have been extensively tested and analyzed by Federal agencies. After each testing event, the USACE has determined, and the EPA has concurred, that sediments were free of objectionable levels of contaminants and bioassay results were completely satisfactory. The testing criteria used by these two agencies is as rigorous and conservative as any environmental testing required in the United States, surpassing criteria for upland disposal of sediments.

Sediment tests were performed at 23 different locations at the Port. The tests have included chemical analysis of sediment and sediment elutriates, liquid phase bioassays for three organisms and solid phase bioassays for two organisms and bioaccumulation impacts for two additional organisms.

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LEGEND

Existing Channel Limits

Utility Lines and Mains

- FP&L 15KV Feeder Cables
- FP&L 69 KV Transmission Cable
- FP&L 138 KV Transmission Cable
- FP&L 69 KV and 138 KV Transmission Cables
- WASD Water Main
- Miami-Dade WASD Water Main
- WASD 54" Sewer Force Main
- Force Main

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Channels and turning basins at the Port have been specifically tested for contaminants on four occasions in the last eight years. Results of all four testing events were reviewed by environmental experts at the EPA and the USACE, as follows:

- In 1992 the USACE conducted a chemical analysis of sediment, elutriates of sediments, bioassays, and bioaccumulation studies for 12 stations in the Port. The USACE determined, and the EPA concurred, that samples were found to be "free of objectionable levels of contaminants and bioassay results were completely satisfactory" (USACE 1997).

- In 1998 the USACE tested eight additional locations in the Port (PPB 1998). The USACE determined, with EPA concurrence, that materials in and adjacent to the Port remained uncontaminated. The testing found almost no difference between the quality of the Port's sediments compared to a clean "reference sample". In fact, survivorship of organisms in elutriate bioassays was found to be same as, or better than, survivorship of organisms in the control sediment in many of the tests.

- In 1998 the Port, in conjunction with the USACE, tested three additional locations in non-Federal portions of the channel. The USACE and EPA analyzed the results and determined that the materials were uncontaminated.

- In 2002, the USACE tested 14 locations in the Port channels. The USACE determined that materials were uncontaminated. EPA is the process of completing their review of the USACE determination, but all indications are that EPA will concur that the sediments are suitable for ocean disposal.

All sediments in Port channels are approved by the EPA and USACE for disposal at the ODMDS. This approval is based on a study of all-available sediment testing, including data from 1995 testing throughout Biscayne Bay conducted by National Oceanic and Atmospheric Administrative (NOAA). The NOAA data (NOAA 1999), which examined a smaller set of sediment quality parameters (for example only one bioassay was conducted instead of the three in the Port's sampling), found that approximately 70 percent of Port sediments had "no" or "slight" toxicity, and less than 6 percent had elevated, or "high" levels of toxicity. Because measurements of toxicity are relative (i.e. compared to reference samples, not set standards), even the few "high" toxicity measurements in the NOAA study do not demonstrate any environmentally significant contamination. Further, the NOAA study specifically states that it is "not intended to focus upon any potential discharger or other source of toxicants, or to provide evidence to be used to identify or regulate any source of pollution."

Port's channels are "Clean" for the following reasons:

- Port channels, when deepened, require minimal maintenance dredging due to the fact that fine sediments (which are generally associated with contaminants) tend not to settle in the channels due to the strong hydraulic currents in the channels.

- The Port has a low potential for on-site contamination: the Port handles primarily containerized cargo and has no facilities for large-scale storage or handling of hazardous or toxic materials.

- The Port's channels have been regularly deepened into environmentally unimpacted rock. Previous deepening projects removed all surface sediments (where contaminants might accumulate) and any potential historic contamination that might have accumulated in channel bottoms.

3.15 Economic Factors

The Port is one of the nation's most important ports. It handles more multi-day cruise passengers than any other port in the world. It is also Florida's largest container Port and it is the tenth biggest container Port in the United States.

Cargo: In fiscal year 2001, the volume of cargo moving through the Port was 8.2 million tons or approximately 955,671 twenty-foot equivalent units (TEU's). This is a 6 percent increase over 2000 volumes of 7,804,946 million tons. The year for which the latest data is available and incidentally the only year the Port cargo trade declined, containers moving through the Port represented approximately 3 percent of the nation's waterborne container volume and 7 percent of volume traded by the Atlantic ports. It is expected that Miami's national role increased significantly in the last two years, due to its significant increase in cargo tonnage.

The Port's cargo volume growth has been exponential over the last ten years, more than doubling between 1990 and 2001 (Table 6).

Table 6 General Cargo Tonnage, Port of Miami 1990-2001

Fiscal Year	Actual General Cargo	
	Total Tonnage	Percent Change
1990	3,590,937	12.0%
1991	3,882,284	8.1%
1992	4,596,481	18.4%
1993	5,198,292	13.1%
1994	5,574,252	7.2%
1995	5,841,212	4.8%
1996	6,002,744	0.3%
1997	6,735,388	15.0%
1998	7,056,664	4.8%
1999	6,930,372	-1.8%
2000	7,804,946	13.0%
2001	8,247,004	5.7%

Sources: 2001 Port of Miami Master Plan and the Miami-Dade County Seaport Department

The Port offers the greatest frequency of cargo service, with the largest number of shipping lines, calling at the most destinations, in the world. The Port has more than 35 shipping lines calling on over 100 countries and over 254 ports. Of these, 26 carriers serve 33 countries and 101 ports in Latin America and the Caribbean. While trade with Latin America has been the Port's mainstay over the last decade, trade with the Far East and Europe is growing, and last year accounted for 35 percent of the Port's gross tonnage (Table 7).

Table 7 Import and Export Tonnage by Region FY 2001

Region	Import Tonnage	% of Total	Export Tonnage	% of Total	Total Trade	% of Total
Caribbean	339,209	8.09%	913,766	23.99%	1,272,975	15.44%
Central America & Mexico	799,361	18.01%	881,567	23.14%	1,680,928	20.38%
Europe	1,436,240	32.36%	381,466	10.02%	1,817,706	22.04%
Far East, Asia, Pacific	622,649	14.03%	331,514	8.70%	954,163	11.57%
Middle East, SW Asia, Africa	49,566	1.12%	13,415	0.35%	62,981	0.76%
North America	241,358	5.44%	97,904	2.57%	339,262	4.12%
South America	929,623	20.95%	1,189,366	31.23%	2,118,989	25.69%

Source: Miami-Dade County Seaport Department 2001

Cruise: In addition to its strength as a cargo port, the Port is also the largest multi-day cruise passenger homeport in the world. Nineteen-cruise ships homeport in Miami, handling nearly 3.4 million passengers in 2001, and forming the mainstay of the North American cruise industry.

The Economic Region: The Port's success is linked in part to its geographic location. Miami-Dade County is the Western Hemisphere's principal hub for international trade with the Caribbean, Latin America, Europe, and Asia. Over half of Miami-Dade County's populace is Hispanic, with roots in Latin America and the Caribbean - the Port's strongest trading partners. Miami-Dade County is also a significant consumer base and the 29th largest metro-area in the world by gross domestic product. The Port's link to important trading and cruise routes, as well as the strength and characteristics of its large and growing hinterland, have positioned the Port as a top performer, and will continue to drive the Port's growth as long as the infrastructure to support marine transportation is in place.

Supporting Infrastructure: Deep-water channels and berths support commerce at the Port, cargo cranes and cruise terminals, and intermodal connections from the Port island to Gulf Stream shipping lanes. The Port's principal shipping channels and turning basins are shown in Figure 10**.** These waterways provide access to berthing areas at the Port, as well as to the Miami

River cargo operations and the ICWW. The Port's berths, RO/RO ramps, 10 gantry cranes and other associated yard equipment, staging and storage areas, transit sheds, and marshalling yards are within three and one-half nautical miles of ocean shipping lanes and less than one-mile from interstate highway connections. Existing channel information is shown in Table 8; existing berth information is shown in Table 9.

Table 8 Existing Channel and Turning Basin Specifics

Type	Name	Width/Radius (feet)	Depth (feet NGVD)	Length (nautical miles)
Channels	Entrance Channel (Government Cut)	500[1]	-44.0	21.50
	Bar Cut	500[1]	-44.0	0.66
	Government Cut	400-500	-42.0/-44.0	0.66
	Main Channel	400/900[2]	-36.5	2.44
	Fisherman's Channel	500	-35.0 to -42.0	2.50
Turning Basins	Fisher Island Turning Basin	r=1,000	-42.0	NA
	Main Channel Turning Basin	r=1,600	-36.0	NA
	Lummus Island Turning Basin	r=1,600	-42.0	NA
	Dodge Island Turning Basin	r=900	-32.0/34.0	NA

[1]At the junction of Entrance Channel and Bar Cut, where a turning movement of 35 degrees is required, a 0.55-nautical mile stretch of the channel has been widened to 600 feet.
[2]The 900-foot width occurs along Dodge Island.

Source: Miami-Dade County Seaport Department 1999

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Table 9 Existing Berth Inventory

Berth Number	Length (feet)	Depth (feet)	Berth Usage
Terminals 6/7	750	-32.0	Cruise, Ro/Ro
Terminals 1-5 & 10 (Bays 1-25¾)	3,220	-36.0	Cruise
Bays 25-38	1,600	-36.0	Cruise, Cargo
Terminals 8/9 (Bays 38-45)	1,680	-36.0	Cruise
Bays 45-55	1,200	-36.0	Cruise, Cargo, RO/RO
Bay 55W (RO/RO, LO/LO)	900	-36.0	RO/RO, LO/LO
Bay 59W (RO/RO, LO/LO)	550	-32.0	RO/RO, LO/LO
Bay 65W (RO/RO, LO/LO)	690	-32.0	RO/RO, LO/LO
Gantry Crane Berths 99-130.5	4,975	-28 – -42	LO/LO
Bays 144-148	600	-25.0	RO/RO
Bay 154 (RO/RO, LO/LO)	670	-25.0	RO/RO, LO/LO
Bay 155 (RO/RO, LO/LO)	550	-25.0	RO/RO, LO/LO
Bays 165-177 (171 and 172 RO/RO, LO/LO)	1,450	-25.0	Cargo, RO/RO, LO/LO
Bays 165-177	1,250	-31.0	Cargo, RO/RO LO/LO
Terminal 12/14 (Bays 187-195)	1,000	-28.0	Cruise
Bays 183-187	450	-25.0	Cruise, Cargo
"RO/RO" refers to cargo that is rolled on and rolled off a ship on a chassis; "LO/LO" refers to cargo that is lifted on and off a ship by a crane.			

Source: Miami-Dade County Seaport Department 2001

Future Growth: Future growth in cargo business at the Port is dependent in large part on the Port's ability to accommodate container ships. The number and size of new container ships delivered or on order from shipyards increased significantly during the past decade. As of November 1, 1998, an additional 419 container ships were on order, which will add capacity of 712,142 TEUs to the 5.9 million TEUs currently in service.

Container ship capacities and dimensions have increased substantially since the 1970's and 1980's. Principal deep-sea shipping routes to and from Asia, Europe, and the United States are currently serviced through use of Panamax (3,000 TEUs and over) and Post-Panamax (4,000 TEUs and over) vessels. First- and second-generation vessels, once the mainstay of the container shipping industry, today operate as feeder vessels from larger, regional hubs to smaller ports. Shipping lines are planning the future development of even larger container vessels (Post-Panamax Plus), which will be able to transport between 6,000 and 8,000 TEUs. The drafts of modern-day vessels are also significantly deeper than in the past. Modern container ships, on average, require drafts of between 30 and 35 feet. Some of the larger container ships require even deeper drafts, ranging from 40 to 45 feet. These larger ships want to call on the Port, but have been unable to access berths due to channel depth constraints.

Economic Impact: Cargo and cruise operations at the Port generate large and growing economic benefits for Miami-Dade County and the South Florida region. Port revenues in 2000 were up 12 percent from 1999, and have increased 37 percent over the last five years that data are available (Table 10). The total economic impact of Port operations on the nation is estimated at more than $8 billion per year. More than 45,000 jobs are directly or indirectly attributable to Port operations. Jobs created by Port and trade activity tend to be good jobs: they pay significantly more than other job sectors in the local economy, have better long-term opportunities for employees and offer better training programs (particularly for minorities). In the year 2000, Port related jobs have estimated average annual wages of $37,418. In Miami-Dade County, where unemployment is higher than the state or the national average, and over a quarter of the state's poor reside, these good jobs are particularly important.

Table 10 Port of Miami Annual Gross Revenue FY 1996-2001

Year	Total	% Change
1996	$53,110,000	1%
1997	$60,639,000	7%
1998	$67,751,000	12%
1999	$64,550,000	-5%
2000	$72,539,000	12%
2001	$76,169,000	5%

The Port has strict limitations on bulk cargo products and is a general cargo port. Primary cargoes include marble, clay, cement, tile, bricks, and concrete; fresh fruits and vegetables; beverages; apparel and textiles; paper and paper products; machinery and equipment; iron, steel, and other metal products; and lumber and wood products. These goods arrive and depart the Port primarily in containers and trailers.

Current and Future Challenges: The Port is only as strong as its weakest intermodal link. For cargo trade, the limiting factor on capacity appears to be navigation - the ability for mega-cargo ships (like the Regina Maersk) to access Port-berthing areas. The Port is increasingly faced with international competition from cargo hubs with these depths. For example, the Freeport Container Port, which officially opened in July of 1997, features 60-ton gantry cranes, a 47-foot-deep harbor, low labor costs, and ample land area for expansion.

The shift toward consolidation of the waterborne cargo shipping industry will continue to distribute a larger proportion of worldwide-containerized cargo through a small number of operators and through a smaller number of strategic hubs or “regional megaport facilities." As these port operations reach a critical mass, they will attract an expanding array of the services (i.e., carriers, freight forwarders, and intermodal connections) required making them even more flexible and profitable. However, if a port is unable to meet the navigational needs of its users, a contraction of the business will occur instead.

Cargo at the Port moves through one of three terminal operators (primary cargo businesses): POMTOC, Maersk, and Seaboard. The loss of any single operator would directly result in the

loss of between 20 percent to 52 percent of the port's cargo business. Further loss would occur as synergies between remaining operators begin to decline.

3.16 Land Use

The Port is the primary water-dependent land use in downtown Miami, occupying a prominent location immediately east of the Miami Central Business District (CBD). In addition, the Port functions as an important component of Miami-Dade County's Empowerment and Foreign Trade Zones. These zones are designed to harness the Port's international trade links to stimulate job creation and economic redevelopment in the many neighborhoods proximate to the port. The Port thus has important functional and commercial relationships with adjacent urban areas (Miami-Dade County 1999c).

The pattern of land uses surrounding the Port is characterized as a mixture of low, medium, and high-density residential, commercial, office, and park/recreation uses. Specific land uses found to the north of the Port's Main Channel include the MacArthur Causeway (I-395/A1A), park/recreation and commercial uses at Watson Island, the Terminal Island industrial area, and the USCG Base at Causeway Island. Low-density residential uses are found beyond the MacArthur Causeway on Palm, Hibiscus, and Star Islands. Medium- and high-density residential, park/recreation, commercial, and institutional land uses are found to the east of the Port on Fisher Island and the southern portion of the City of Miami Beach. Approximately one-half mile south of the Port, across Biscayne Bay, is Virginia Key. Land uses there include park/recreation, environmentally protected areas, and institutional and public facilities including the Miami-Dade County Virginia Key Wastewater Treatment Plant. Miami's CBD is found to the west of the Port. Land uses include mixed commercial and office, transportation, park/recreation (American Airlines Arena and Bayfront Park), medium-high-density residential, and industrial.

The Port has complex and multi-faceted connections and relationships with Miami-Dade County intermodal facilities such as the MIA, the FEC Hialeah Intermodal Facility, and the West Miami-Dade trade-related, freight forwarding and consolidation warehouses. The Port also utilizes the local, regional, and inter-regional transportation network components consisting of roads, railway lines, and channels to facilitate the efficient movement of goods and passengers.

3.17 Recreation

The Port is a working Port conducting operations on a twenty-four hour basis. It has not been designed to accommodate recreational opportunities for the general public because of attendant safety and security consideration, particularly for cargo operations. For this reason, public access points to the Port shoreline and public access facilities providing recreational opportunities such as roads with scenic overlooks, marinas, boat ramps and public docks are limited (Miami-Dade County 1999). However, recreational boating and other water-dependent activities are commonly seen in Biscayne Bay and surrounding waters.

3.18 Aesthetics

The Port is located in Biscayne Bay, a shallow salt water sound on the Atlantic coast, near the southern end of the Florida peninsula. The City of Miami is situated on the western shore of Biscayne Bay. Miami Beach, Fisher Island, and Virginia Key are located northwest and northeast of the Port. Typical skyline associated with the Port includes light industrial sites, large cargo ships, cranes, and other facilities associated with Port infrastructure.

3.19 Cultural Resources

Biscayne Bay is frequently mentioned in historic literature and significant historic properties may be located in the Port vicinity. Shipwrecks occurred within Biscayne Bay, although exact locations of these wrecks are not known. To determine if any potentially historic or cultural resources exist within the specific project area, archival research and consultation with SHPO was conducted. In addition, a remote sensing survey was completed by the USACE (Watts 2002). Neither the archival review nor the remote sensing survey identified any historical or cultural resources within the study area. If the USACE constructs its reef mitigation sites in localities currently not permitted by DERM, then the USACE will coordinate the placement of this material with SHPO.

4.0 ENVIRONMENTAL CONSEQUENCES

This section describes the impacts associated with the proposed alternatives considered for widening and deepening of the Port. NEPA defines direct impacts as those effects caused by the action and occur at the same time and place. Indirect impacts are defined as those that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable [CEQ Regulation Section 1508.18; Section 1508.8(a) & (b)]. Figures 11, 12, and 13 depict the direct and indirect impacts to natural resources associated with both Alternative 1 and Alternative 2 (Recommended Plan).

4.1 Coastal Environment

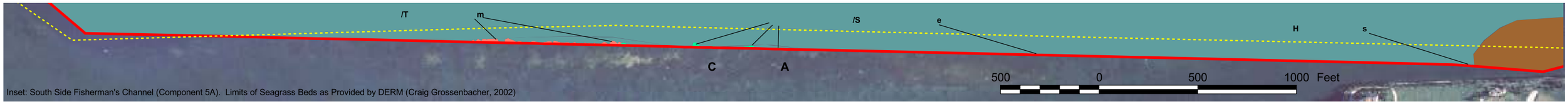
4.1.1 No-Action Alternative

No impacts would occur to the coastal environment with the No-Action Alternative.

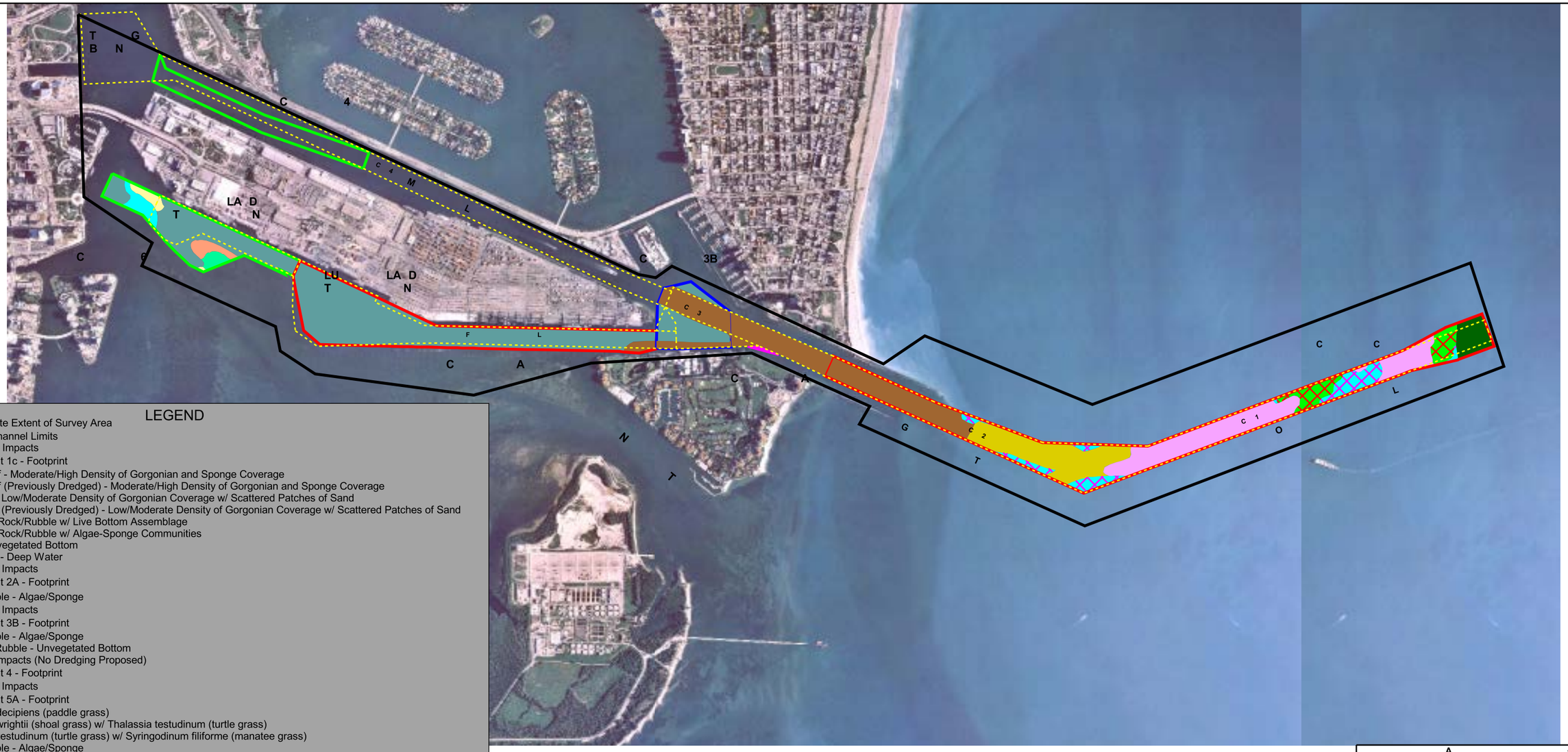
4.1.2 Alternative 1

The tidal ebb and flood velocity comparisons yield maximum differences between the existing conditions and Alternative 1 on the order of 0.5 ft/sec. These differences occur primarily in Government Cut, Fisherman's Channel, and Dodge Island Cut. The residual velocity difference comparisons show that a weak residual vortex appears in both the Fisher Island Turning Basin and proposed Dodge Island Turning Basins. These vortices have velocities of less than 0.2 ft/sec. The time-history analysis indicates that the channel deepening tends to divert some tidal flow from the Main Channel to Fisherman's Channel. Also, a tidal amplitude attenuation and a phase lag of approximately two hours are observed for the plan condition west of Dodge Island. There is no observable impact on the Atlantic Ocean shoreline tidal velocities in any of the simulations.

Subtle differences in salinity were also identified between existing conditions and Alternative 1. These changes are close to detection limits and confidence levels of present field data collection capability and associated model assessments. The salinity comparisons yielded maximum salinity differences on the order of 1.0 part per thousand (ppt). The maximum differences occur just west of Dodge Island Cut, with differences observable in Fisherman's Channel, the western end of the Main Channel, and to the northwest of the Port. The differences observed west of Dodge Island may be influenced by the attenuated tidal amplitude and tidal phase lag induced by the channel deepening. The influence of channel deepening on the salinity north of the Port appears to be most pronounced during neap tides (CHL 2001). Based on these results, the USACE has determined that the modeled changes in the coastal environment are insignificant and no impacts would occur from Alternative 1.



Inset: South Side Fisherman's Channel (Component 5A). Limits of Seagrass Beds as Provided by DERM (Craig Grossenbacher, 2002)



LEGEND

- Approximate Extent of Survey Area
- Existing Channel Limits

Component 1C - Impacts
- Component 1c - Footprint
- High Relief - Moderate/High Density of Gorgonian and Sponge Coverage
- High Relief (Previously Dredged) - Moderate/High Density of Gorgonian and Sponge Coverage
- Low Relief Low/Moderate Density of Gorgonian Coverage w/ Scattered Patches of Sand
- Low Relief (Previously Dredged) - Low/Moderate Density of Gorgonian Coverage w/ Scattered Patches of Sand
- Scattered Rock/Rubble w/ Live Bottom Assemblage
- Scattered Rock/Rubble w/ Algae-Sponge Communities
- Sand - Unvegetated Bottom
- No Impact - Deep Water

Component 2A - Impacts
- Component 2A - Footprint
- Rock/Rubble - Algae/Sponge

Component 3B - Impacts
- Component 3B - Footprint
- Rock/Rubble - Algae/Sponge
- Sand/Silt/Rubble - Unvegetated Bottom

Component 4 - Impacts (No Dredging Proposed)
- Component 4 - Footprint

Component 5A - Impacts
- Component 5A - Footprint
- Halophila decipiens (paddle grass)
- Halophila wrightii (shoal grass) w/ Thalassia testudinum (turtle grass)
- Thalassia testudinum (turtle grass) w/ Syringodinum filiforme (manatee grass)
- Rock/Rubble - Algae/Sponge
- Sand/Silt/Rubble - Unvegetated Bottom

Component 6 - Impacts
- Component 6 - Footprint
- Halophila decipiens (paddle grass)
- Halophila wrightii (shoal grass) w/ Halophila decipiens (paddle grass)
- Halophila wrightii (shoal grass) w/ Thalassia testudinum (turtle grass)
- Thalassia testudinum (turtle grass) w/ Syringodinum filiforme (manatee grass)
- Sand/Silt/Rubble - Unvegetated Bottom

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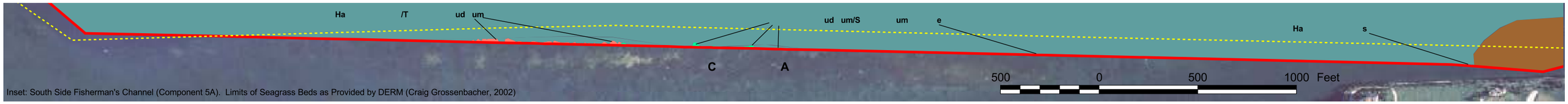
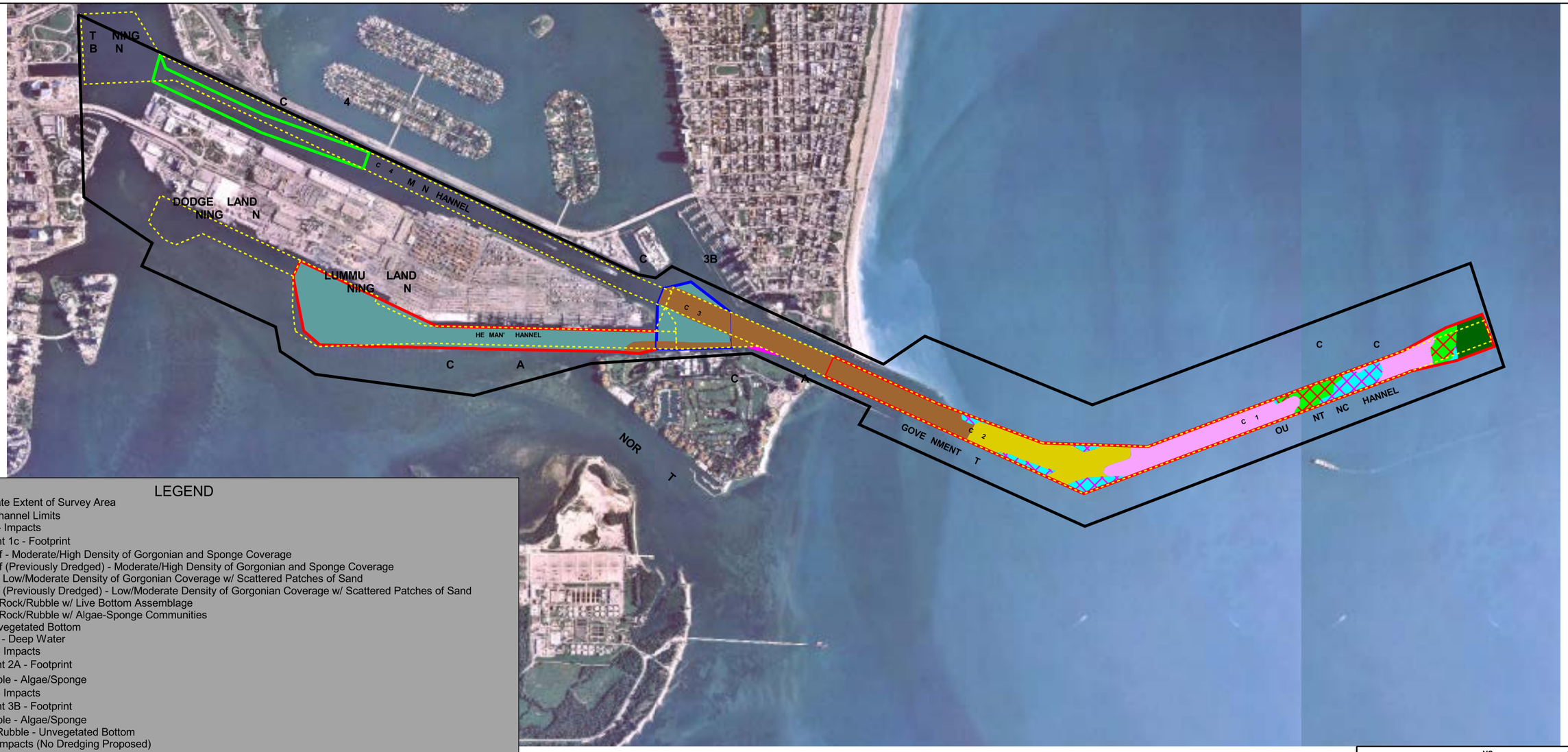


Inset: South Side Fisherman's Channel (Component 5A). Limits of Seagrass Beds as Provided by DERM (Craig Grossenbacher, 2002)



LEGEND

- Approximate Extent of Survey Area
- Existing Channel Limits

Component 1C - Impacts
- Component 1c - Footprint
- High Relief - Moderate/High Density of Gorgonian and Sponge Coverage
- High Relief (Previously Dredged) - Moderate/High Density of Gorgonian and Sponge Coverage
- Low Relief Low/Moderate Density of Gorgonian Coverage w/ Scattered Patches of Sand
- Low Relief (Previously Dredged) - Low/Moderate Density of Gorgonian Coverage w/ Scattered Patches of Sand
- Scattered Rock/Rubble w/ Live Bottom Assemblage
- Scattered Rock/Rubble w/ Algae-Sponge Communities
- Sand - Unvegetated Bottom
- No Impact - Deep Water

Component 2A - Impacts
- Component 2A - Footprint
- Rock/Rubble - Algae/Sponge

Component 3B - Impacts
- Component 3B - Footprint
- Rock/Rubble - Algae/Sponge
- Sand/Silt/Rubble - Unvegetated Bottom

Component 4 - Impacts (No Dredging Proposed)
- Component 4 - Footprint

Component 5A - Impacts
- Component 5A - Footprint
- Halophila decipiens (paddle grass)
- Halophila wrightii (shoal grass) w/ Thalassia testudinum (turtle grass)
- Thalassia testudinum (turtle grass) w/ Syringodinum filiforme (manatee grass)
- Rock/Rubble - Algae/Sponge
- Sand/Silt/Rubble - Unvegetated Bottom

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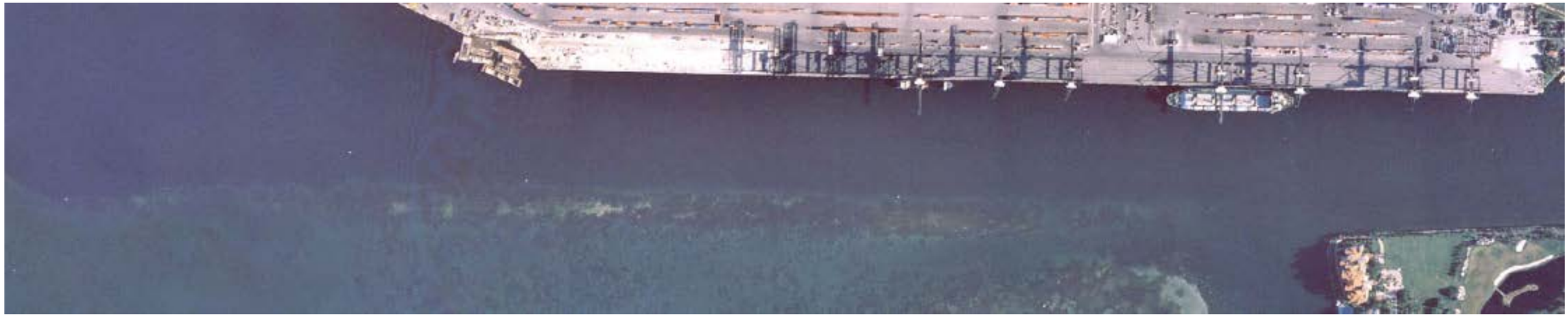

Component 5A Potential Seagrass Indirect Impacts Due to Side Slope Equilibration, Assuming 1:7 Slope

Component 6 Potential Seagrass Indirect Impacts Due to Side Slope Equilibration, Assuming 1:7 Slope

LEGEND

Existing Channel Limits

Component 5A - Indirect Impacts

- Component 5A - Footprint
- Halophila decipiens (paddle grass)
- Halophila wrightii (shoal grass) w/ Thalassia testudinum (turtle grass)
- Thalassia testudinum (turtle grass) w/ Syringodinum filiforme (manatee grass)

Component 6 - Indirect Impacts

- Component 6 - Footprint
- Halophila decipiens (paddle grass)
- Halophila wrightii (shoal grass) w/ Halophila decipiens (paddle grass)
- Halophila wrightii (shoal grass) w/ Thalassia testudinum (turtle grass)
- Thalassia testudinum (turtle grass) w/ Syringodinum filiforme (manatee grass)

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4.1.3 Alternative 2 (Recommended Plan)

The effects of Alternative 2 would be similar to the effects of Alternative 1. The maximum ebb and flood velocity comparisons yield maximum differences between the existing conditions and Alternative 2 on the order of 0.5 ft/sec. These differences occur primarily in Government Cut, Fisherman's Channel, and Dodge Island Cut. The residual velocity difference comparisons show that a weak residual vortex appears in the Fisher Island Turning Basin. These vortices have velocities of less than 0.2 ft/sec. The time-history analysis indicates that the channel deepening tends to divert some tidal flow from the Main Channel to Fisherman's channel. Also, a tidal amplitude attenuation and a phase lag of approximately two hours are observed for the plan condition west of Dodge Island. There is no observable impact on the Atlantic Ocean shoreline tidal velocities in any of the simulations.

Subtle differences in salinity were also identified between existing conditions and Alternative 2. These changes are close to detection limits and confidence levels of present field data collection capability and associated model assessments. The salinity comparisons yielded maximum salinity differences on the order of 1.0 ppt. The maximum differences occur just west of Dodge Island Cut, with differences observable in Fisherman's Channel, the western end of the Main Channel, and to the northwest of the Port. The differences observed west of Dodge Island may be influenced by the attenuated tidal amplitude and tidal phase lag induced by the channel deepening. The influence of channel deepening on the salinity north of the Port appears to be most pronounced during neap tides (CHL 2001). The natural salinity variability existing in Biscayne Bay far exceeds the predicted changes associated with the deepened channels. Freshwater discharge, tidal, and wind condition variations have far greater influence on the Bay salinity conditions then the deepened channel condition. Based on these results, the USACE has determined that the modeled changes in the coastal environment are insignificant and no impacts would occur from Alternative 2.

4.2 Geology and Sediments

4.2.1 No-Action Alternative

The No-Action Alternative would not have any direct impact on geology and sediments since no construction activities would occur.

4.2.2 Alternative 1

Alternative 1 would impact geology and sediments in the locations where excavation would occur. The majority of materials within the project area include interbedded layers of sand and rock with a minority of the material including silts, clays, and peat/organics. Rock would be

removed along some of the channel for widening, and rock may be encountered during channel deepening, as well. Sediments to be affected would be placed in the appropriate disposal site or mitigation area.

4.2.3 Alternative 2 (Recommended Plan)

Alternative 2 would impact geology and sediments in the locations where excavation would occur. The majority of materials within the project area include interbedded layers of sand and rock with a minority of the material including silts, clays, and peat/organics. Rock would be removed along some of the channel for widening, and rock may be encountered during channel deepening, as well. Sediments to be affected would be placed in the appropriate disposal site or mitigation area.

4.3 Water Quality

4.3.1 No-Action Alternative

The No-Action Alternative would not have any direct impact on water quality since no dredging or blasting would occur.

4.3.2 Alternative 1

Alternative 1 would impact water quality due to proposed construction activities. State Water Quality Certification would be obtained prior to construction and state water quality standards would be met during construction. Alternative 1 would result in temporary increases in turbidity where dredging is taking place and may cause increased turbidity at the point of discharge from the disposal sites. The State of Florida water quality regulations require that water quality standards not be violated during dredging operations. Various protective measures and monitoring programs would be conducted during construction to ensure compliance with state water quality standards. Should turbidity exceed state water quality standards during construction as determined by monitoring, the contractor would be required to cease operations until water quality standards are met.

Indirect impacts may result from implementation of Component 5A and Component 6. Based on sediment analysis, substrates along the southern margin of Fisherman's Channel and the Dodge Island Cut include fine materials (USACE 2001). Therefore, dredging would likely resuspend fine sediments into the water column. The strong tidal currents may redistribute suspended sediments to other areas that support submerged vegetation both inside and outside the study area. Possibly affected areas would include seagrass habitats immediately adjacent to Fisherman's Channel, as well as habitats inside the BSCWA, and possibly other areas of the Biscayne Bay Aquatic Preserve. Resuspended particulate matter may temporally decrease water

clarity in the above areas. Deposition of sediments on beds may have adverse effects. These effects include, but are not limited to, the temporary displacement of, and/or alteration of, fish, invertebrate, and epiphyte communities.

4.3.3 Alternative 2 (Recommended Plan)

Alternative 2 would impact water quality due to proposed construction activities. State Water Quality Certification would be obtained prior to construction and state water quality standards would be met during construction. Alternative 2 would result in temporary increases in turbidity where dredging is taking place and may cause increased turbidity at the point of discharge from the disposal sites. The State of Florida water quality regulations require that water quality standards not be violated during dredging operations. Various protective measures and monitoring programs would be conducted during construction to ensure compliance with state water quality standards. Should turbidity exceed state water quality standards during construction as determined by monitoring, the contractor would be required to cease operations until conditions return to normal.

Indirect impacts may result from implementation of Component 5A. Based on sediment analysis, substrates along the southern margin of Fisherman's Channel and the Dodge Island Cut comprise a considerable amount of fine materials (USACE 2001). Therefore, dredging would likely resuspend fine sediments into the water column. The strong tidal currents may redistribute suspended sediments to other areas both inside and outside the study area that support submerged vegetation. Possibly affected areas would include seagrass habitats immediately adjacent to Fisherman's Channel, as well as habitats inside the BSCWA, and possibly other areas of the Biscayne Bay Aquatic Preserve. Resuspended particulate matter may temporally decrease water clarity in the above areas. Deposition of sediments on beds may have adverse effects. These effects include, but are not limited to, the temporary displacement of, and/or alteration of, fish, invertebrate, and epiphyte communities.

4.4 Seagrass Communities

4.4.1 No-Action Alternative

The No-Action Alternative would not have any direct impact on seagrass communities since no dredging or blasting would occur.

4.4.2 Alternative 1

For three of the project components (1C, 2A, and 4), direct and/or indirect impacts to seagrass beds are not anticipated (Table 11). No impacts would occur due to Component 2A (widening

the channel at the intersection of Government Cut and Fisherman's Channel). Resources within 2,000 feet of the proposed dredge site for that component include an isolated *H. decipiens* bed (over 500 feet away), and a large mixed-species (*H. decipiens* and *H. wrightii*) bed (over 750 feet away). Since material to be dredged as a part of Component 2A principally comprises limestone, sandstone, and clean quartz sand (USACE 2001) transport and deposition of fine sand/ silt onto the nearby seagrass beds is not expected. Component 1C falls outside Biscayne Bay and inner channels and is not likely to result in any adverse direct or indirect impacts to seagrass. Component 4 does not involve any dredging activity, and would therefore not affect seagrass beds mapped during the 2000 survey (DC&A 2001).

Table 11 Dredging Impacts on Seagrass Habitat for Alternative 1

	Impact (ac)						
Habitat Type and Current Dredge Status	**Component**						
	1C	**2A**	**3B**	**4**	**5A**	**6**	**Total**
Seagrass- new direct impacts (side slope equilibration) to areas not previously dredged that exist outside proposed channel boundaries	0.0	0.0	**0.1**	0.0	**7.6**	**3.5**	**11.2**
Seagrass- new direct impacts, not previously dredged, inside proposed channel boundaries	0.0	0.0	0.0	0.0	**0.2**	**22.4**	**22.6**

Deepening/widening of the Fisher Island Turning Basin (Component 3B) would not result in the initial removal of seagrass communities but may include some secondary subsidence effects on adjacent seagrass habitats, particularly those immediately to the northeast (a large mixed-species bed of *H. decipiens* and *H. wrightii*) and southeast (an isolated *H. decipiens* bed associated with the littoral zone of Fisher Island) of the proposed dredging activity. No direct impacts are expected to occur as a result of Component 3B. Approximately 0.1 acre of indirect impact is expected due to side slope equilibration. Side slope impacts were estimated using the methodology described in Appendix G.

Direct impacts as a result of Components 5A and 6 would include the removal of seagrass habitat along Fisherman's Channel, Dodge Island Cut, Dodge Island Turning Basin, and Lummus Island Turning Basin during dredging activities. Dredging associated with deepening and widening would impact a total of 22.6 acres of seagrass habitat by removal of substrate, and an estimated additional loss of 11.2 acres due to side slope equilibration of adjacent substrate. Side slope impacts were estimated using the methodology described in Appendix G. Direct impacts would include the loss of 7.8 acres of *H. decipiens*, 4.7 acres of mixed *H. wrightii* and *H. decipiens*, 6.0 acres of mixed *H. wrightii* and *T. testudinum*, and 4.1 acres of mixed bed consisting of *T. testudinum* and *S. filiforme*. Indirect impact would include the loss of 2.1 acres of *H. decipiens*, 1.8 acres of mixed *H. decipiens* and *T. testudinum*, 6.3 acres of mixed *T. testudinum* and *S. filiforme*, and 0.5 acre of mixed *H. wrightii* and *H. decipiens*. The density and cover abundance values, generally an indication of habitat quality, for seagrass species ranged from low to moderate with *S. filiforme* having the highest mean abundance and density scores, and *T. testudinum* and *H. decipiens* having the lowest (Appendix E). Figure 13 shows the probable southern limit of subsidence for Component 5A.

Direct and indirect (side slope equilibration) impacts associated with the removal of these seagrass beds would include the loss of habitat and functional values attributable to submerged aquatic vegetation. The reduction of seagrass beds in the areas inside the proposed new channel and in areas immediately adjacent to dredging activities may result in the direct loss of forage habitat for manatees. This impact would be significant for Component 6, which includes several acres of seagrass removal from an area of frequent manatee occurrence (see Figure 7). Component 5A would have less impact because of the relative quality of the habitat and because of its location directly along the channel edge. Manatee sightings are much less frequent in this area. Because of direct loss of habitat of seagrass beds, impacts to resident and transient fish, and invertebrates may also result.

Since light penetration is a major factor limiting productivity of subtropical seagrasses (Fonseca et al. 1998), turbidity and sedimentation are expected to have indirect impacts where they occur over seagrasses. The seagrasses in Miami Harbor, especially adjacent to the Port, already experience a certain level of chronic turbidity and sedimentation due to erosion, daily outflow from the Miami River, and daily ship and tug activity. These sources are in addition to natural turbidity sources of runoff, and wind or tide-driven shifting of shallow sediments. Although the proposed dredging activity would need to comply with state water quality standards for turbidity, the additional turbidity and sedimentation would add to background sources already present at the Port. This is expected to place additional stress on adjacent seagrasses over the short-term.

Based upon field observations and assessment of historic aerial photography and past major dredging events, however, dredging is not expected to result in long-term negative impacts to seagrass beds outside the limits of the direct and indirect impacts discussed above. In addition, no seagrass habitat within the BSCWA south of Fisherman's Channel would be adversely affected.

4.4.3 Alternative 2 (Recommended Plan)

Alternative 2 includes all of the same components and impacts as listed in Alternative 1 except for Component No. 6 (Table 12). Exclusion of Component 6 significantly minimizes the direct impacts that would occur to areas along Fisherman’s Channel, especially those containing seagrass beds (Figures 12 and 13). Dredging associated with deepening and widening would directly impact a total of 0.2 acre of seagrass habitat by removal of substrate, and an estimated additional loss of 7.6 acres due to side slope equilibration of adjacent substrate. Side slope impacts were estimated using the methodology described in Appendix G. Direct impacts (0.20 acre) would include the loss of 0.01 acre of sparse *H. decipiens*, 0.14 acre of sparse mixed *H. wrightii* and *T. testudinum*, and 0.05 acre of sparse mixed *S. filiforme* and *T. testudinum*. Additional losses would include 0.5 acre of *H. decipiens*, 5.3 acres of mixed *T. testudinum* and *S. filifome*, and 1.8 acres of mixed *H. wrightii* and *T. testudinum*. Additional impacts other than the aforementioned side slope equilibration and sedimentation described for Alternative 1, are not anticipated. The density and cover abundance values for seagrass species, generally an indication of habitat quality, ranged from low to moderate, with *S. filiforme* having the highest mean

abundance and density scores, and *T. testudinum* and *H. decipiens* having the lowest (Appendix E).

Based upon field observations and assessment of historic aerial photography and past major dredging events, however, dredging is not expected to result in long-term negative impacts to seagrass beds outside the limits of the direct and indirect impacts discussed above. In addition, no seagrass habitat within the BSCWA south of Fisherman's Channel would be adversely affected.

Table 12 Dredging Impact on Seagrass Habitat for Alternative 2

	Impacts (ac)					
Habitat Type and Current Dredge Status	**Component**					
	1C	**2A**	**3B**	**4**	**5A**	**Total**
Seagrass- new direct impacts (side slope equilibration) to areas not previously dredged that exist outside proposed channel boundaries	0.0	0.0	**0.1**	0.0	**7.6**	**7.7**
Seagrass- new direct impacts, not previously dredged, inside proposed channel boundaries	0.0	0.0	0.0	0.0	**0.2**	**0.2**

4.5 Hardbottom and Reef Communities

4.5.1 No-Action Alternative

The No-Action Alternative would not result in any adverse direct impact on hardbottom and reef communities since no dredging or blasting would occur.

4.5.2 Alternative 1

Direct impacts to hardbottom and reef communities would occur as a result of the dredging process to deepen and widen channels within the Port (Figure 12). Areas that have been dredged previously would be affected. In total there would be 49.4 acres of impact to hardbottom and reef habitat within the existing channel, including 28.7 acres of low relief hardbottom/reef and 20.7 acres of high relief habitat (Table 13). Of the 49.4 acres of combined hardbottom/reef impacts, 46.1 acres are areas that have been previously dredged and recolonized.

Table 13 Dredging Impacts on Hardbottom and Reef Communities for Alternative 1

	Impacts (ac)						
Habitat Type and Current Dredge Status	**Component**						
	1C	**2A**	**3B**	**4**	**5A**	**6**	**Total**
Low relief hardbottom/reef- new impacts, not previously dredged	**0.6**	0.0	0.0	0.0	0.0	0.0	**0.6**
Low relief hardbottom/reef, previously dredged and recolonized	**28.1**	0.0	0.0	0.0	0.0	0.0	**28.1**
High relief hardbottom/reef- new impacts, not previously dredged	**2.7**	0.0	0.0	0.0	0.0	0.0	**2.7**
High relief hardbottom/reef, previously dredged and recolonized (ac)	**18.0**	0.0	0.0	0.0	0.0	0.0	**18.0**

New impacts would include only 0.6 acre of low relief hardbottom/reef and 2.7 acres of high relief hardbottom/reef. These habitats are located outside the present channel and have not been previously dredged. High relief hardbottom/reef is characterized by a vertical relief >3 feet and supports a diverse assemblage of soft corals and sponges. The low relief hardbottom/reef is <3 feet in profile and has minimal structure and a less diverse coral/sponge community than the high relief areas.

In addition, the proposed project would impact established hardground habitat on the limestone walls of the existing channel. Inshore channel walls may also function as hardgrounds, in particular the inshore wall habitat of Fisherman's Channel, which would be impacted with the proposed widening. All previously dredged areas including hardgrounds on channel walls are expected to recolonize rapidly with similar species assemblages after dredging.

Indirect impacts to dredging hardbottom/reef habitat may include temporary changes in adjacent habitats. In particular, hardbottom/reef habitats just outside the Entrance Channel and seaward to the Outer Entrance Channel may be affected. Potential indirect impacts may include the resuspension and deposition of sediments on nearby coral reef assemblages, although hard coral cover is typically <10 percent. This resuspension of sediments may also result in temporary periods of increased turbidity within the area. As previously stated, however, the majority of materials within the project area include interbedded layers of sand and rock that are not expected to generate significant turbidity on removal.

Other indirect effects include the displacement of fishes and invertebrates during dredge operations. Blasting impacts on finfish are addressed in Section 4.8. These effects would be short-term and not significantly adverse.

4.5.3 Alternative 2 (Recommended Plan)

Alternative 2 would have the same impacts to hardbottom/reef communities as Alternative 1 (Figure 12, Table 14), since all the affected resources are associated with Component 1C.

Table 14 Dredging Impacts on Hardbottom and Reef Communities for Alternative 2

	Impacts (ac)					
Habitat Type and Current Dredge Status	**Component**					
	1C	**2A**	**3B**	**4**	**5A**	**Total**
Low relief hardbottom/reef- new impacts, not previously dredged	**0.6**	0.0	0.0	0.0	0.0	**0.6**
Low relief hardbottom/reef, previously dredged and recolonized	**28.1**	0.0	0.0	0.0	0.0	**28.1**
High relief hardbottom/reef- new impacts, not previously dredged	**2.7**	0.0	0.0	0.0	0.0	**2.7**
High relief hardbottom/reef, previously dredged and recolonized	**18.0**	0.0	0.0	0.0	0.0	**18.0**

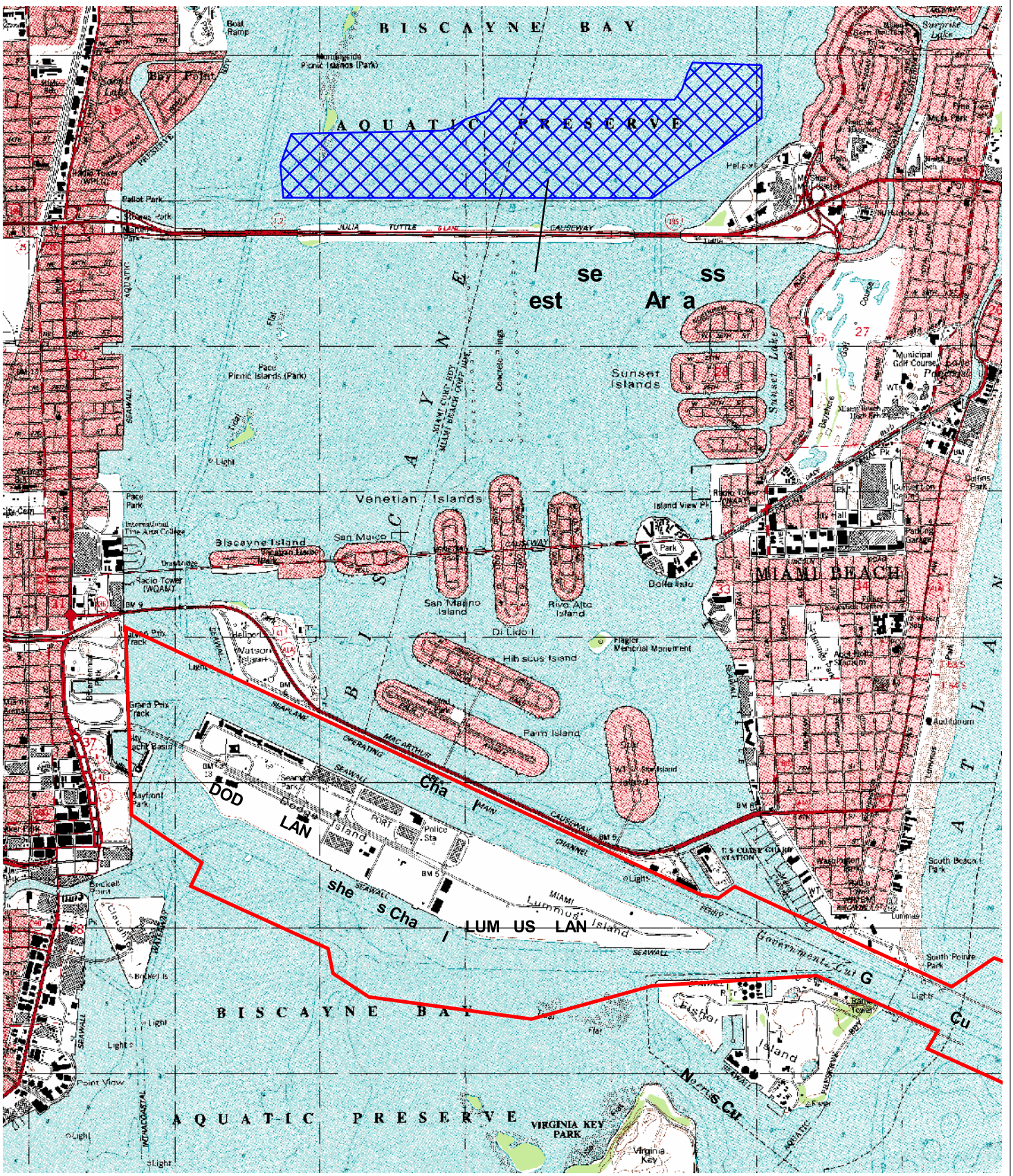
4.5.4 Cutterhead Dredge Impacts

If cutterhead dredging is used the construction method to deepen the Entrance Channel, additional direct impacts to both low relief and high relief hardbottom reefs would occur due to anchoring and cable systems for the cutterhead vessel. Figure 14 provides a worst-case scenario of potential hardbottom impacts with this construction method. The potential exists for up to 26.9 acres of low relief and 10.0 high relief hardbottom reefs to be impacted based on the maximum number of anchor positions and footprint of cable movement. However, as previously described in Section 2.7.1, implementation of an anchoring and vessel operation plan to effectively minimize anchor and cable impacts to hardbottom habitat would occur through the RFP process and would include incentives to encourage potential contractors to avoid reef impacts. The evaluation criteria in the RFP would consider the technical aspects of the contractor's proposal as the most significant factor. As a result, the vessel operational and anchoring plan that best avoids or reduces impacts to reefs would receive the highest evaluation and the incentives that follow. Measures such as the use of surge buoys to lift anchor cables and restricting anchor placement to minimize impacts would be important factors in determining the construction methodology. Since the construction method has not yet been determined, and since the actual impacts using this method are unknown, the USACE would conduct pre-construction and post-construction surveys to determine actual impacts and coordinate with the resource agencies on appropriate mitigation.

4.6 Unvegetated Bottom

4.6.1 No-Action Alternative

The No-Action Alternative would have no impact on unvegetated communities since no dredging or blasting would occur.



LEGEND

Approximate Extent of Study Area

Proposed Seagrass Restoration Area

3000 0 3000 6000 Feet

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4.6.2 Alternative 1

Unvegetated silt/sand/rubble and sand bottom habitats comprise a significant proportion of the total area proposed for dredging (Figure 11). In areas where these habitats comprise minor associates of other major habitat categories (such as seagrass beds, rock/rubble, or reef), substrata
were not categorized as unvegetated habitat during recent surveys (see DC&A 2001, Appendix E) unless the condition was clearly dominant. Wide expanses of this type of community in its natural state are found only in the area comprising Component 1C, but smaller tracts are also present adjacent to seagrass habitats along the south side of Fisherman's Channel and between the Lummus and Dodge Island Turning Basins. Direct impacts to unvegetated communities (due to dredging operations) in all three of these areas would mainly include impacts to benthic epifauna and infauna with the magnitude of impacts differing according to location. In total, there would be 68.2 acres of unvegetated habitat impacted during dredging under Component 1C, and the vast majority of this acreage comprises previously dredged substrate (66.9 acres). Benthic infaunal populations in these areas are expected to recolonize. The degree to which the substrate remains viable for benthos may depend on light attenuation relative to the additional eight feet of depth. Increased depth may not promote the growth of some macroalgae and epipsammic algae.

In comparison, impacts to unvegetated habitats within Component 3B would entail direct removal of 24.4 acres of unvegetated habitat, 19.1 acres of which has been dredged previously (Figure 11, Table 15).

Table 15 Dredging Impacts on Unvegetated Habitat for Alternative 1

	Impacts (ac)						
Habitat Type and Current Dredge Status	**Component**						
	1C	**2A**	**3B**	**4**	**5A**	**6**	**Total**
Unvegetated (i.e., silt/sand/rubble and sand bottom habitats without seagrasses)- new impacts, not previously dredged	**1.3**	0.0	**5.3**	0.0	**16.7**	**16.7**	**40.0**
Unvegetated (i.e., silt/sand/rubble and sand bottom habitats without seagrasses), previously dredged	**66.9**	0.0	**19.1**	0.0	**127.1**	**39.3**	**252.4**

The largest impact acreages in Alternative 1 to unvegetated sand/silt/rubble communities occur with Components 5A and 6, mainly within the previously dredged channel. Approximately 143.8 acres of the area proposed for dredging under Component 5A includes unvegetated bottom. Of this, 127.1 acres is from previous dredging activities, while an additional impact of 16.7 acres of unvegetated silt/sand/rubble habitat that has not been dredged previously is also required to complete this part of the project. Component 6 would comprise 56.0 additional acres of unvegetated sand/silt/rubble impacts, of which 39.3 acres is from previous dredging activities.

Impacts to benthic infaunal and epifaunal communities would be considered as relatively minimal when examined on a spatial scale. Infaunal communities in particular have very high reproductive potential and recruitment. Adjacent areas that have not been impacted would most likely be the primary source of recruitment to the impacted areas. Previous studies have shown a relatively short recovery time for infaunal communities following dredging (Taylor et al. 1973; Culter and Mahadevan 1982; Saloman et al. 1982). Succession of post-dredging infaunal communities should begin within days following construction. This initial settlement usually consists of pelagic larval recruits settling within the impact area. Later recruitment from adjacent non-impacted areas is more gradual, and involves less opportunistic species. Saloman et al. (1982) stated that communities would be close to pre-dredge conditions within one year and potentially as quickly as 8 to 9 months. Culter and Mahadevan (1982) found similar results and no long-term effects to benthic communities as a result of dredging activities. Based on these previous studies, infaunal communities would most likely be re-established within 1 to 2 years post-dredging.

4.6.3 Alternative 2 (Recommended Plan)

Impacts would be similar to the impacts described in Alternative 1. However, overall impacts to unvegetated communities would be decreased to 213.1 acres that had previously been dredged and 23.1 acres of new impacts (not previously dredged) (Figure 12, Table 16).

Table 16 Dredging Impacts on Unvegetated Habitat for Alternative 2

	Impacts (ac)					
Habitat Type and Current Dredge Status	**Component**					
	1C	**2A**	**3B**	**4**	**5A**	**Total**
Unvegetated (i.e., silt/sand/rubble and sand bottom habitats without seagrasses), new impacts, not previously dredged	**1.3**	0.0	**5.3**	0.0	**16.7**	**23.3**
Unvegetated (i.e., silt/sand/rubble and sand bottom habitats without seagrasses), previously dredged	**66.9**	0.0	**19.1**	0.0	**127.1**	**213.1**

4.7 Rock/Rubble Communities

4.7.1 No-Action Alternative

The No-Action Alternative would not result any adverse direct impacts to rock/rubble communities since no dredging or blasting would occur.

4.7.2 Alternative 1

The majority of benthic habitat proposed for dredging is categorized as rock/rubble (see Section 3.7). These rock/rubble habitats are characterized by two types; scattered rock/rubble with live bottom (i.e. coral), and scattered rock/rubble with algae/sponges (Figures 6 and 11). In most areas, scattered rubble remains from previous dredging activities. Therefore, all project elements would directly impact rock/rubble habitats. The majority of these habitats proposed for dredging have already been dredged at some time in the past and have successfully recovered from past disturbances.

To implement Alternative 1, approximately 123.5 acres of combined rock/rubble habitat would be impacted (Table 17). Of those habitats, 120.5 acres lie within previously dredged areas, and only 3.0 acres lie outside previously dredged areas. Rock/rubble live bottom habitats composed 51.7 acres of the area to be impacted. All of the rock/rubble live bottom acreage impacted by Alternative 1 has been impacted previously by earlier dredging activity within the Port. An additional 68.8 acres of rock/rubble with algae/sponge habitat has been previously dredged and would again be impacted by Alternative 1. Three acres of new rock/rubble with sponge/algae habitat impacts would occur with the implementation of Alternative 1.

Table 17 Dredging Impacts on Rock/Rubble Communities for Alternative 1

	Impacts (ac)						
Habitat Type and Current Dredge Status	**Component**						
	1C	**2A**	**3B**	**4**	**5A**	**6**	**Total**
Rock/rubble with live bottom- new impacts, not previously dredged	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Rock/rubble with live bottom, previously dredged and recolonized	**51.7**	0.0	0.0	0.0	0.0	0.0	**51.7**
Rock/rubble with algae/sponges- new impacts, not previously dredged	0.0	**0.6**	**0.9**	0.0	**1.5**	0.0	**3.0**
Rock/rubble with algae/sponges, previously dredged and recolonized	**41.3**	0.0	**25.2**	0.0	**2.3**	0.0	**68.8**

Direct impacts to rock/rubble communities would result from the removal of benthic organisms and dredged material that contains benthic infauna. In some of the more diverse habitats, live bottom with interspersed hermatypic corals and gorgonians may be destroyed (see Section 3.7). However, in deeper areas within the Port, or where fine silt and silty sand are dominant, these habitats may be of very low quality for infauna or benthos, and play a minimal role in terms of primary and secondary productivity in the project area.

Impacts to populations of epibenthic fauna and benthic infauna would be temporary, as long as the areas remained viable aquatic habitat for re-colonization following dredging. Field research indicates that within several weeks, colonization by opportunistic species will take place. Their numbers would increase for several months, before the historic fauna once again becomes established. This is anticipated within two years. Algae, sponge, and soft coral colonies may take several years to become established, assuming conditions remain conducive to the recruitment of such taxa.

4.7.3 Alternative 2 (Recommended Plan)

Rock/rubble impacts associated with Alternative 2 would be identical to those of Alternative 1 (Figure 12, Table 18).

Table 18 Dredging Impacts on Rock/Rubble Communities for Alternative 2

	Impacts (ac)					
Habitat Type and Current Dredge Status	**Component**					
	1C	**2A**	**3B**	**4**	**5A**	**Total**
Rock/rubble with live bottom- new impacts, not previously dredged	0.00	0.0	0.0	0.0	0.0	0.0
Rock/rubble with live bottom, previously dredged and recolonized	**51.7**	0.0	0.0	0.0	0.0	**51.7**
Rock/rubble with algae/sponges- new impacts, not previously dredged	0.0	**0.6**	**0.9**	0.0	**1.5**	**3.0**
Rock/rubble w/ algae/sponges, previously dredged and recolonized	**41.3**	0.0	**25.2**	0.0	**2.3**	**68.8**

4.8 Essential Fish Habitat

4.8.1 No-Action Alternative

The No-Action Alternative would not have any direct impact on EFH since no dredging or blasting would occur.

4.8.2 Alternative 1

EFH present in the project area include seagrass beds, hardbottoms, reefs, and algae (including beds of the red alga *Laurencia* sp.), and the water column (Table 19). With the exception of the water column habitat, anticipated loss of these habitats due to project implementation is quantified in Sections 4.3 through 4.6. The EFH Assessment can be found in Appendix F. Significant decreases in EFH, particularly high-quality habitat and those designated as HAPC, could affect populations of managed fish and invertebrate species. Section 3.8 addresses the various habitat affiliations of managed fish and invertebrate species in southeast Florida and further details are provided in Appendix F.

Table 19 Incidental Impacts to Essential Fish Habitats

Component	Essential Fish Habitats Impacted
1C	Water Column, Hardbottom, Reefs, Algae
2A	Water Column, Algae
3B	Water Column, Seagrass Beds
4	None
5A	Water Column, Seagrass Beds
6	Water Column, Seagrass Beds

The most obvious direct impact of Alternative 1 on managed species in all habitats would be the potential for mortality and/or injury of individuals through the dredging and/or blasting processes. Species in any and all of the project area's habitats are susceptible. Fishes and invertebrates are at risk at any life-history stage.

Blasting would also have a direct impact on managed fish species residing in/migrating through the harbor and associated waterways. Previous studies (USACE 1996b; O' Keefe and Young 1984; Keevin and Hempen 1997; Young 1991) have addressed the impacts of blasting on fishes. Fishes with air bladders are particularly more susceptible to the effects of blasting than aquatic taxa without air bladders [e.g. shrimp, crabs, etc. (Keevin and Hempen 1997)]. Small fishes are the most likely to be impacted.

Dredging and blasting may also have more subtle effects observable only at the population level rather than at the individual level. For example, dredging/blasting activities, particularly in linear corridors (such as Government Cut and Fisherman's Channel) may temporarily alter migration patterns of species that require utilization of both inshore and offshore habitats through ontogeny. This is a particular concern for species that travel along shorelines and bulkheads. Therefore the dredging of berths and littoral zone habitats is anticipated to have greater effects. These impacts may result in displacement of individuals or disjuncture in the life cycles of managed species.

Impacts to the water column may have localized effects on marine and estuarine species. The water column is a habitat used for foraging, spawning, and migration by both managed species and organisms consumed by managed species. Water quality concerns are of particular importance in the maintenance of this important habitat. During dredging in substrates comprising coarser materials and rock, water quality impacts would be expected to be minimal. However, where silt and/or silty sand are to be dredged, short-term water quality impacts are expected to occur primarily due to temporarily increased levels of turbidity. Resuspended materials may interfere with the diversity and concentration of phytoplankton and zooplankton, and therefore could affect foraging success and patterns of schooling fishes and other grazers that comprise prey for managed species. Foraging patterns would be expected to return to normal upon cessation of dredging activities.

Impacts to EFH result in the loss of substrates used by managed species for spawning, nursery, foraging, and migratory/temporary habitats. The most critical losses of EFH would be those areas additionally designated as HAPC such as seagrass beds, algal beds, hardbottom, and reefs. Coastal inlets are HAPC for shrimps, red drum, and grouper. These species prefer estuarine inshore habitats such as seagrass beds for portions off their life history requirements. Medium and high profile reefs are also considered HAPC for grouper, and the hardbottom existing in 5 to 30 meters of depth off of Miami-Dade County is listed as HAPC for corals and coral reefs (SAFMC 1998b).

Significant impacts to EFH-HAPC within the areas proposed for dredging under Alternative 1 would include removal of seagrass and hardbottom/reef habitats. Seagrass beds are an important part of the Biscayne Bay ecosystem due to their proximity to reef and hardbottom habitats. Their function is closely coupled with reefs to provide life-stage-specific habitat for certain managed species. Seagrass habitat directly adjacent to the existing Port's channels are subjected to daily man-made and natural disturbances that make it a less optimal habitat for managed species relative to the surrounding area. Nevertheless, loss of these two habitats (hardbottom/reef and seagrasses) will result in a loss of habitat likely used by species of the Snapper-Grouper Complex; such as blue stripe grunts, French grunts, mahogany snapper, yellowtail snapper, and red grouper. Managed crustaceans including pink shrimp and spiny lobster found in nearby mangrove habitats at Virginia Key also likely use grassbeds for foraging during some life stages.

4.8.3 Alternative 2 (Recommended Plan)

Alternative 2 would have similar impacts to EFH as Alternative 1. However, the acreage of direct and indirect impacts would be reduced within the water column and seagrass beds (7.9 acres) with the exclusion of Component 6. The minimization of seagrass impacts under this alternative is especially significant given the fact that impacts are limited only to the perimeter of Fisherman’s Channel and the Fisher Island Turning Basin and don’t alter higher quality seagrass beds located away from the existing channel edge.

4.9 Protected Species

4.9.1 Marine Vegetation

4.9.1.1 Johnson’s Seagrass

4.9.1.1.1 No-Action Alternative

The No-Action Alternative would not affect Johnson's seagrass.

4.9.1.1.2 Alternative 1

Alternative 1 would have no effect on Johnson's seagrass. This species is not found in the project footprint.

4.9.1.1.3 Alternative 2 (Recommended Plan)

Alternative 2 would have no effect on Johnson's seagrass. This species is not found in the project footprint. The NMFS issued a Biological Opinion (Appendix H) concluding that the proposed action is "not likely to jeopardize the existence of Johnson's seagrass nor destroy or adversely modify critical habitat".

4.9.2 Marine Mammals

4.9.2.1 West Indian Manatee

4.9.2.1.1 No-Action Alternative

The No-Action Alternative would have no effect on the West Indian manatee.

4.9.2.1.2 Alternative 1

Alternative 1 could impact the West Indian manatee. Given the large numbers of manatees in the area, any loss of seagrass represents a loss of foraging habitat for manatees. A substantial amount of seagrass (33.8 acres) would be lost with the implementation of Alternative 1. Dredging and construction activities in the area may also temporarily alter behavior and migration routes of manatees. Care should be taken in winter months to assure that migration routes of manatees remain open and that dredging activities do not disturb the animals using this area. Any disturbance of manatees would be considered harassment of a marine mammal under the MMPA of 1972.

The highest potential for direct impacts to threatened and endangered marine mammal species may result from the use of explosives to break/dislodge rock substrates in the Government Cut and Fisherman’s Channel. Both the pressure and noise associated with blasting can injure marine mammals.

4.9.2.1.3 Alternative 2 (Recommended Plan)

Alternative 2 could impact the West Indian manatee. Given the large numbers of manatees in the area, any loss of seagrass represents a loss of foraging habitat for manatees. Some seagrass (7.9 acres) would be lost with the implementation of Alternative 2. Dredging and construction activities in the area may also temporarily alter behavior and migration routes of manatees. Care should be taken in winter months to assure that migration routes of manatees remain open and that dredging activities do not disturb the animals using this area.

The highest potential for direct impacts to threatened and endangered marine mammal species may result from the use of explosives to break/dislodge rock substrates in the Government Cut and Fisherman's Channel. Both the pressure and noise associated with blasting can injure marine mammals.

A Biological Assessment (BA) was prepared and submitted to FWS, and an ESA Section 7 consultation was initiated (Appendix H). It is the USACE's determination that impacts associated with Alternative 2 would not adversely affect the West Indian manatee. The USACE has coordinated with FWS and NMFS to determine an appropriate safety zone for the West Indian manatee during any blasting operations through the ESA and has received "no effect" Biological Opinions from both agencies (Appendix H; Appendix K).

4.9.2.2 North Atlantic Right Whale

4.9.2.2.1 No-Action Alternative

The No-Action Alternative would have no effect on the North Atlantic right whale.

4.9.2.2.2 Alternative 1

Alternative 1 would have no effect on the North Atlantic right whale. Due to the scarcity of the right whale in the project area and unlikelihood of encountering a northern right whale, it is anticipated that project construction will not have any effect on the whale.

4.9.2.2.3 Alternative 2 (Recommended Plan)

Alternative 2 would have no effect on the North Atlantic right whale. Due to the scarcity of the right whale in the project area and unlikelihood of encountering a northern right whale, it is anticipated that project construction will not have any effect on the whale.

4.9.2.3 Bottlenose Dolphin

4.9.2.3.1 No Action Alternative

The No-Action Alternative would have no effect on the Bottlenose dolphin.

4.9.2.2.2 Alternative 1

Alternative 1 may have an effect on bottlenose dolphins in the area of any blasts fired to break rock during construction of the project. It is likely that any effect on dolphins outside of the proposed safety radius will be in the form of a Temporary Threshold Shift (TTS). Due to the use of a safety zone, the USACE does not believe that any dolphin will be killed or injured. However, because the proposed action may harass bottlenose dolphins by causing a TTS, the USACE has submitted a request for an "incidental take" authorization from the NMFS. Section 101 (a)(5) of the MMPA allows the incidental (but not intentional) taking of marine mammals upon request if the taking will (1) have a negligible impact on the species or stock(s); and (2) not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

4.9.2.3.3 Alternative 2

Alternative 2 may have an effect on bottlenose dolphins in the area of any blasts fired to break rock during construction of the project. It is likely that any effect on dolphins outside of the proposed safety radius will be in the form of a TTS. Due to the use of a safety zone, the USACE does not believe that any dolphin will be killed or injured. However, because the proposed action may harass bottlenose dolphins by causing a TTS, the USACE has submitted a request for an "incidental take" authorization from the NMFS. Section 101 (a)(5) of the MMPA allows the incidental (but not intentional) taking of marine mammals upon request if the taking will (1) have a negligible impact on the species or stock(s); and (2) not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

4.9.2.4 Sperm Whale

4.9.2.4.1 No Action Alternative

The No-Action Alternative would have no effect on the sperm whale.

4.9.2.4.2 Alternative 1

Alternative 1 may have an effect on endangered sperm whales in the vicinity of the outer reef in the entrance channel when blasts are fired to break rock during construction of the channel extension portion of the project. It is likely that any effect on sperm whales outside of the proposed safety radius will be in the form of a TTS. Due to the use of a safety zone, the USACE does not believe that any whale will be killed or injured. However, because the proposed action may harass sperm whales by causing a TTS, the USACE has submitted a request for an "incidental take" authorization from the NMFS. Section 101 (a)(5) of the MMPA allows the incidental (but not intentional) taking of marine mammals upon request if the taking will (1) have a negligible impact on the species or stock(s); and (2) not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

The sperm whale is listed as an endangered species under the ESA and may be affected by the proposed action; the USACE initiated formal consultation with the NMFS under Section 7 of the Endangered Species Act. A Biological Assessment was submitted to the NMFS. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.4.3 Alternative 2

Alternative 2 may have an effect on endangered sperm whales in the vicinity of the outer reef in the entrance channel when blasts are fired to break rock during construction of the channel extension portion of the project. It is likely that any effect on sperm whales outside of the proposed safety radius will be in the form of a TTS. Due to the use of a safety zone, the USACE does not believe that any whale will be killed or injured. However, because the proposed action may harass sperm whales by causing a TTS, the USACE has submitted a request for an "incidental take" authorization from the NMFS. Section 101 (a)(5) of the MMPA allows the incidental (but not intentional) taking of marine mammals upon request if the taking will (1) have a negligible impact on the species or stock(s); and (2) not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

The sperm whale is listed as an endangered species under the ESA and may be affected by the proposed action; the USACE initiated formal consultation with the NMFS under Section 7 of the Endangered Species Act. A Biological Assessment was submitted to the NMFS. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.5 Humpback Whale

4.9.2.5.1 No Action Alternative

The No-Action Alternative would have no effect on humpback whale.

4.9.2.5.2 Alternative 1

Alternative 1 may have an effect on endangered humpback whales in the vicinity of the outer reef in the entrance channel when blasts are fired to break rock during construction of the channel extension portion of the project. It is likely that any effect on humpback whales outside of the proposed safety radius will be in the form of a TTS. Due to the use of a safety zone, the USACE does not believe that any whale will be killed or injured. However, because the proposed action may harass humpback whales by causing a TTS, the USACE has submitted a request for an "incidental take" authorization from the NMFS. Section 101 (a)(5) of the MMPA allows the incidental (but not intentional) taking of marine mammals upon request if the taking will (1) have a negligible impact on the species or stock(s); and (2) not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

The humpback whale is listed as an endangered species under the ESA and may be affected by the proposed action; the USACE initiated formal consultation with the NMFS under Section 7 of the Endangered Species Act. A Biological Assessment was submitted to the NMFS. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.5.3 Alternative 2

Alternative 2 may have an effect on endangered humpback whales in the vicinity of the outer reef in the entrance channel when blasts are fired to break rock during construction of the channel extension portion of the project. It is likely that any effect on sperm whales outside of the proposed safety radius will be in the form of a TTS. Due to the use of a safety zone, the USACE does not believe that any whale will be killed or injured. However, because the proposed action may harass humpback whales by causing a TTS, the USACE has submitted a request for an "incidental take" authorization from the NMFS. Section 101 (a)(5) of the MMPA allows the incidental (but not intentional) taking of marine mammals upon request if the taking will (1) have a negligible impact on the species or stock(s); and (2) not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

The humpback whale is listed as an endangered species under the ESA and may be affected by the proposed action; the USACE initiated formal consultation with the NMFS under Section 7 of the Endangered Species Act. A Biological Assessment was submitted to the NMFS. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.6 Fin Whale

4.9.2.6.1 No Action Alternative

The No-Action Alternative would have no effect on the fin whale.

4.9.2.6.2 Alternative 1

Alternative 1 would have no effect on the fin whale. Due to the scarcity of the fin whale in the project area and unlikelihood of encountering a fin whale, it is anticipated that project construction will not have any effect on the whale. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.6.3 Alternative 2

Alternative 1 would have no effect on the fin whale. Due to the scarcity of the fin whale in the project area and unlikelihood of encountering a fin whale, it is anticipated that project construction will not have any effect on the whale. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.7 Sei Whale

4.9.2.7.1 No Action Alternative

The No-Action Alternative would have no effect on the sei whale.

4.9.2.7.2 Alternative 1

Alternative 1 would have no effect on the sei whale. Due to the scarcity of the sei whale in the project area and unlikelihood of encountering a sei whale, it is anticipated that project construction will not have any effect on the whale. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.7.3 Alternative 2

Alternative 2 would have no effect on the sei whale. Due to the scarcity of the sei whale in the project area and unlikelihood of encountering a sei whale, it is anticipated that project

construction will not have any effect on the whale. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.8 Blue Whale

4.9.2.8.1 No Action Alternative

The No-Action Alternative would have no effect on the blue whale.

4.9.2.8.2 Alternative 1

Alternative 1 would have no effect on the blue whale. Due to the scarcity of the blue whale in the project area and unlikelihood of encountering a blue whale, it is anticipated that project construction will not have any effect on the whale. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.2.8.3 Alternative 2

Alternative 2 would have no effect on the blue whale. Due to the scarcity of the blue whale in the project area and unlikelihood of encountering a blue whale, it is anticipated that project construction will not have any effect on the whale. Based on this information, NMFS issued a "no effect" Biological Opinion for the proposed project (Appendix H).

4.9.3 Sea Turtles

4.9.3.1 No-Action Alternative

The No-Action Alternative would have no impact on sea turtles.

4.9.3.2 Alternative 1

Alternative 1 would not have a significant adverse impact on listed sea turtle species. However, since beaches of Miami Beach and Virginia Key provide important nesting areas for three sea turtle species, the project area comprises important resources for turtles. Removal of sections of hardbottom, reef, and seagrass habitats would eliminate potential foraging habitat for juvenile sea turtles. Also, dredge activities and associated disturbances offshore may interrupt the movement of turtles swimming toward or away from nesting beaches. The highest potential impact to sea turtles may be the use of explosives.

4.9.3.3 Alternative 2 (Recommended Plan)

Alternative 2 would not have a significant adverse impact on listed sea turtle species. However, since beaches of Miami Beach and Virginia Key provide important nesting areas for three sea turtle species, the project area comprises important resources for turtles. Removal of sections of hardbottom, reef, and seagrass habitats would eliminate potential foraging habitat for juvenile sea turtles; however, seagrass impacts with Alternative 2 (7.9 acres) are substantially less than for Alternative 1. Also, dredge activities and associated disturbances offshore may interrupt the movement of turtles swimming toward or away from nesting beaches. The highest potential impact to sea turtles may be the use of explosives to remove areas of rock at the east end of the Entrance Channel.

A Biological Assessment (BA) was prepared and submitted to NMFS initiating consultation under Section 7 of the ESA (Appendix H). NMFS issued a Biological Opinion (Appendix H) and determined that sea turtles would not likely be affected by the proposed action.

4.9.4 American Crocodile

4.9.4.1 No-Action Alternative

The No-Action Alternative would have no effect on the American crocodile.

4.9.4.2 Alternative 1

Alternative 1 would have no effect on the American crocodile. While the crocodile has been observed as far north as Crandon Park, Bill Baggs State Recreation Area, and Snapper Creek in Biscayne Bay, the species is generally shy and avoids contact with humans and areas of activity, such as heavily used channels and waterways.

4.9.4.3 Alternative 2 (Recommended Plan)

Alternative 2 would have no effect on the American crocodile. While the crocodile has been observed as far north as Crandon Park, Bill Baggs State Recreation Area, and Snapper Creek in Biscayne Bay, the species is generally shy and avoids contact with humans and areas of activity, such as heavily used channels and waterways.

A Biological Assessment (BA) was prepared and submitted to FWS and an ESA Section 7 consultation was initiated (Appendix H). The FWS subsequently determined that the American crocodile is not likely to be affected by the proposed action (Appendix K).

4.9.5 Piping Plover

4.9.5.1 No-Action Alternative

The No-Action Alternative would have no effect on the piping plover.

4.9.5.2 Alternative 1

Alternative 1 would have no effect on the piping plover. Although the piping plover overwinters in south Florida, there are no records of the species in the project area.

4.9.5.3 Alternative 2 (Recommended Plan)

Alternative 2 would have no effect on the piping plover. Although the piping plover overwinters in south Florida, there are no records of the species in the project area.

4.9.6 Least Tern

4.9.6.1 No-Action Alternative

The No-Action Alternative would have no impact on the least tern.

4.9.6.2 Alternative 1

Alternative 1 would have no effect on the least terns. Although the species is found in south Florida, there are no records of the species occurring within the project area.

4.9.6.3 Alternative 2 (Recommended Plan)

Alternative 1 would have no effect on the least terns. Although the species is found in south Florida, there are no records of the species occurring within the project area.

4.10 Other Areas of Special Concern

4.10.1 Manatee Protection Areas

4.10.1.1 No-Action Alternative

The No-Action Alternative would not have any impact on designated Manatee Protection Zones.

4.10.1.2 Alternative 1

Alternative 1 would not have any significant impact on designated Manatee Protection Zones. Component 6, which would relocate the western end of Dodge Island Cut, would have a direct impact on the Essential Manatee Habitat. Although portions of the Port southwest of Dodge Island have been designated by DERM as Essential Manatee Habitat, neither construction activities nor post-construction operations would have a significant adverse effect. See Appendix K.

4.10.1.3 Alternative 2 (Recommended Plan)

Alternative 2 would not have any significant impact on designated Manatee Protection Zones. Although portions of the Port southwest of Dodge Island have been designated by DERM as Essential Manatee Habitat, neither construction activities nor post-construction operations would have a significant adverse effect. See appendix K.

4.10.2 Bill Sadowski Critical Wildlife Area

4.10.2.1 No-Action Alternative

The No-Action Alternative would not have any impact on the BSCWA.

4.10.2.2 Alternative 1

Alternative 1 would have no direct impact on the BSCWA. The proposed project is in the vicinity of the BSCWA, but it is contained within Port-owned lands and does not intrude upon the BSCWA. According to information from Florida Fish & Wildlife Conservation Commission (FFWCC) and Florida Department of Environmental Protection (FDEP) staff, the BSCWA was established in 1990 and then was amended in 1993 to reflect the boundaries of the Virginia Key No Entry Manatee Protection Zone. However, there are a number of problems with the legal description used to identify the BSCWA area including longitude references that do not exist; longitude references that do not coincide with the corresponding location description; coordinates which are not taken to a consistent level of specificity; and points and bearings

which do not define a closed area. As a result, the existing CWA description does not meet the Florida Administrative Code (FAC) provision that the *area shall be described … in sufficient specificity as to permit identification.*

The Port is currently surveying and defining the southern boundary of the Port, as part of the resolution of other issues. As part of that process, a Specific Purpose survey located the boundary between City of Miami and the Port properties will be prepared. The minimum distance from the existing channel toe and the boundary is greater than 250 feet. The proposed project extends the existing channel 100 feet to the south and the maximum anticipated slope impact extends 78.25 feet from the new channel toe to top of slope. The worst-case scenario of the NW corner of the BSCWA coinciding with the maximum extension of the channel (178.25 feet (100.0 + 78.25) continues to place the proposed project within Port owned lands (178.25 feet < 200 feet), outside of the BSCWA. The Port formally contacted the State to resolve this issue.

Indirect impacts to seagrass beds adjacent to Fisherman's Channel would not extend into the BSCWA. Turbidity levels during construction would comply with the Section 401 Water Quality Certification.

4.10.2.3 Alternative 2 (Recommended Plan)

Alternative 2 would have no direct impact on the BSCWA as with Alternative 1. Indirect impacts to seagrass beds adjacent to Fisherman's Channel would not extend into the BSCWA. Turbidity levels during construction would comply with the Section 401 Water Quality Certification.

4.10.3 Biscayne Bay Aquatic Preserve

4.10.3.1 No-Action Alternative

The No-Action Alternative would not have any impact on the Biscayne Bay Aquatic Preserve.

4.10.3.2 Alternative 1

Alternative 1 would not significantly impact the Biscayne Bay Aquatic Preserve. Proposed activities are predominately within the existing authorized Federal Channel, and widening activities are minor and adjacent to the existing channel.

4.10.3.3 Alternative 2 (Recommended Plan)

Alternative 2 would not significantly impact the Biscayne Bay Aquatic Preserve. Proposed activities are predominately within the existing authorized Federal Channel, and widening activities are minor and adjacent to the existing channel.

4.11 Air Quality

4.11.1 No-Action Alternative

The No-Action Alternative would have no impact on air quality in the region. No construction activities would occur with this alternative, and no increase in air emissions would occur.

4.11.2 Alternative 1

Short-term impacts from dredge emissions and other construction equipment associated with all of the action alternatives would occur with Alternative 1, but the alternative would not significantly impact air quality. No air quality permits would be required. Because the project is located within an attainment area, U.S. Environmental Protection Agency's general conformity rule to implement Section 176 (c) of the Clean Air Act does not apply, and a conformity statement should not be required.

During construction of any disposal dikes and associated haul roads with upland disposal, dust could be generated. The contractor would be required to control dust through periodically wetting dust prone work areas or though application of an approved dust retardant agent.

4.11.3 Alternative 2 (Recommended Plan)

Short-term impacts from dredge emissions and other construction equipment would occur with Alternative 2, but the alternative would not significantly impact air quality. No air quality permits would be required. Because the project is located within an attainment area, U.S. Environmental Protection Agency's general conformity rule to implement Section 176 (c) of the Clean Air Act does not apply, and a conformity statement should not be required.

During construction of any disposal dikes and associated haul roads with upland disposal, dust could be generated. The contractor would be required to control dust through periodically wetting dust prone work areas or though application of an approved dust retardant agent.

4.12 Noise

4.12.1 No-Action Alternative

The No-Action Alternative would have no impact on noise levels. No construction activities or additional sources of ambient noise would occur due to this alternative.

4.12.2 Alternative 1

Alternative 1 is not expected to have a significant impact to noise levels. Additional noise sources with the alternative would not be noticeable in the current ambient noise levels of the Port from existing and future highway, jet flight path, ship traffic, as well as normal Port activities.

With the construction activities of the proposed action, there would be a slight and temporary increase in noise levels. Construction equipment would be properly maintained to minimize the effects of the noise and the distance of the activity from residential areas would also reduce any noise impacts associated with construction. Excavation of rock formations would be coordinated with local regulations regarding noise and vibration levels.

4.12.3 Alternative 2 (Recommended Plan)

Alternative 2 is not expected to have a significant impact to noise levels. Additional noise sources with the alternative would not be noticeable in the current ambient noise levels of the Port from existing and future highway, jet flight path, ship traffic, as well as normal Port activities.

With the construction activities of the proposed action, there would be a slight and temporary increase in noise levels. Construction equipment would be properly maintained to minimize the effects of the noise and the distance of the activity from residential areas would also reduce any noise impacts associated with construction. Excavation of rock formations would be coordinated with local regulations regarding noise and vibration levels.

4.13 Utilities

4.13.1 No-Action Alternative

No impacts to utilities would occur with the No-Action Alternative.

4.13.2 Alternative 1

Alternative 1 would impact utility crossings. The WASD force sewer main in the submarine crossing within Component 2 leading from Miami Beach to Fisher Island would require relocation.

Additionally, the WASD water main in the submarine crossing within Component 5 leading from Fisher Island to Lummus Island would also require relocation.

The USACE estimates that design and construction would cost approximately $4.6 million for both the sewer force main and the water main.

The FP&L's two transmission lines in the submarine crossing within Component 5, leading from Lummus Island to areas south of Component 5,should have been relocated under the previously authorized phase I deepening. Relocation will occur as part of the phase II deepening under a new Project Cooperation Agreement with Miami-Dade County Seaport Department. As such the FP&L transmission lines are part of the without project condition and not included in this proposed project.

Coordination with the appropriate utility companies would be conducted by the USACE and the Port to ensure all relocations are completed prior to dredging activities near those areas.

4.13.3 Alternative 2 (Recommended Plan)

Alternative 2 would impact utility crossings. The WASD force sewer main in the submarine crossing within Component 2 leading from Miami Beach to Fisher Island would require relocation.

Additionally, the WASD water main in the submarine crossing within Component 5 leading from Fisher Island to Lummus Island would also require relocation. The USACE estimates that design and construction would cost approximately $4.6 million for both the sewer force main and the water main.

The FP&L's two transmission lines in the submarine crossing within Component 5, leading from Lummus Island, to areas south of Component 5, should have been relocated under the previously authorized phase I deepening. Relocation will occur as part of the phase II deepening under a new Project Cooperation Agreement with Miami-Dade County Seaport Department. As such the FP&L transmission lines are part of the without project condition and not included in this proposed project.

Coordination with the appropriate utility companies would be conducted by the USACE and the Port to ensure all relocations are completed prior to dredging activities near those areas.

4.14 Hazardous, Toxic, and Radioactive Materials

4.14.1 No-Action Alternative

The No-Action Alternative would have no impact to hazardous, toxic, or radioactive material sources within the project area.

4.14.2 Alternative 1

Alternative 1 would have no impact to hazardous, toxic, or radioactive material sources within the project area. No potential sources of contamination have been identified in the project area, and no new sources of hazardous, toxic, or radioactive material would occur with the alternative construction or implementation. Sediments and materials to be excavated during construction have been evaluated and approved for offshore disposal.

4.14.3 Alternative 2 (Recommended Plan)

Alternative 2 would have no impact to hazardous, toxic, or radioactive material sources within the project area. No potential sources of contamination have been identified in the project area, and no new sources of hazardous, toxic, or radioactive material would occur with the alternative construction or implementation. Sediments and materials to be excavated during construction have been evaluated and approved for offshore disposal.

4.15 Economic Factors

4.15.1 No-Action Alternative

The No-Action Alternative would have significant negative national and regional economic impacts. By doing nothing, the transportation savings associated with the proposed improvements would be lost. Goods and services produced by U.S. businesses would be less competitive with foreign goods and services. U.S. citizens would pay more for goods and services than they need to pay. From a regional perspective, there are income and employment impacts. Doing nothing would result in a significant loss of cargo business at the Port due to the Port's inability to efficiently handle the new industry standard deep draft cargo vessels, which results in an increased cost of doing business. Business loss is expected to occur both in incremental declines in growth (as lines increasingly deploy vessels to other ports with deeper draft channels and feeder lines begin to relocate), and in large declines in existing business if the Port loses one of its three main operators.

There are short-term and long-term consequences of the No-Action Alternative. In the short-term, the increased costs would be passed on to consumers, and businesses would reduce their production and lay off workers, increasing local unemployment. In the long-term, Miami-based businesses would become less competitive with foreign sources of goods and services and would move to regions where the cost of business is less due to more efficient ports, resulting in significantly more unemployment and income losses for the Miami region.

4.15.2 Alternative 1

Channel widening comprises widening the seaward portion of the Entrance Channel from 500 feet to 800 feet, dredging the widener between Buoys #13 and #15, and widening Fisherman's Channel approximately 100 feet to the south. The purpose of channel widening is to increase safety, reduce damages, reduce delays, and avoid increases in tug assist costs for the Post-Panamax vessels that are expected to call in the future. Ships have grounded at the entrance due to currents. Existing conditions allow surging that prevents cargo vessels at berth from discharging or loading cargo when a vessel passes.

In the without-project condition, as Post-Panamax vessels begin to call, grounding frequency and associated safety reduction and incurred damages would increase. Surging caused by passing vessels would worsen. The Post-Panamax vessels would require extra tug assistance. In the with-project condition, groundings would be significantly reduced. Surging caused by passing vessels would be lessened. Post-Panamax vessels would require less tug assistance. Benefits attributable to channel widening include; (1) reduced damages, (2) reduced delays (vessels holding until grounded vessel is removed and less interruption to discharging vessels), (3) increase in navigation safety, and (4) reduction in tug assist costs.

The Fisher Island Turning Basin is not large enough for the expected Post-Panamax container vessels to turn in either with or without project conditions. Without the Fisher Island Turning Basin Extension measure, these vessels can turn in the previously authorized 42-foot deep Lummus Island Turning Basin, but extending the Fisher Island Turning Basin would provide a closer place to turn for the larger vessels. Therefore, this measure would provide more flexibility in allocating turning basin use among vessels, leading to timesaving efficiencies.

Panamax and future-calling Post-Panamax container vessels arriving to or departing from the Port cannot fully load because of current channel depths. In the without-project condition, this light loading of vessels would sustain current transportation costs. Deepening the channel would allow vessels to more fully load, increasing efficiency. Benefits to deepening are reduced transportation costs resulting from the partial or full elimination of light loading.

4.15.3 Alternative 2 (Recommended Plan)

Channel widening comprises widening the seaward portion of the Entrance Channel from 500 feet to 800 feet, dredging the widener between Buoys #13 and #15, and widening Fisherman's Channel approximately 100 feet to the south. The purpose of channel widening is to increase safety, reduce damages, reduce delays, and avoid increases in tug assist costs for the Post-Panamax vessels that are expected to call in the future. Ships have grounded at the entrance due to currents. Existing conditions allow surging that prevents cargo vessels at berth from discharging or loading cargo when a vessel passes.

In the without-project condition, as Post-Panamax vessels begin to call, grounding frequency and associated safety reduction and incurred damages would increase. Surging caused by passing vessels would worsen. The Post-Panamax vessels would require extra tug assistance. In the with-project condition, groundings would be significantly reduced. Surging caused by passing vessels would be lessened. Post-Panamax vessels would require less tug assistance. Benefits attributable to channel widening include; (1) reduced damages, (2) reduced delays (vessels holding until grounded vessel is removed and less interruption to discharging vessels), (3) increase in navigation safety, and (4) reduction in tug assist costs.

The Fisher Island Turning Basin is not large enough for the expected Post-Panamax container vessels to turn in either with or without project conditions. Without the Fisher Island Turning Basin Extension measure, these vessels can turn in the previously authorized 42-foot deep Lummus Island Turning Basin, but extending the Fisher Island Turning Basin would provide a closer place to turn for the larger vessels. Therefore, this measure would provide more flexibility in allocating turning basin use among vessels, leading to timesaving efficiencies.

Panamax and future-calling Post-Panamax container vessels arriving to or departing from the Port cannot fully load because of current channel depths. In the without-project condition, this light loading of vessels would sustain current transportation costs. Deepening the channel would allow vessels to more fully load, increasing efficiency. Benefits to deepening are reduced transportation costs resulting from the partial or full elimination of light loading.

4.16 Land Use

4.16.1 No-Action Alternative

The No-Action Alternative would not require changes in land use. Port expansion and associated facilities would likely occur on compatible land use.

4.16.2 Alternative 1

Alternative 1 would not require changes in land use. Port expansion and associated facilities would likely occur on compatible land use.

4.16.3 Alternative 2 (Recommended Plan)

Alternative 2 would not require changes in land use. Port expansion and associated facilities would likely occur on compatible land use.

4.17 Recreation

4.17.1 No-Action Alternative

The No-Action Alternative would have no impact on recreational resources in the area.

4.17.2 Alternative 1

Impacts to recreational activities with Alternative 1 would be minor. Temporary minor impacts may occur to recreational boat traffic during construction of the mitigation sites in areas adjacent to the Port. No impacts would occur with normal project operations.

4.17.3 Alternative 2 (Recommended Plan)

Impacts to recreational activities with Alternative 2 would be minor. Temporary minor impacts may occur to recreational boat traffic during construction of the mitigation sites in areas adjacent to the Port. No impacts would occur with normal project operations.

4.18 Aesthetics

4.18.1 No-Action Alternative

The No-Action Alternative would have no impact on aesthetic resources in the area.

4.18.2 Alternative 1

Impacts to aesthetic resources with Alternative 1 would be minor. Temporary aesthetic impacts would occur due to construction activities. Construction equipment including dredges, dredge pipes, loaders, scrapers, dump trucks, etc. would be visible to the public. Temporary aesthetic impacts due to construction of staging areas, access roads, and associated construction-related amenities would also occur. No impacts would occur with normal project operations.

4.18.3 Alternative 2 (Recommended Plan)

Impacts to aesthetic resources with Alternative 2 would be minor. Temporary aesthetic impacts would occur due to construction activities. Construction equipment including dredges, dredge pipes, loaders, scrapers, dump trucks, etc. would be visible to the public. Temporary aesthetic impacts due to construction of staging areas, access roads, and associated construction-related amenities would also occur. No impacts would occur with normal project operations.

4.19 Cultural Resources

4.19.1 No-Action Alternative

The No-Action Alternative would have no impact on cultural resources in the area.

4.19.2 Alternative 1

Alternative 1 would have no effect on cultural resources. A remote sensing survey was conducted within the project boundaries as requested by SHPO. No historic properties were located within the project area (Watts 2002). A concurrence letter from SHPO, indicating that the proposed project would have no effect on any historic properties eligible for listings in the National Register of Historic Places, was received in April 2002 (Appendix I). If the USACE constructs its reef mitigation sites in localities currently not permitted by DERM, then the USACE will coordinate the placement of this material with SHPO.

4.19.3 Alternative 2 (Recommended Plan)

Alternative 2 would have no effect on cultural resources. A remote sensing survey was conducted within the project boundaries of the Port as requested by SHPO. No historic properties were located within the project area (Watts 2002). A concurrence letter from SHPO, indicating that the proposed project would have no effect on any historic properties eligible for listings in the National Register of Historic Places, was received in April 2002 (Appendix I). If the USACE constructs its reef mitigation sites in localities currently not permitted by DERM, then the USACE will coordinate the placement of this material with SHPO.

4.20 Cumulative Impacts

Cumulative impacts are the impacts on the environment resulting from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7). The proposed project would provide long-term benefits, which would outweigh any short-term environmental losses. The cumulative impact of navigation improvements would be to improve the local economy, provide increased navigation and safety, and enhance the overall quality of the human environment.

4.20.1 Historic Natural Resource Impacts

4.20.1.1 Past Activities, 1970-Present

The Port has been operating from its current location at Dodge Island since approximately 1946. Dredging to accommodate and expand Port operations occurred throughout the 1960s. With the adoption of NEPA in 1969 and the Clean Water Act (CWA) in 1972, impacts to area natural resources resulting from navigation improvements were evaluated as part of the Federal permitting process. Since that time, two major Federal permitting actions are on record for Port

expansion and navigation improvements. They are the Port Expansion Project of 1980 and the Channel Deepening Project of 1991. Prior to 1980, the last Federally authorized navigation project at the Port occurred in 1968. That project involved widening of the Entrance Channel to 500 feet and deepening of that channel and other channels and basins around the Port to depths of 36 to 38 feet (USACE 1991).

4.20.1.2 Port Expansion Project of 1980

On April 23, 1979, immediately following adoption of the Port's 1979 Master Development Plan by the Miami-Dade County Commission, an application was made to the USACE for dredging and filling activities to expand the Port. The application request included deepening of Fishermen's Channel, widening of the Dodge Island Turning Basin, creation of the Lummus Island Turning Basin and filling for creation of additional land area at Lummus Island. A Federal permit was issued on October 6, 1980. A state permit from the Florida Department of Environmental Regulation (FDER) was issued for the same project on July 11, 1980. Table 20 summarizes the permit contents. In 1986, FDER "reissued" their permit with additional deepening of Fisherman's Channel and widening of the Dodge Island Turning Basin. The USACE issued a permit for this work in 1988. In the meantime, a modification had been made to the original USACE permit to change the scope of required mitigation. All of the mitigation work required by the permits was completed by 1994 although some of the authorized construction work remains unfinished at this time (Fielland 2001).

Submerged natural resource communities impacted by the 1980 expansion project within Biscayne Bay may have included hardbottom, seagrasses, and unvegetated bottom although the impact acreages were not specified in the permits. Required mitigation on the original permit included 251 acres of seagrass habitat creation. A FWS report on the project states that the Port was "required to mitigate for the loss of 251 acres of shallow water and marine grassbeds by planting seagrasses" implying that the 251 acreage figure represented the project impact as well as the required mitigation (USACE 1989). After the seagrass mitigation project proved largely unsuccessful (USACE 1989; Fonseca et al. 1998), the mitigation requirements were revised in a 1988 USACE permit modification to include 15 acres of mangrove habitat restoration and other habitat creation (spoil islands and artificial reefs) of unspecified acreage.

4.20.1.3 Channel Deepening Project of 1991

On October 31, 1991, both the USACE and the FDEP issued permits for the Channel Deepening Project. On February 6, 1992, DERM, the local environmental permitting authority, also issued a permit for the project. This project was designed to meet the needs of increased numbers and sizes of vessels using the Port. The project focused on deepening shipping channels leading into the Port including Government Cut, the Entrance Channel, and Fisher Island Turning Basin. The project impacted 4.92 acres of hardbottom habitat and 94.0 acres of rock/rubble habitat. To offset these impacts the permits included 15.91 acres of artificial reef creation, 94.0 acres of rock/rubble habitat creation, and an unspecified amount of mangrove wetlands restoration.

The State of Florida Department of Environmental Protection and Miami-Dade County entered into a Consent Order on May 7, 2002 to address the damage to low- to moderate-density sea grasses outside of the permitted dredging area. This Order requires the Port of Miami to undertake a mitigation project at the Oleta River State Park in North Miami. The plan includes 1) restoration of 42.5 acres of red mangrove swamp, tidal streams, and tidal pools; 2) enhancement of approximately 20 acres of tidal red mangrove habitat; 3) and creation and installation of bilingual environmental education signs within the Park. This mitigation work addresses the Department of Environmental Resources Management (DERM) Notice of Violation as well.

Table 20 Natural Resource Impact and Mitigation History of Navigational Improvements

Permitting Agency	Permit Numbers and Dates[1]	Final Permitted Navigation Improvements	Acreage Impacts		Mitigation[3]		
1980 Expansion Project							
USACE	No. 79B-0623 Issue Date: 10/6/80 Mod Date: 6/16/81 Mod Date: 3/9/88 Mod Date: 9/2/88 Mod Date: 2/8/93 Mod Date: 9/25/01 Mod Date: 11/26/01	1. Deepening of Fisherman's Channel to 42 feet 2. Creation of Fisher Island Turning Basin of 1,600 foot diameter and 42 feet in depth 3. Deepening of Dodge Island Turning Basin and intervening channel to Fisher Island Turning Basin to 36.5 feet and widening of Dodge Island Turning Basin to 1,600-foot diameter 4. Landside expansion (filling of Lummus Island) 5. Blasting	Not specified		Seagrass habitat creation; Biscayne Bay;	Complete; less than 10% successful; alternative mitigation provided	140.0
					Mangrove wetlands restoration - Oleta River State Park;	Complete	15.0
					Hardbottom Habitat creation (artificial reefs); various locations;	Complete	NR[2]
					Spoil island habitat enhancement; various locations;	Complete	NR[2]
					Shoreline habitat enhancement (stabilization); var. loc.;	Complete	NR[2]
FDER	No. 13-19502 Issue Date: 7/11/80 No. 131106409 Issue Date: 3/7/86 Mod Date: 5/22/86 Mod Date: 9/1/94 Mod Date: 12/30/94 Mod Date: 6/10/02	(same as above without Blasting)	Not specified		Seagrass habitat creation	Complete; less than 10% successful; alternative mitigation provided	140.0
					Mangrove wetlands restoration	Complete	15.0
DERM	No. CC94-290 Issue Date: 9/4/95 No. CC 98-405 Issue Date: 2/3/99	Deepening of portions of Lummus Island and Fisher Island Turning Basins to 42 feet	Not specified		None required	None required	

[1] Permit Issuance ("Issue") and Modification ("Mod.") Dates – only those modifications affecting impact acreage and/or mitigation acreage are listed here.
[2] NR = not reported in permit.
[3] Acreage of mitigation represents the final amount of mitigation acreage approved and carried out as of the latest permit modification

Table 20 Continued

Permitting Agency	Permit Numbers and Dates[1]	Final Permitted Navigation Improvements	Acreage Impacts		Acreage Mitigation[3]		
1991 Deepening Project							
			Type	**Acres**	**Type**	**Status**	**Acres**
USACE	No. 199101030 (IP-DM) Issue Date: 10/31/91 Mod Date: 5/17/93 Mod Date: 9/13/93 Mod Date: 1/27/95 Mod Date: 2/16/98 Mod Date: 5/22/02	1. Deepening of Fisher Island Turning Basin and widener to 42 feet 2. Deepening of Entrance Channel, Bar Cut, Government Cut- and widener to 44 feet	Hardbottom	4.92	Mangrove wetlands restoration; Biscayne Bay canals;	complete	NR[2]
			Channel bottom rock/ rubble	94.0			
FDER	No. 131982259 Issue Date: 10/30/91 Mod Date: 9/22/92 Mod Date: 11/29/93 Mod. Date: 1/28/94 Mod Date: 3/22/94 Mod. Date: 5/24/95 Mod Date: 4/8/97	(Same as above)	Hardbottom	4.92	Hardbottom creation (artificial reef habitat)	Complete	15.91
					Mangrove wetlands restoration	Complete	NR
			Channel bottom rock/ rubble	94.0	Channel bottom rock rubble; In channel; complete	Complete	94
DERM	No. CC91-191 Issue Date: 2/6/92 Mod Date: 2/3/95	(Same as above)	Hardbottom	4.86	Hardbottom creation (artificial reef habitat)	Complete	15.91
			Channel bottom rock/ rubble	94.0	Channel bottom rock rubble	Complete	94.0

[1] Permit Issuance ("Issue") and Modification ("Mod.") Dates – only those modifications affecting impact acreage and/or mitigation acreage are listed here.

[2] NR = not reported in permit.

[3] Acreage of mitigation represents the final amount of mitigation acreage approved and carried out as of the latest permit modification

4.20.1.4 Other Minor Activities

A permit to fill the previously dredged northwest corner of Dodge Island was issued on July 23, 1992 by the USACE [Permit Number 199200151(IP-RP)]. They required creation of 0.4 acre of limestone boulder shoreline revetment habitat as mitigation for installation of the bulkhead. The USACE made reference to compliance with the local jurisdictional permit issued by DERM (CC92-175) with respect to the mitigation requirement.

Two additional activities were permitted by the USACE but had no impacts for which mitigation was required:

- Filling of the "NOAA" docking slip consisting of 6.2 acres of previously dredged area [Permit No. 199406346(IP-DS)] issued May 21, 1997 (although the USACE did not specifically require mitigation for this project, state and local jurisdictions did require creation of up to 2,929 cubic yards of shoreline riprap as mitigation for bulkhead installation pursuant to FDEP permit number 132605579 and DERM permit number CC94-339), and,

- Miami ODMDS [Permit No. 199301155(IP-DSG)] issued on October 12, 1994.

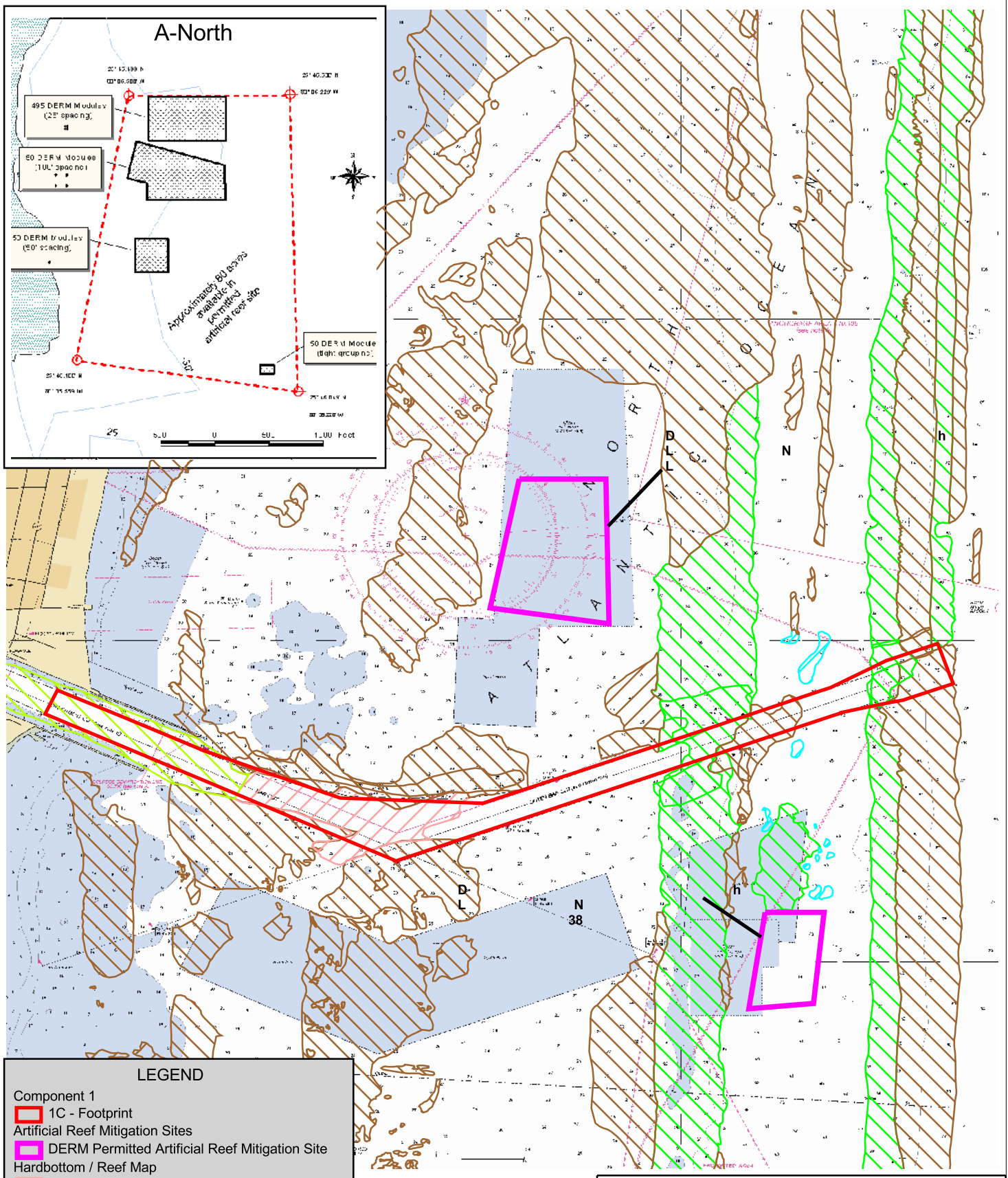
4.20.1.5 Impacts Summary for Past Activities

Table 20 summarizes permitted natural resource impacts from the two known major Port expansion/improvement projects, the 1980 expansion and the 1991 deepening. Unfortunately, records of the impact acreages for the 1980 expansion project have not been located and may not exist at all. Therefore, it is not possible at this time to determine the correct cumulative impact acreages for individual habitat types from past permitted activities. It is known, however, that the required mitigation to offset those impacts was completed successfully (Fielland 2001; USACE 2000). Figures 15 and 16 provide locations of the mitigation sites presented in Table 20.

4.20.2 Current Natural Resource Impacts

4.20.2.1 Current Proposed Miami Harbor Navigational Improvements

Table 21 summarizes the proposed navigational improvements for the Recommended Plan and projected impact estimates available at this time. The proposed improvements would impact an estimated total surface area of 415.6 acres including 7.9 acres of seagrass habitat, 49.4 acres of hardbottom/reef habitat, 123.5 acres of rock/rubble habitat and 236.4 acres of unvegetated bottom.



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4.20.2.2 Direct and Indirect Natural Resource Impacts

As summarized in Table 21, the estimated natural resource impacts to the Port area resulting from the current proposed navigational improvements include:

- 7.9 acres of seagrass habitat (New impacts; 0.2 acres direct and 7.7 acres indirect)
- 49.4 acres of hardbottom/reef habitat (3.3 acres new impacts)
- 123.5 acres of rock/rubble habitat (Previously impacted)
- 236.4 acres of unvegetated bottom (23.3 acres new impacts)

4.20.3 Future Natural Resource Impacts

The 1999 Port Master Development Plan contains recommended plans for Port expansion and maintenance through the year 2015 (Miami-Dade County 1999c). This is the best source for listing and quantifying anticipated Port needs for the foreseeable future. Activities that may involve work in the water and therefore have the potential for natural resource impacts include the following:

- Dodge Island Turning Basin and Cut Expansions
- Filling of southwest corner of Dodge Island
- Filling of northwest corner of Dodge Island near Terminals 1 through 5
- Filling of northeast corner of Dodge Island to create new Terminal 19
- Construction of a Maritime Park (location not finalized at this point)
- Design and construct tunnel connecting Watson Island to Dodge Island

Some future activities can be specifically stated (e.g., filling of southwest corner of Dodge Island) while others are only conceptual at this stage (e.g., construction of a Maritime Park). Impact acreages for specific habitats that can be quantified at this time appear in Table 22.

Table 21 Summary of Recommended Plan Impacts

	Footprint Area	Seagrass Acres		Unvegetated Bottom Acres		Rock Rubble w/ Algal Sponge Community Acres		Rock/Rubble w/ Live Bottom Acres		Low Relief Hardbottom/Reef Reef Acres		High Relief Hardbottom/Reef Acres	
		Direct (New)	Side Slope Equilibration (Previous)	New	Previous	New	Previous	New	Previous	New	Previous	New	Previous
Component 1C	210.6	0	0	66.9	1.3	41.3	0	51.7	0	28.1	0.6	18.0	2.7
Component 2A	0.6	0	0	0	0	0	0.6	0	0	0	0	0	0
Component 3B	50.5	0	0.1	19.1	5.3	25.2	0.9	0	0	0	0	0	0
Component 4	49.6*	0	0	0	0	0	0	0	0	0	0	0	0
Component 5A	153.8	0.2	7.6	127.1	16.7	2.3	1.5	0	0	0	0	0	0
Totals	415.6	7.9		236.4		71.8		51.7		28.7		20.7	

*No impacts

Table 22 Summary of Future Planned Navigational Improvements to Miami Harbor

NAVIGATIONAL IMPROVEMENT	PRELIMINARY IMPACT ESTIMATES (AC)		
	Seagrass	**Unvegetated Bottom**	**Total Surface Area**
Dodge Island Turning Basin Expansion Dodge Island Cut Expansion, Filling of S.W. Dodge Island	16.8	8.6	25.4
Filling of N.W. Dodge Island	0	<2.0**	<2.0
Filling of N.E. Dodge Island	0	<1.5	<1.5
Totals	16.8	12.1	28.9

Note: This table is limited to planned improvements for which estimated impact acreage information was available at the time of this report.

** Acreage figures and habitat types are estimates based on aerial photographs.

4.20.4 Overview of Cumulative Impacts

The full picture of natural resource impacts at the Port is appropriately viewed over the 45-year timeframe of Port activity covered in this report (1970 – 2015). Since the advent of NEPA in 1969, the CWA in 1972 and other Federal actions such as the "no net loss" of habitat initiative (1989), increasing focus on the adverse natural resource impacts of certain human activities has caused a careful and due consideration of the extent of and alternatives to those impacts. The decisions of city and county officials in the mid-1940s to keep the Port operation focused within the downtown area and expand on existing facilities rather than to relocate it to an entirely new area was a fortunate one from a natural resource standpoint. It resulted in relocation and expansion of the Port area directly adjacent to its previous site along Biscayne Boulevard, an area that had already been significantly altered by dredging. For this reason, the location and configuration of the Port has resulted in notable cumulative impacts on a local scale but minimal cumulative impacts on a regional scale over the long-term. Future planned improvements are focused on the best use of existing facilities and would therefore continue this trend.

Direct natural resource impacts associated with known past permitted, current proposed, and future planned navigational and improvements at the Port are summarized in Table 23. The total surface area is approximately 800 acres, about 69 percent (552 acres) of which involves some type of significant natural community (i.e., other than unvegetated). The past permitting impacts, totaling perhaps 349.9 acres, have been offset through mitigation. Mitigation would also be required to offset the unavoidable impacts of current proposed and future planned improvements as well.

Table 23 Cumulative Natural Resource Impacts

	IMPACT ESTIMATES (AC)			
HABITAT	**Past Permitted**	**Current Proposed**	**Future Planned**	**Total**
Seagrass	251.0*	7.9	16.8	275.7
Hardbottom/Reef	4.9	49.4 (3.3 N)	0	54.3
Rock/Rubble	94.0	123.5 (P)	0	217.5
Unvegetated	NR**	236.4	12.1	248.5
Total Acres Impacted	349.9	417.2	28.9	796.0

*Based on U.S. Fish and Wildlife Service statement in Appendix EIS-IV of USACE 1989. This number is considered to be a conservative estimate of seagrass impacts.
**NR = not reported. Acreage impact for this habitat was either not present or, if present, was not reported.
N = new impacts
P = previously impacted

Current proposed impacts consist of 7.9 acres of seagrass (7.7 acres impacted by side slope equilibration); 49.4 acres of hardbottom/reef (3.3 acres new impacts, 46.1 acres of previously impacted reef); 123.5 acres of previously impacted rock/rubble habitat and 236.4 acres of unvegetated bottom (23.3 acres new impacts, 213.1 acres of previously impacted unvegetated bottom). Though future impacts are unknown at this time, projected impacts are estimated at 22.8 acres of seagrass and 3.5 acres of unvegetated bottom. These improvements together involve about 25 percent of the cumulative impacts to significant natural resource communities.

While past impacts have been significant, impacts for currently proposed activities have been minimized and the probability of success for proposed mitigation measures are high.

With successful mitigation for currently proposed projects and minimal future impacts projected, cumulative impacts from past, present, and future Port expansion are considered adverse, but not significant. Of the 48.3 acres of resources impacted from past and currently proposed activities, over 55 percent are considered temporary in nature and involve dredging previously dredged and mitigated areas.

4.21 Unavoidable Adverse Impacts

Extensive plan formulation, plan revision, and plan refinement have avoided impacts to the environment, whenever possible, and minimized impacts to the environment to the greatest extent possible while still meeting the project need and purpose (Table 2). Efforts have been made to include all stakeholders in the planning process to assist the USACE in minimizing environmental impacts. There are several unavoidable environmental impacts of the proposed project to the natural environment.

There are two areas within the project that would have an impact on several species of seagrasses. These areas are located in Fisher Island Turning Basin and along the south side of Fisherman's Channel. The total acreage associated with all aspects of the project's impacts to the seagrasses is approximately 7.9 acres.

In addition, there would be some impacts to hardbottom communities within the confines of the Entrance Channel. Project impacts total approximately 49.4 acres for hardbottom/reef, of which 46.1 acres has been previously dredged.

4.22 Irreversible and Irretrievable Commitments of Resources

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. Energy used during construction activities would be an irreversible loss. Irreversible loss of resources in certain areas due to widening and deepening of project elements would occur; however it is proposed to mitigate for those unavoidable losses by restoring seagrass beds and through artificial reef construction.

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. Irretrievable resource impacts would occur with the loss of seagrass and hardbottom communities. Seagrass impacts would be mitigated by the restoration of similar habitat north of the impact area by filling in borrow holes associated with creation of the Julia Tuttle Causeway. The impacts to hardbottom communities would be mitigated at the permitted artificial reef sites.

4.23 The Relationship Between Local Short-Term Uses of Man's Environment and Maintenance of Long-Term Productivity

Long-term productivity in the form of enhanced and increased use of the Port would result from implementation of this project. The natural resource impacts associated with local use of the Port area are expected to be offset via a combination of on-site avoidance and minimization activities and mitigation. Some of the existing rock/rubble habitat in the channels, for example, would be temporarily impacted during construction but then would be left to recover, recommitting the productivity of this area over the long-term. In addition, new mitigation sites would commit previously non-productive areas to long-term natural resource productivity.

4.24 Energy Requirements and Conservation

The energy requirements for this project would be confined to fuel for dredges, labor transportation and other construction equipment. The No-Action Alternative would eliminate

these requirements, but would allow a continuation of and possible increase in navigational safety and economic problems.

4.25 Natural or Depletable Resources

No depletable resources would be used other than fossil fuels to power equipment and produce materials or equipment needed for dredging, disposal site construction, and pipeline construction.

4.26 Scientific Resources

The mitigation as proposed is planned to compensate for impacts. Monitoring of the mitigation areas would provide scientific information regarding the newly created and restored habitat areas and associated species.

4.27 Native Americans

No Native American community or any tribal lands are known to exist within the project or mitigation areas, therefore the project should not adversely impact Native Americans or any tribal lands.

4.28 Reuse and Conservation Potential

Reuse and conservation of material generated as a result of the Port's dredging program would be accomplished by placement of material into the dredge holes in Biscayne Bay to create seagrass beds for mitigation. Dredged rock and coarse material would also be used for artificial reef creation in designated permitted sites.

4.29 Indirect Effects

The Recommended Plan would have substantial positive regional and Federal economic impacts. Indirect effects would occur from implementation of the Recommended Plan from side slope equilibration that would affect 7.7 acres of seagrass beds.

4.30 Compatibility With Federal, State, and Local Objectives

The State Clearinghouse responded to scoping with comments and concerns from FDEP and the FFWCC. The letter concluded that “Based on the information contained in the notice of intent and the enclosed comments provided by our reviewing agencies, we have determined

that the referenced project is, at this stage, consistent with the Florida Coastal Management Program (FCMP). The letter also indicated that the SFRPC has identified goals and policies in its Strategic Policy Plan that may apply to the project (Appendix B). A Coastal Zone Management Plan Consistency Determination was completed and is included in Appendix D, and the State determined that the proposed project is consistent with the Florida Coastal Management Program (Appendix N).

4.31 Conflicts and Controversy

It is anticipated that there will be controversy regarding the level of impacts to natural resources and the means to mitigate for those impacts.

4.32 Uncertain, Unique, or Unknown Risks

Uncertainty in re-establishment of seagrasses exists. Monitoring and mitigation is proposed to compensate for the uncertainty. Less uncertainty exists relative to mitigation proposed for hardbottom/reef impacts and as such, no increases in mitigation ratios are proposed. If cutterhead dredging is used, additional impacts to hardbottom reefs would occur, but the extent is unknown. Pre- and post-construction monitoring would be performed to accurately determine those impacts and coordination with the resource agencies would determine appropriate mitigation. Some uncertainty also exists with potential effects of blasting on marine mammals and fish species.

4.33 Precedent and Principle for Future Actions

The proposed action does not establish any precedent for further improvements at the Port.

4.34 Environmental Commitments

Environmental commitments include:

- Implement best management practices for construction and include incentives in the RFP for minimizing environmental impacts
- Abide by requirements of endangered species consultation
- Comply with the blasting plan
- Follow requirements of the State Water Quality Certification
- Mitigate as proposed
- Conduct monitoring of mitigation sites according to agreements with the resource agencies.

5.0 MITIGATION FOR ADVERSE IMPACTS

This section outlines the preferred options for providing compensatory mitigation for unavoidable impacts to seagrass and offshore hardbottom/reef habitats impacted by implementation of Alternative 2 (Recommended Plan) considered in this document (see Appendix J for additional details). Mitigation is proposed for seagrass and hardbottom/reef habitats where new construction or dredging is proposed. All of these habitat types are considered EFH by the SAFMC and NMFS (SAFMC 1998). Mitigation is not proposed for dredging the rubble and unvegetated bottom types within the channel since dredging was previously performed in the channel and recovery is expected to be rapid. Over 25 mitigation options ranging from significant tidal and mangrove habitat restoration in south Biscayne Bay to restoring seagrass habitat in north Biscayne Bay were considered for mitigating seagrass impacts. Based on detailed analysis and significant agency coordination, restoring seagrass habitat in north Biscayne Bay was the preferred option. Artificial reef construction using dredged rock from the entrance channel was the only option considered to meet mitigation requirements for impacts to hardbottom/reef habitat. A summary of the preferred mitigation options is provided below. The Mitigation Plan found in Appendix J includes a revised review of mitigation options evaluated, agency requirements, the preferred plan and a review of the effectiveness of preferred restoration options. Additional site-specific documentation is available in Appendix L.

5.1 Mitigation Plan

Seagrass Impacts and Mitigation

Direct impacts to seagrass communities would be restricted to the widening of Fisherman's Channel and the Fisher Island Turning Basin and would include the permanent loss of 0.2 acre of mixed beds of seagrass. Approximately 7.7 acres of indirect losses would occur from the natural equilibration of the side slopes based on the methodology described in Appendix G. Based upon coordination with the resource agencies and comments received on the DEIS, restoration of approximately 24 acres of seagrass beds is proposed as compensation for unavoidable impacts.

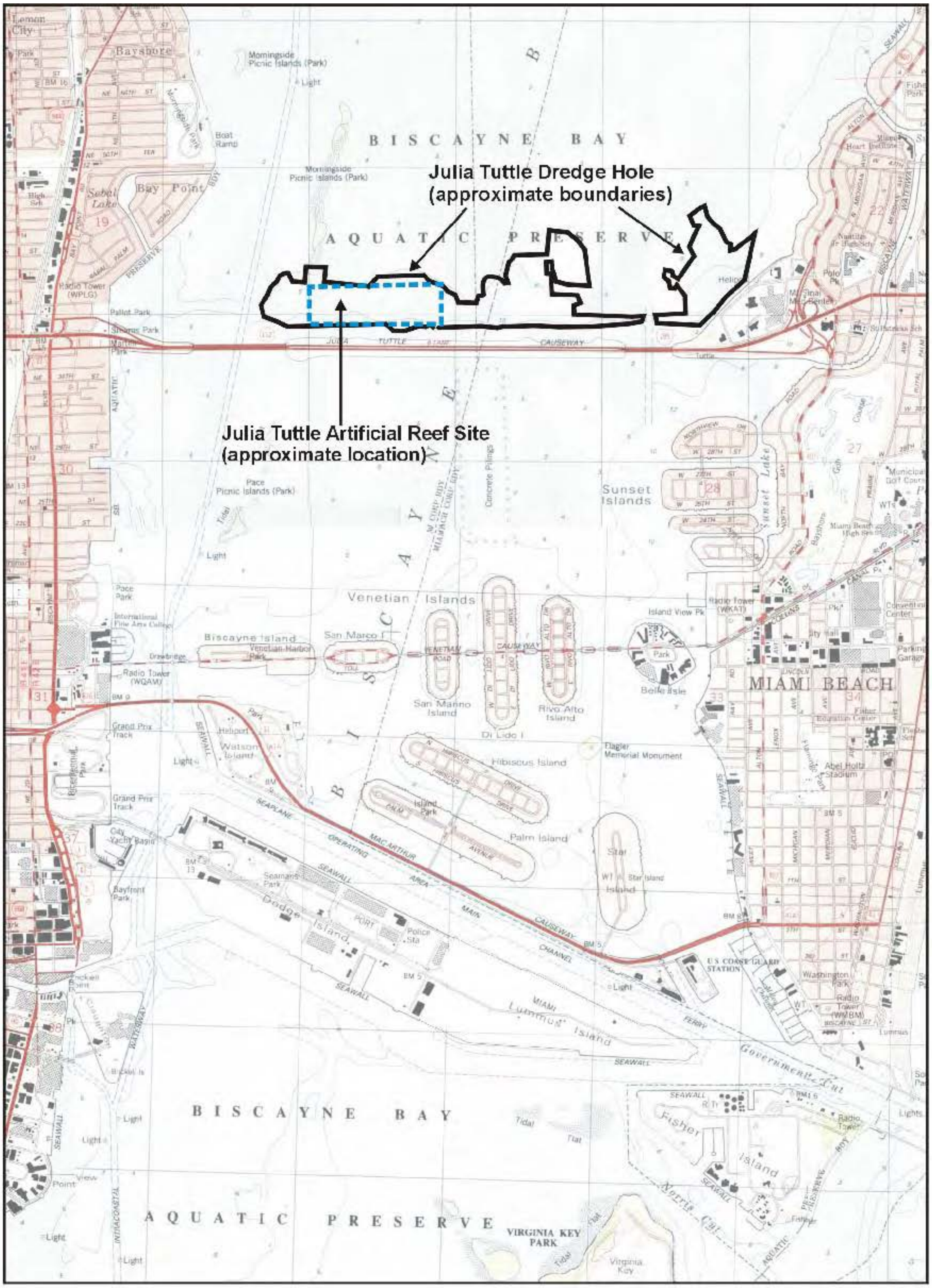
In order to replace local seagrass functions and values, restoration will be implemented within Biscayne Bay, preferably in areas where seagrass once occurred and is now absent due to past anthropogenic activities such as dredging. Seagrass habitat will be restored by filling approximately 24 acres of old borrow areas located in the Julia Tuttle dredge hole, the proposed seagrass mitigation area North Biscayne Bay (Figure 16). Evaluations of the areas within the dredge hole were conducted in June 2002, July 2003, and October 2003 to determine the most appropriate site for seagrass mitigation within the proposed seagrass mitigation area. An approximately 24-acre site, known as the east central dredge hole,

appears to be the most suitable mitigation area. The mitigation plan presented in the DEIS has been revised based on the results of the subsequent surveys of the proposed mitigation site. A conceptual approach is included in Appendix J.

Hardbottom Impacts and Mitigation

New impacts to low relief hardbottom/reef and high relief hardbottom/reef total 0.6 acre and 2.7 acres, respectively. Based on the Habitat Equivalency Analyses (HEA) calculations, direct impacts to hardbottom/reef would require the creation of artificial reef habitat at an effective mitigation ratio of 2:1 for high relief hardbottom/reef habitat and an effective mitigation ratio of 1.3:1 for low relief hardbottom/reef habitat. Mitigation reefs would be constructed in two different designs, to reflect the differences in the habitat structure of the two types of hardbottom/reef habitat to be impacted. The proposed mitigation would be type-for-type, to reflect the ecological differences between the different reef types impacted. A total of 0.8 acre of low relief-low complexity (LRLC) reef would be required to mitigate for the new low relief reef and previously impacted hardbottom habitat. A total of 5.4 acres of high relief-high complexity (HRHC) reef would be required to mitigate for the high relief impact. Reefs would be constructed at proposed artificial reef sites to be managed by DERM (Figure 17).

Limestone rock excavated from the Entrance Channel would be used in reef construction. Artificial reef construction will be conducted at one or two of the sites located south of the entrance channel identified in Appendix L. The material would be deployed in a shore-parallel orientation typical of natural reefs. This reef design would have a vertical relief of approximately 3-5 feet and rocks would be deployed to provide the maximum structural complexity and to provide refugia for cryptic and reclusive species. As interstitial sand patches associated with reef habitat are thought to be important in the ecological function of the reef habitat, the reef footprint would contain approximately 20 percent open sand surface. Temporary buoys delineating the deployment strip would mark areas for deployment. Corner buoys for the sites shall be placed using DGPS with sub-meter accuracy. Natural limestone provides an ideal substrate for the establishment of a fouling community and colonization by the common reef community species. HRHC reefs are intended to provide persistent habitat with higher complexity and habitat diversity than LRLC hardbottom or reefs.



Source: Port of Miami

Proposed Seagrass Restoration Area	
Miami Harbor General Reevaluation Report Final Environmental Impact Statement	
Scale: NTS	Drawn By: MR
Date: Sept, 2003	
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J00-499
	Figure 16

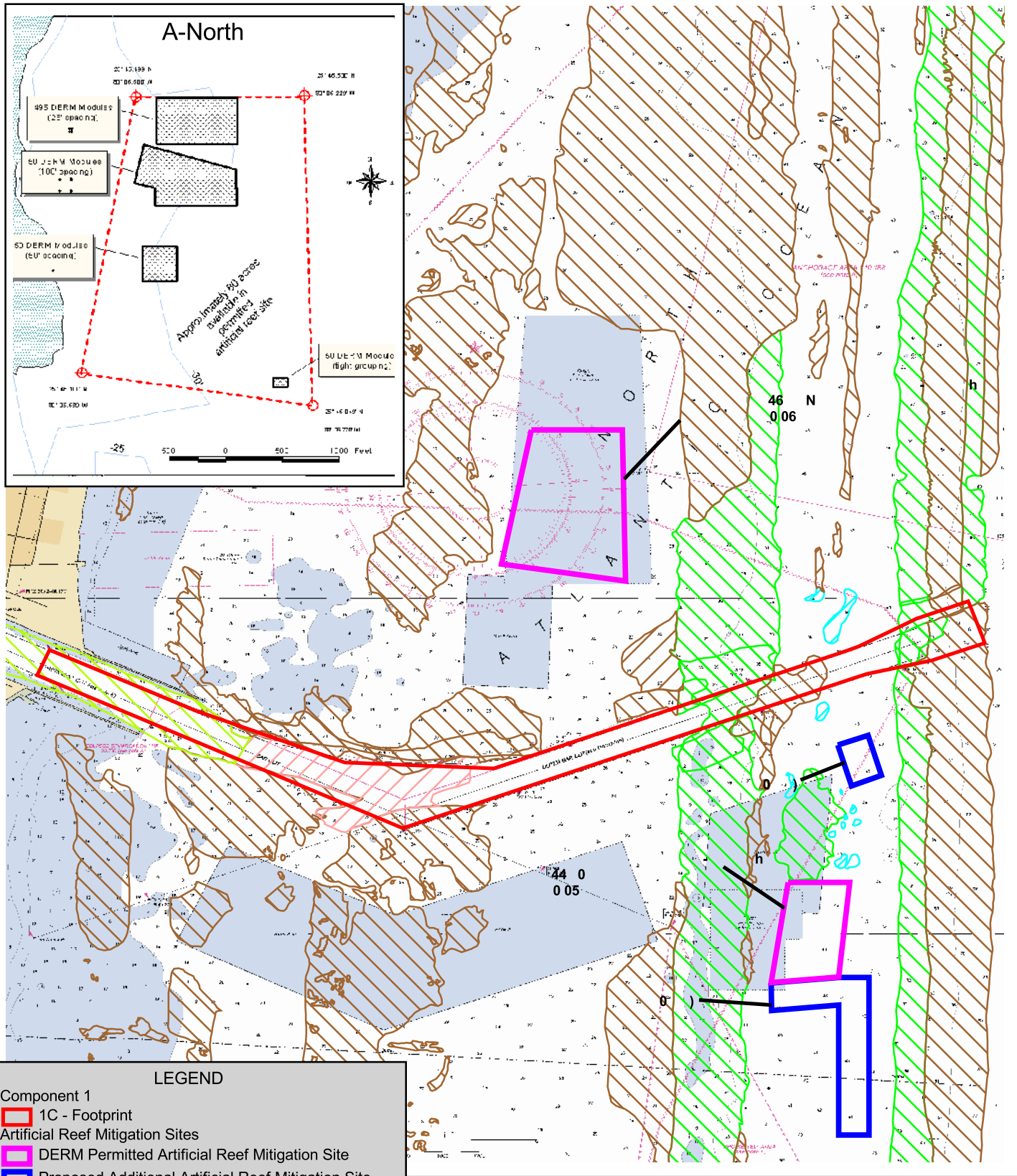


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	Figure 17

LRLC reefs would have a vertical relief of 1 to 2 feet and would be placed inshore of, and shallower than, HRHC reefs. It is recognized that the LRLC reefs may be periodically buried by shifting sands, like the low relief natural reefs they are intended to mimic. This does limit their habitat value to some extent, but it has been suggested (albeit without much empirical evidence) that this sort of ephemeral, low relief habitat may be particularly important in supporting the recruitment and post settlement survival of juvenile fishes. Dredged limestone rock placement should provide LRLC habitat. To provide interstitial sand habitat, approximately 20 percent of the LRLC reef footprint shall be open sand. Deployment sites would be delineated as outlined above for HRHC reefs.

Construction of mitigation reefs would take place during dredging of the Entrance Channel and Fisherman's Channel, as rock material suitable for reef building is excavated from these channels .

The monitoring program for the mitigation reefs would consist of both physical and biological components. Physical monitoring would assess the degree of settling of the reef materials, and biological monitoring would assess populations of algae, invertebrates, and fishes, as compared with concurrent control sampling of natural reefs. Monitoring would be conducted annually in the summer months. In order to supplement quantitative monitoring efforts and provide a permanent record of reef conditions and biota, each sampling effort would include representative video transects of the mitigation reefs.

6.0 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

Compliance with Federal Statutes, Executive Orders, and polices have been considered for the three project alternatives. The following sections describe the various requirements and the compliance status for each of the alternatives.

6.1 National Environmental Policy Act of 1969

Environmental information on the project has been compiled and this Environmental Impact Statement (EIS) was prepared. The project is in full compliance with the National Environmental Policy Act.

6.2 Endangered Species Act of 1973

Consultation was initiated with NMFS and FWS upon submittal of Biological Assessments (Appendix H). A Biological Opinion dated February 26, 2003 was received from the National Marine Fisheries Service concerning species under their jurisdiction, and a concurrence with the USACE finding of not likely to adversely affect species under FWS jurisdiction was included in the Final CAR dated June 17, 2003 (Appendix K).

6.3 Fish and Wildlife Coordination Act of 1958

This project has been coordinated with the FWS. The Final CAR was received from FWS on June 17, 2003 (Appendix K). This project is in full compliance with the Act.

6.4 National Historic Preservation Act Of 1966

The Archeology and Historic Preservation Act (PL 93-291), and Executive Order 11593 have been complied with. Archival research and field investigations have been conducted for the proposed channel realignment and for new disposal areas. Concurrence of compliance with this Act has been received from the State Historic Preservation Officer. Impacts to any resources included in or eligible for inclusion in the National Register of Historic Places would be avoided. If the USACE constructs its reef mitigation sites in localities currently not permitted by DERM, then the USACE will coordinate the placement of this material with SHPO.

6.5 Clean Water Act of 1972

The project will be in compliance with this Act. A Section 401 Water Quality Certification will be obtained prior to construction. All state water quality standards will be met. A Section 404(b)(1) evaluation is required for this action and is included in Appendix C.

6.6 Clean Air Act of 1972

The short-term impacts from dredge emissions and other construction equipment associated with the project would not significantly impact air quality. No air quality permits would be required for this project. Miami-Dade County is designated as an attainment area for Federal air quality standards under the Clean Air Act. Because the project is located within an attainment area, EPA's General Conformity Rule to implement Section 176(c) of the Clean Air Act does not apply and a conformity determination is not required.

6.7 Coastal Zone Management Act of 1972

A Federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix D. The State of Florida reviewed the DEIS and on May 14, 2003, determined that the proposed project is in compliance with the Florida Coastal Management Program (Appendix D).

6.8 Farmland Protection Policy Act of 1981

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

6.9 Wild and Scenic River Act of 1968

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

6.10 Marine Mammal Protection Act of 1972

The USACE has initiated consultation with NMFS and FWS under the Marine Mammal Protection Act of 1972. A Small Take Authorization (STA) application will be submitted in the near future for blasting activities conducted in the Jacksonville District. After issuance of the STA, a Letter of Authorization will be requested to authorize the take of marine mammals associated with the use of blasting as a construction technique at Miami Harbor.

6.11 Estuary Protection Act of 1968

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

6.12 Federal Water Project Recreation Act

The principles of the Federal Water Project Recreation Act, (Public Law 89-72) as amended, do not apply to this project.

6.13 Fishery Conservation and Management Act of 1976

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

6.14 Submerged Lands Act of 1953

The project would occur on submerged lands of the State of Florida. The project has been coordinated with the State and is in compliance with the Act.

6.15 Coastal Barrier Resources Act (CBRA) and Coastal Barrier Improvement Act (CBIA) of 1990

The proposed action has been coordinated with the FWS under the CBRA and CBIA and is in compliance with the Acts.

6.16 Rivers and Harbors Act of 1899

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

6.17 Anadromous Fish Conservation Act

Anadromous fish species would not be affected. The project has been coordinated with the NMFS and is in compliance with the Act.

6.18 Migratory Bird Treaty Act and Migratory Bird Conservation Act

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

6.19 Marine Protection, Research and Sanctuaries Act

The term "dumping" as defined in the Act [3(33 U.S.C. 1402) (f)] does not apply to the placement of material for a purpose other than disposal (i.e. placement of rock material as an artificial reef or the construction of artificial reefs as mitigation). Therefore, the Marine Protection, Research and Sanctuaries Act, does not apply to this project as currently proposed, however if any of the dredged material is disposed in the ODMDS, then this act will apply. Concurrence from EPA under Section 103 of the Act would be required along with any required testing of the material for suitability for ocean dumping. More information on the ODMDS site can be found in the Preliminary Assessment, Dredged Material Management Plan in Appendix E to the General Reevaluation Report. The disposal activities addressed in this EIS have been evaluated under Section 404 of the Clean Water Act.

6.20 Magnuson-Stevens Fishery Conservation And Management Act

An EFH assessment describing existing EFH and potential impacts to EFH with project implementation was prepared and submitted to NMFS with the DEIS. Therefore, the project is in compliance with this Act.

6.21 E.O. 11990, Protection of Wetlands

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

6.22 E.O. 13089, Coral Reef Protection

The proposed action would affect United States coral reef ecosystems as defined in the Executive Order. Precautions would be implemented during construction to minimize impacts. Artificial reefs would be constructed to mitigate for any reef impacts associated with dredging activities. Therefore, the project is in compliance with the goals of this Executive Order.

6.23 E.O. 11988, Flood Plain Management

The project is in the base flood plain (100-year flood) and has to be evaluated in accordance with this Executive Order. The project is in compliance.

6.24 E.O. 12898 Environmental Justice

The purpose of the proposed action is to provide increased safety, efficiency and lower costs for navigation while protecting the environment. Existing Port facilities are not easily accessible to some larger vessels that must await favorable tidal conditions, because of depth limitations in parts of the channel, and other large vessels can only use the channel if they are "light-loaded." The proposed activity would not (a) exclude persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color or national origin, nor would the proposed action adversely impact "subsistence consumption of fish and wildlife." The proposed action would benefit shipping and the general economy including minority and low-income populations.

7.0 PUBLIC INVOLVEMENT

7.1 Scoping and Agency Coordination

In accordance with the National Environmental Policy Act (NEPA), an information letter was sent to interested parties on January 6, 2000. In addition, all parties were invited to participate in the plan formulation process by identifying any additional concerns on issues, studies needed, alternatives, procedures, and other matters related to the project. A local, state, and Federal resource agency meeting was held on March 13, 2000, to determine the areas of coverage for an environmental baseline resource survey. A meeting followed on November 1, 2000, with those resource agencies to review preliminary results. Appendix A and Appendix B include all documents associated with scoping including comments received from various stakeholders during the scoping process. A Notice of Intent (NOI) was published in the Federal Register (Volume 66, No. 167:45290) on August 28, 2001 informing the public of the USACE's intent to prepare a Draft EIS.

A Notice of Availability (NOA) was published in the Federal Register (Volume 68, No. 80:20386-20387) on April 25, 2003 to advertise the release of the Draft EIS for public review and comment. A public meeting was held on May 6, 2003 at the Port of Miami to present the results of the Draft GRR and Draft EIS and to give the public an opportunity to express their views and furnish specific data to support their views for consideration in preparing the final report. Written comments from commenting federal, state, and local government agencies, various private and non-profit organizations and individuals are included in Appendix N along with the official responses from the USACE.

Federal agencies involved included the USACE, the U.S. Coast Guard (USCG), the Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), and the National Marine Fisheries Service (NMFS). State agencies included the Florida Department of Environmental Protection (FDEP), Florida Fish and Wildlife Conservation Commission (FFWCC), State Historic Preservation Office (SHPO), and the Florida Department of Transportation (FDOT). Local agencies included Miami-Dade County Department of Environmental Resources Management (DERM), South Florida Regional Planning Council (SFRPC), and the City of Miami. Non-Government Organizations/Institutions included the Pilots and the Biscayne Bay Regional Coordination Team (formerly the Biscayne Bay Partnership Initiative).

7.2 List of Recipients

See Appendix M.

7.3 Comments Received and Response

Comments received regarding the Draft EIS have been fully addressed and are included in Appendix N of this document.

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