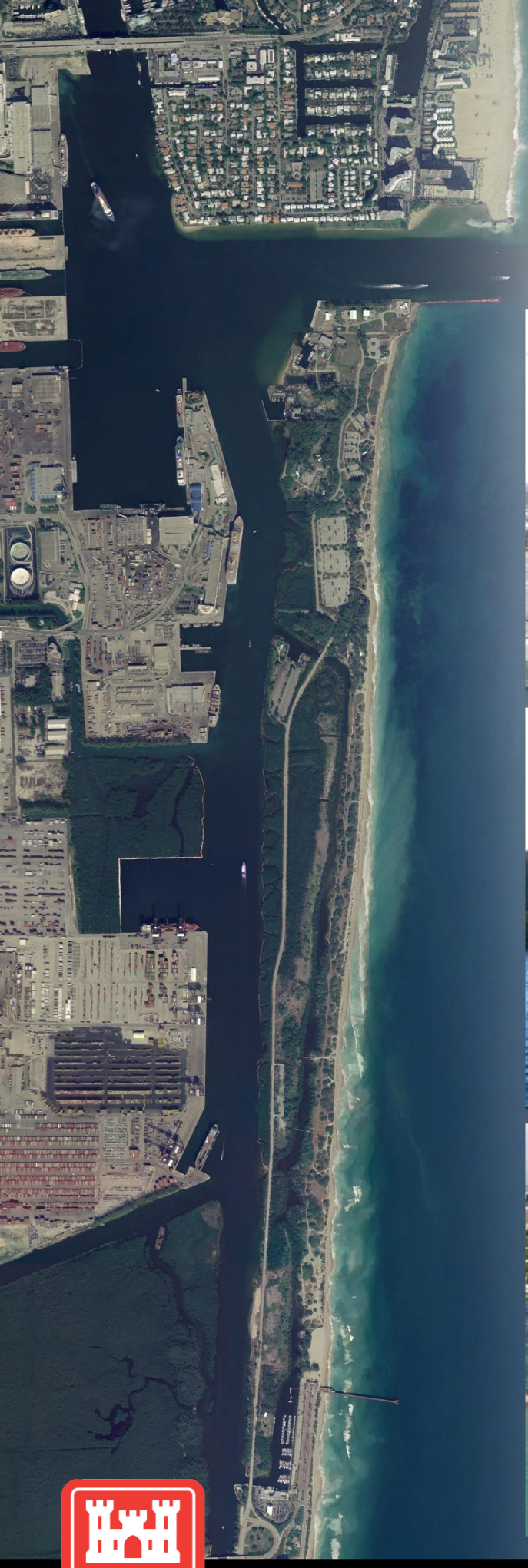
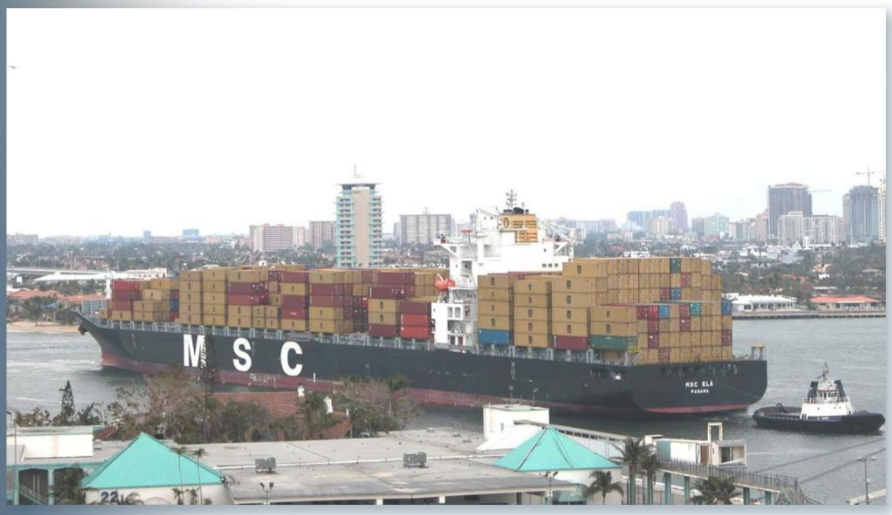


FINAL Feasibility Report and Environmental Impact Statement

PORT EVERGLADES HARBOR Navigation Study

Broward County, Florida

March 2015



Executive Summary

Description of Report: This report presents an evaluation of alternative plans considered for navigation improvements at Port Everglades (Broward County), Florida, the Recommended Plan, cost-sharing and cost allocation, and implementation requirements. An Environmental Impact Statement (EIS) follows the main text of this document and evaluates impacts on the quality of the human environment, effects of the Recommended Plan, and proposed mitigation.

Purpose and Need: The purpose of the Port Everglades Harbor feasibility study is to assess Federal interest in navigation improvements resulting in transportation cost savings to the nation. The navigation project at Port Everglades is authorized by the River and Harbors Act of 1930, as amended. This feasibility study was initially authorized in House Document 126, 103rd Congress, 1st Session, and House Document 144, 93rd Congress, and by a resolution of the House Committee on Transportation dated May 9, 1996. In response to the study authority, the feasibility study was initiated. The non-federal sponsor is Broward County represented by its Board of County Commissioners.

Port Everglades is the largest Florida Atlantic coast port in terms of total tonnage, one of three ports in Florida receiving petroleum, is ranked 32nd nationally in tonnage, and is the 2nd busiest cruise port in the world based on multi-day passengers. Port Everglades has land available for growth in warehousing and staging, and has access to rail, air and roadway transportation systems for efficient movement of goods. The continued long-term population growth in south Florida in combination with an active Mediterranean, South American, and Caribbean trade connection creates an opportunity for future growth at Port Everglades, especially for the transport, docking and loading/unloading of container ships.

As a result of increased traffic and overall growth in vessel size, improvements including deepening and widening were considered to help alleviate vessel congestion and improve transit efficiency and maneuverability. In addition, there are strong unpredictable crosscurrents in the Entrance Channel due to the proximity of the Gulf Stream and strong opposing nearshore currents.

The scope of the feasibility study includes;

- widening and deepening the major channels and basins within the Port,
- expanding into the Dania Cutoff Canal, and
- deepening the turning basin (Turning Notch) at the end of the Southport Access Channel.

Alternative Plans: Widening and deepening measures were evaluated throughout the Port. The Port is comprised of three main areas: Northport, Midport, and Southport. The Northport terminal area serves multiple cargoes and vessel types, including cruise operations, liquid bulk unloading (and occasionally loading), small container vessels, general cargo, roll-on/roll-off ("RO/RO") cargo, float-on/ float-off cargo (yachts and other vessels), military berthing, and lay-berth areas. The Midport terminal area serves cruise ships, containerships up to Panamax size, bulk vessels, lift-on/lift-off ("LO/LO") cargo, RO/RO cargo, naval ships, harbor tugboats, and

smaller lay-in vessels. Southport services predominantly container ships and has the largest area for growth.

The structural measures evaluated were grouped into six different plans based on structural characteristics, environmental impacts, and economic benefits. *Plan 1* focused on solutions for petroleum vessel constraints. *Plan 2* focused on container ship constraints (which incidentally solves the petroleum vessel constraints). *Plan 3* focused on increasing the number of berths and improving port operations by relocating fleets without impacting environmentally sensitive areas. *Plan 4* focused on improving operational efficiency in the Main Turning Basin while minimizing environmental impacts. *Plan 5* focused on solutions for all of the port constraints and creating opportunities for efficiencies. *Plan 6* focused on accommodating light-loaded Post-Panamax container vessels and reduced impacts on environmentally sensitive areas. Different versions and different channel depths were considered for each plan. Channel width was optimized to improve maneuverability and minimize environmental impacts, while depth was optimized to maximize economic benefits.

Recommended Plan: The Recommended Plan is the locally preferred plan (LPP) recommending deepening to 48 feet. After evaluation and comparison, the NED plan was identified as 47 feet. Included in the 47-foot alternative is deepening, widening, and extending the Outer Entrance Channel, deepening the Inner Entrance Channel, and deepening and widening the Main Turning Basin, Southport Access Channel, and Turning Notch. The NED plan is the plan that reasonably maximizes net benefits. USACE ER 1105-2-100 Exhibit G-1 3.c directs that "where two cost-effective plans produce no significantly different levels of net benefits, the less costly plan is to be the NED plan." The 48-foot alternative did result in higher net benefits by approximately $400,000 but was only 1.3% greater benefits than at 47 feet; as such the 47-foot plan was determined to be the NED plan. The non-federal sponsor, Broward County, requested an LPP of 48-feet on August 14, 2014. The ASA (CW) approved the LPP on October 16, 2014. The Recommended Plan includes deepening the Federal channel to 48 feet from the Outer Entrance Channel to the Main Turning Basin, Southport Access Channel, and Turning Notch with associated widening and including an extension of the Outer Entrance Channel. Through Authorization of the recommended plan, the existing limits of the Federal channel will be expanded (see **Figure A**). The LPP includes the same recommended navigation features (i.e. areas of widening) as the NED plan with the exception of the one foot of additional depth.

To compensate for the unavoidable adverse effects of the action on various significant habitat types, USACE has proposed the following: mitigate for (a) the removal of approximately 7.41 acres of vegetated and unvegetated seagrass habitat (including that within the new channel footprint and resulting side slopes) and (b) the loss of approximately 1.16 acres of mangroves in the project footprint through use of ecosystem benefits from a previously permitted restoration project at West Lake Park (Broward County, FL), which is currently under design. Mitigation for impacts will involve use of approximately 2.4 seagrass functional units and approximately one (1) mangrove functional unit, respectively, from that project, located in a county-operated, state-owned, natural area immediately to the south of the project area. USACE has also proposed the following: mitigate for (c) the direct removal of approximately 14.62 acres of complex, high-profile, linear and spur/groove reef habitat through the creation of approximately 5 acres of artificial reef with the transplantation of 11,502 corals from the impact site to the artificial reef

and the outplanting of approximately 103,000 nursery raised corals. Additional mitigation will be provided due to any detectable, incidental, direct impacts of dredging equipment and indirect impacts on hardbottom habitats due to turbidity/sedimentation. These mitigation components were determined to be economic "Best Buys" from among mitigation alternatives.

Construction of the Recommended Plan involves dredging of approximately 5.5 million cubic yards of material. The widening/extension of the project will increase the channel by approximately 2,033,000 square feet, increasing the estimated annual shoaling rate for the increased project footprint by 5,740 cy/yr to total rate of 27,440 cy/yr. All dredged material will be placed in the ocean dredged material disposal site (ODMDS). Expansion of the site is underway. The U.S. Environmental Protection Agency (EPA) has drafted an Environmental Assessment (EA) and the public comment period has concluded on the document. EPA is working to finalize the EA and is scheduled to complete the formal designation process including rule making and publication in the Federal Register in 2015.

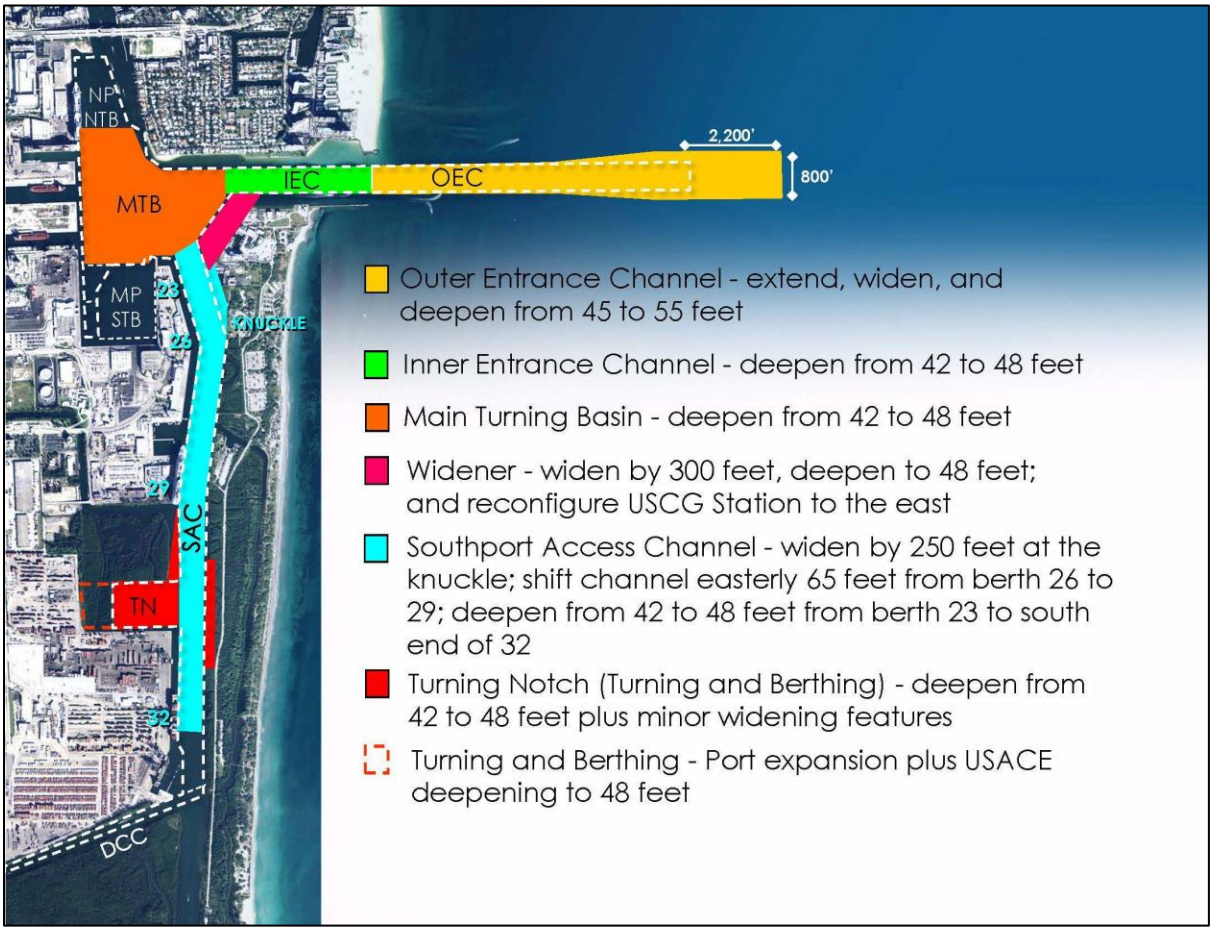


Figure A: Recommended Plan

Table A: Recommended Plan Costs and Benefits

Depth	Plan	AAEQ Costs	*AAEQ IDC*	AAEQ Benefits	AAEQ Net Benefits	BCR 3.375%	BCR 7%
47ft	NED	$ 15,900,000	*$ 1,200,000*	$46,900,000	$ 31,000,000	2.9	1.5
48ft	LPP	$ 16,860,000	*$ 1,400,000*	$48,240,000	$ 31,400,000	2.9	1.5

**AAEQ IDC costs are included in the AAEQ Costs.*

Benefits, Costs, and Implementation of the Recommended Plan: Project benefits are based on transportation cost savings. These benefits, or transportation cost savings, are attributable to enabling vessels to use their capacity more efficiently and/or reduced susceptibility to tidal delays and congestion. The project first cost of the Recommended Plan is estimated at $323 million at October 1, 2014 price levels with the Federal share of the Recommended Plan $220 million and the non-federal share $103 million. The additional deepening costs of dredging one additional foot from 47 feet to 48 feet are 100% non-federal, Table B. After authorization, it is estimated that the project could be constructed in approximately 5 years, assuming sufficient Federal and non-federal appropriations to support award of construction contracts. Additionally, **Table C** displays the recommended plan cost sharing table for the FY16 rates as displayed in the Cost Certification (**Appendix F**) at the October 1, 2015 price levels.

Table B: 48-Foot Recommended Plan Cost Sharing Table

(October 1, 2014 Price Levels and FY15 discount rate)
Cost Summary
Recommended Plan/Locally Preferred Plan (Deepen to 48 feet)

General Navigation Features	Total Cost	Federal Share	Non-federal Share
	20-45 ft.	75%	25%
	46-47 ft.	50%	50%
	48 ft.	0%	100%
Mobilization	$3,100,000	$2,100,000	$1,000,000
Dredging and Disposal	$147,800,000	$93,000,000	$54,800,000
Environmentally Friendly Bulkhead[6]	$61,000,000	$45,800,000	$15,200,000
Associated General Items[1]	$5,100,000	$3,200,000	$1,900,000
Environmental Mitigation	$52,800,000	$37,100,000	$15,700,000
Mitigation (Mangrove, Seagrass, Art Reef w/Corals)	*$35,600,000*	*$25,400,000*	*$10,200,000*
Monitoring	*$900,000*	*$700,000*	*$200,000*
Coral Propagation	*$16,300,000*	*$11,000,000*	*$5,300,000*
Pre-Construction, Engineering, and Design	$5,600,000	$3,900,000	$1,700,000
Construction Management (S&I)	$8,400,000	$5,900,000	$2,500,000
USCG Reconfiguration	$38,900,000	$29,200,000	$9,700,000
Subtotal Construction of GNF	$322,700,000	$220,200,000	$102,500,000
Lands and Damages[2]	-	-	-
Total Project First Costs	$322,700,000	$220,200,000	$102,500,000
Non-federal Construction Costs (Local Service Facilities)	$37,800,000	$0	$37,800,000
Non-federal Berthing Area Costs	$13,400,000	$0	$13,400,000
Aids to Navigation[3]	$200,000	$200,000	$0
10% GNF Non-Federal[4]	$0	($30,500,000)	$30,500,000
Total Cost Allocation[5]	$374,100,000	$189,900,000	$184,200,000

1. Includes Turbidity Monitoring and Dedicated Marine Animal Observer

2. Real Estate Costs: There are no LERR for this project, there is $12,000 under PED for minimal administrative costs.

3. Navigation Aids - 100% Federal

4. The Non-Federal Sponsor shall pay an additional 10% of the costs of GNF of the NED plan, pursuant to Section 101 of WRDA 86. The value of LERR shall be credited toward the additional 10% payment. The value of lands provided for mitigation including the sponsor's incidental cost of acquisition are not creditable against this 10% since that value is cost shared as a GNF.

5. In addition to these costs the AAEQ increases in O&M costs are approximately $55,500. Future O&M costs are due to the channel widening and are 100% Federal. There is no increase in O&M costs from 47 to 48 feet.

6. These bulkheads are required to stabilize the shoreline as the channel is deepened and widened the natural side slopes will fall. To prevent damage to John U Lloyd and the Conservation Easement from slide slopes, these bulkheads will be placed along portions of the SAC to maintain the existing shoreline.

Coordination with Agencies and the Public: To ensure that the public and Federal, tribal, state, and local agencies were kept informed about progress on technical analyses and policy issues, public meetings were held throughout the study period, EIS Section 1.6.

Areas of Controversy and Unresolved Issues: The Jacksonville District continues to coordinate with resource agencies and other stakeholders concerning fish and wildlife habitat, threatened or endangered species, and designated critical habitat. Discussions include assessed impact acreages, functional assessment output, and potential compensation derived from the proposed mitigation alternatives. The Jacksonville District has coordinated multiple surveys, conducted a review through the USACE environmental center of expertise of functional assessment methods and outputs, and applied experience from other recent deepening projects. USACE worked closely with the agencies to finalize the mitigation plan included in the Final EIS package.

FINAL
FEASIBILITY REPORT
AND ENVIRONMENTAL IMPACT STATEMENT
ON
PORT EVERGLADES HARBOR NAVIGATION STUDY
BROWARD COUNTY, FLORIDA

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B	Economic Appendix
C	Real Estate Plan
D	Pertinent Correspondence
E	Dredge Material Management Plan
F	Cost Estimate

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1.0 STUDY INFORMATION

1.1 STUDY LOCATION

The Port Everglades Harbor is a major seaport located on the southeast coast of Florida in Broward County, (**Figure 1**). It is located in the cities of Hollywood, Dania Beach and Fort Lauderdale, with immediate access to the Atlantic Ocean. The entrance of the Port is approximately 27 nautical miles north of Miami Harbor, Florida, 31 nautical miles south of the Port of Palm Beach, and 301 nautical miles south of Jacksonville Harbor, Florida.

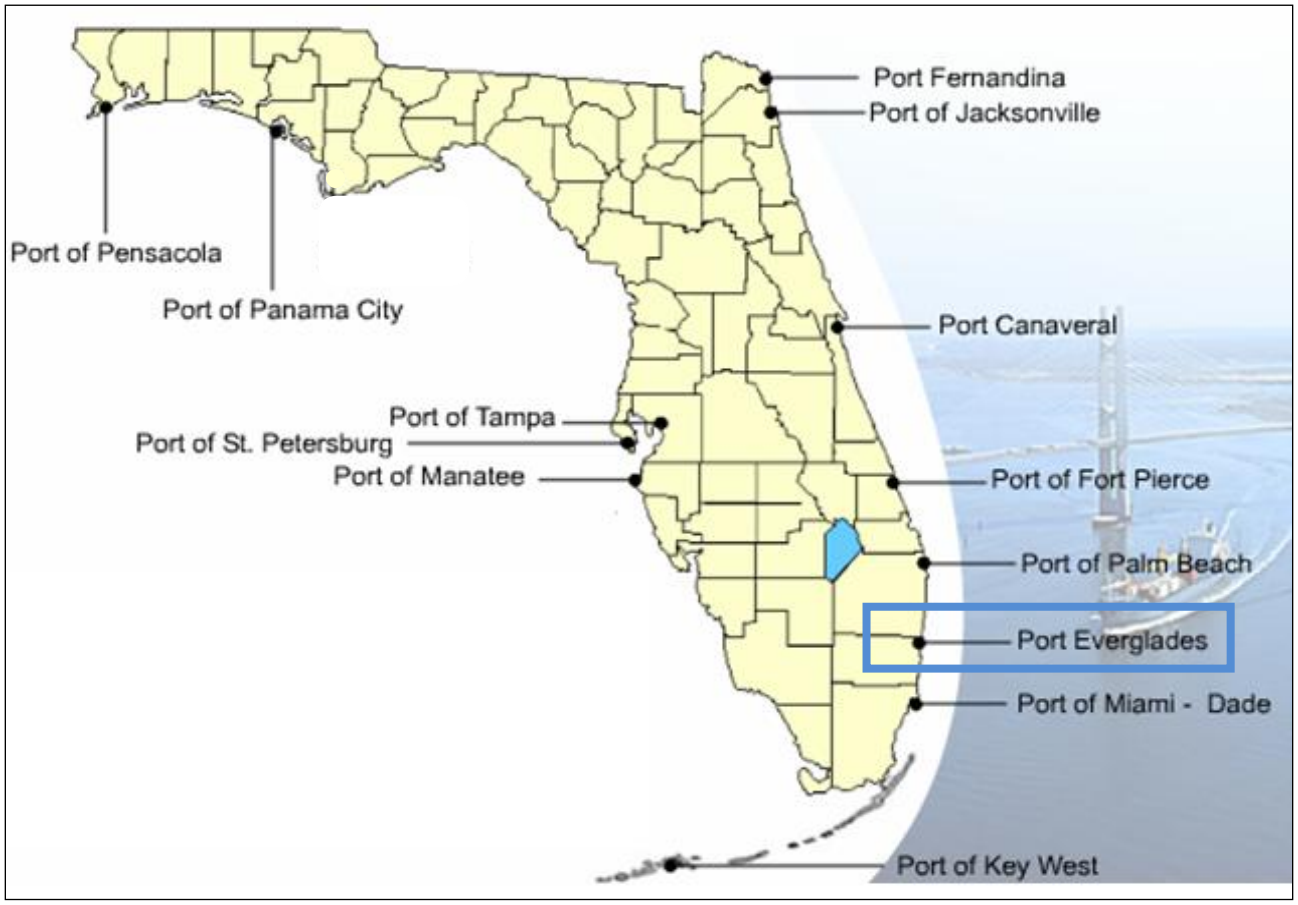

Figure 1: Florida Deep Draft Ports

Graphic was modified from Florida Ports Council (http://www.flaports.org/index.htm).

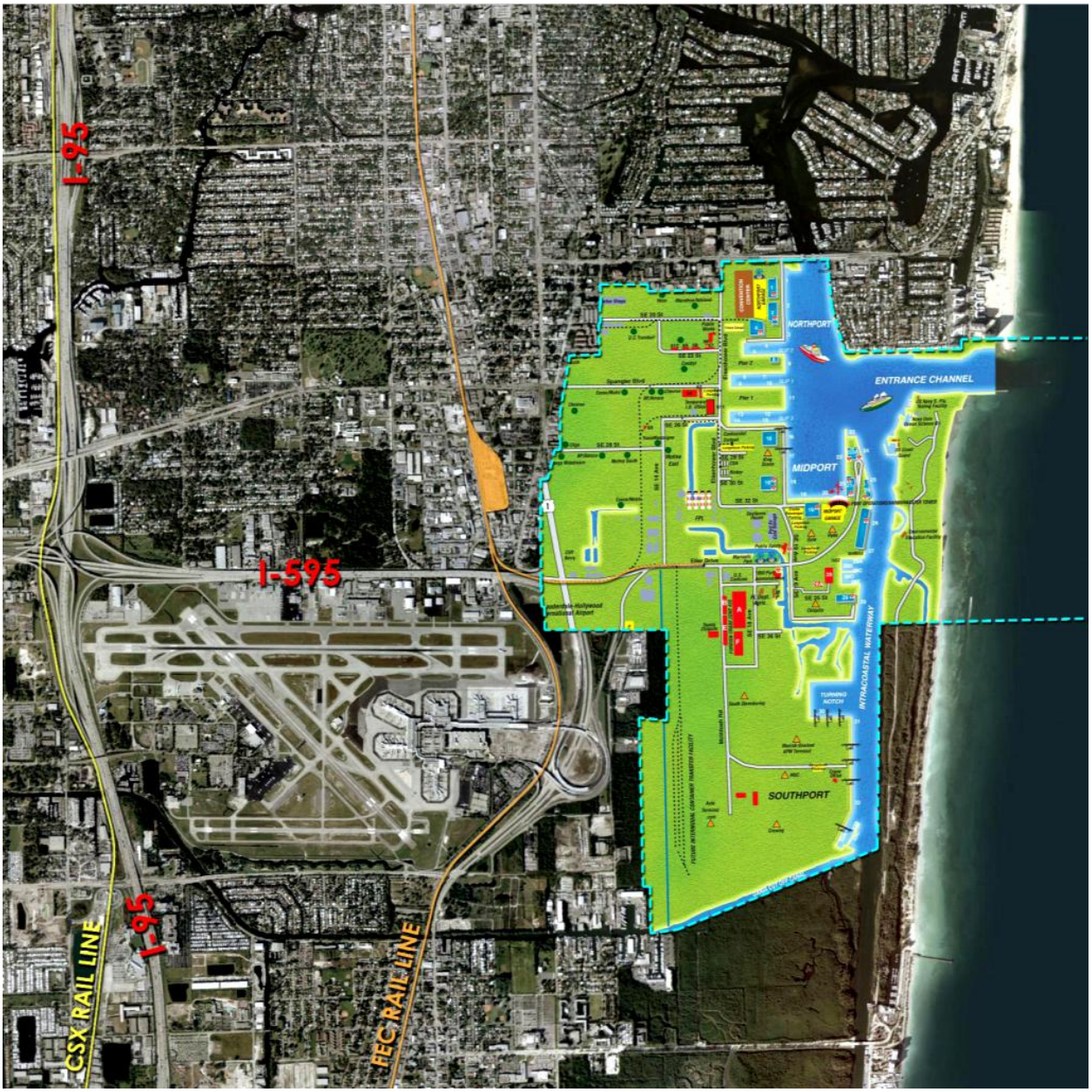

Figure 2: Port Everglades Vicinity Map

1.2 STUDY AUTHORITY

This Feasibility Study was authorized by a May 9, 1996 resolution of the House Committee on Transportation. The resolution reads, in part, 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 reports of the Chief of Engineers on Port Everglades Harbor, Florida, published as House Document 126, 103rd Congress, 1st Session, and House Document 144, 93rd Congress, 1st Session, and other pertinent reports to determine whether any

modifications of the recommendations contained therein are advisable at the present time in the interest of navigation and related purposes, with particular reference to navigation into and within the part of the project known as the Southport Channel.

1.3 STUDY PURPOSE AND SCOPE (GOALS AND OBJECTIVES)

The existing Federal channel project depth of 42 feet at Port Everglades does not provide an adequate, safe depth for large tankers and containerships currently transiting the harbor. The largest ships must light-load or transit at high tide in order to assure the proper safety clearances. Furthermore, the next (larger) generation of containerships and petroleum tankers require significantly more channel depth and width to maintain safe and routine navigation transit.

The primary objectives of this feasibility study are the following;

- decrease costs associated with vessel delays from congestion, and channel passing restrictions at Port Everglades through the 50-year period of analysis;
- decrease transportation costs through increasing economies of scale for container and petroleum vessels at Port Everglades through the 50-year period of analysis;
- increase channel maneuverability and efficiency at Port Everglades for existing vessel use as well as for larger vessels through the 50-year period of analysis;

This study follows the U.S. Army Corps of Engineers (USACE) six-step planning process as defined in the Principles and Guidelines (P&G) and incorporates the USACE seven Environmental Operating Principles (EOP).

The main report summarizes feasibility study assumptions, analyses and findings. Following the main report is the Environmental Impact Statement (EIS) and its supporting appendices.

All channel depths indicated in this report are "project depths" unless otherwise specified. Project depth is the authorized depth to which the Federal government maintains channels and basins. The Outer Entrance Channel (OEC) has additional depth requirements for squat and underkeel clearance, currently three feet beyond the required and allowable overdepth. These depths and USACE engineering requirements can be found in further detail in the **Engineering Appendix A**.

1.4 REGIONAL BACKGROUND

The following text provides a general description of Federal and non-federal navigation and beach nourishment projects located within the general study area.

1.4.1 Port Everglades Federal Navigation Project

Table 1 shows Federal Authorizations for the Port Everglades Harbor project.

Table 1: Federal Authorizations

Act	Document, Congress/Session	Work Authorized
R&H Act 1930	HD 357, 71/2	Federal maintenance of entrance channel, turning basin, and jetties constructed by local interests.
R&H Act 1935	HR Committee of R&H Doc. 25, 74/1	Construction and maintenance of an enlarged entrance channel, and a 1,200 foot square turning basin to a depth of 35 feet.
R&H Act 1938	HD 545, 75/3	Construction and maintenance of a 350 foot wide trapezoidal area on the north side of the main turning basin.
R&H Act 1946	HD 768, 78/2	Construction and maintenance of a 200 foot northerly and 500 foot southerly extensions to the main turning basin.
R&H Act 1958	HD 346, 85/2	Construction and maintenance of outer entrance channel deepening to 40 feet, inner entrance channel deepening to 37 feet, expanding the main turning basin to the north and south.
PL 89-298 Section 201, 1965	HD 93-144	Deepen outer entrance channel to 45 feet at a width of 500 feet, inner entrance channel to 42 feet at a width of 450 feet, main turning basin to 42 feet, channel opposite Pier 7 to 36 feet, maintain channel opposite Berth 18 to 36 feet.
WRDA 1992	HD 103-126, 103/1	Federal maintenance of locally constructed Southport Access Channel dredging to 42 feet, and locally constructed turning notch to a depth of 42 feet.

**Rivers and Harbors (R&H), House Report (HR), House Document (HD), Public Law (PL)*

The current Federal Navigation Project Dimensions (**Table 2**) incorporate the most recent Federal and non-federal improvements. The Federal improvements of the 1970s include modifications to the Outer Entrance Channel (OEC), Inner Entrance Channel (IEC), Main Turning Basin (MTB), and South Turning Basin (STB). The non-federal improvements of the 1980s and 1990s include modifications to the Southport Access Channel (SAC) and the Turning Notch (TN). Water Resources Development Act (WRDA) 1992 (PL 102-580) Title I, Section 101(9) authorized Federal maintenance of the locally constructed SAC and TN. WRDA 2000 (PL 106-541) Section 515 authorized Federal reimbursement of $15,003,000 to Broward County for the local construction of the SAC and the TN (**Figure 3**).

Table 2: Existing Federal and Non-federal Navigation Project Dimensions

Existing Federal and Non-federal Navigation Project Features		
Existing Port Components	**Authorized and Maintained Nominal Depth in feet MLLW[1]**	**Authorized and Maintained Nominal Width in feet**
Outer Entrance Channel (OEC)	45	500
Inner Entrance Channel (IEC)	42	450
Main Turning Basin (MTB)	42	Varies[2]
North Turning Basin (NTB)	31	Varies[3]
South Turning Basin (STB)	31, 36, 37[4]	1,000 X 1,100
Southport Access Channel (SAC)	42	400
Turning Notch (TN)	42	750 X 1,000
Non-federal Project Features	**Constructed and Maintained Nominal Depth in feet MLLW**	**Constructed and Maintained Nominal Width in feet**
Dania Cut-off Canal (DCC) from SAC to Port Dania	15	Varies (about 100 feet)

[1]*MLLW: Mean Lower Low Water: A tidal datum. The average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch. (NOAA).*
[2]*Basin is irregular shaped that varies in width 800 to 1,100 feet.*
[3]*Basin is irregular shaped. North to South length is 1,200 feet, north side is 500 feet and extends 800 feet on south side.*
[4] *Variable depths by location..*

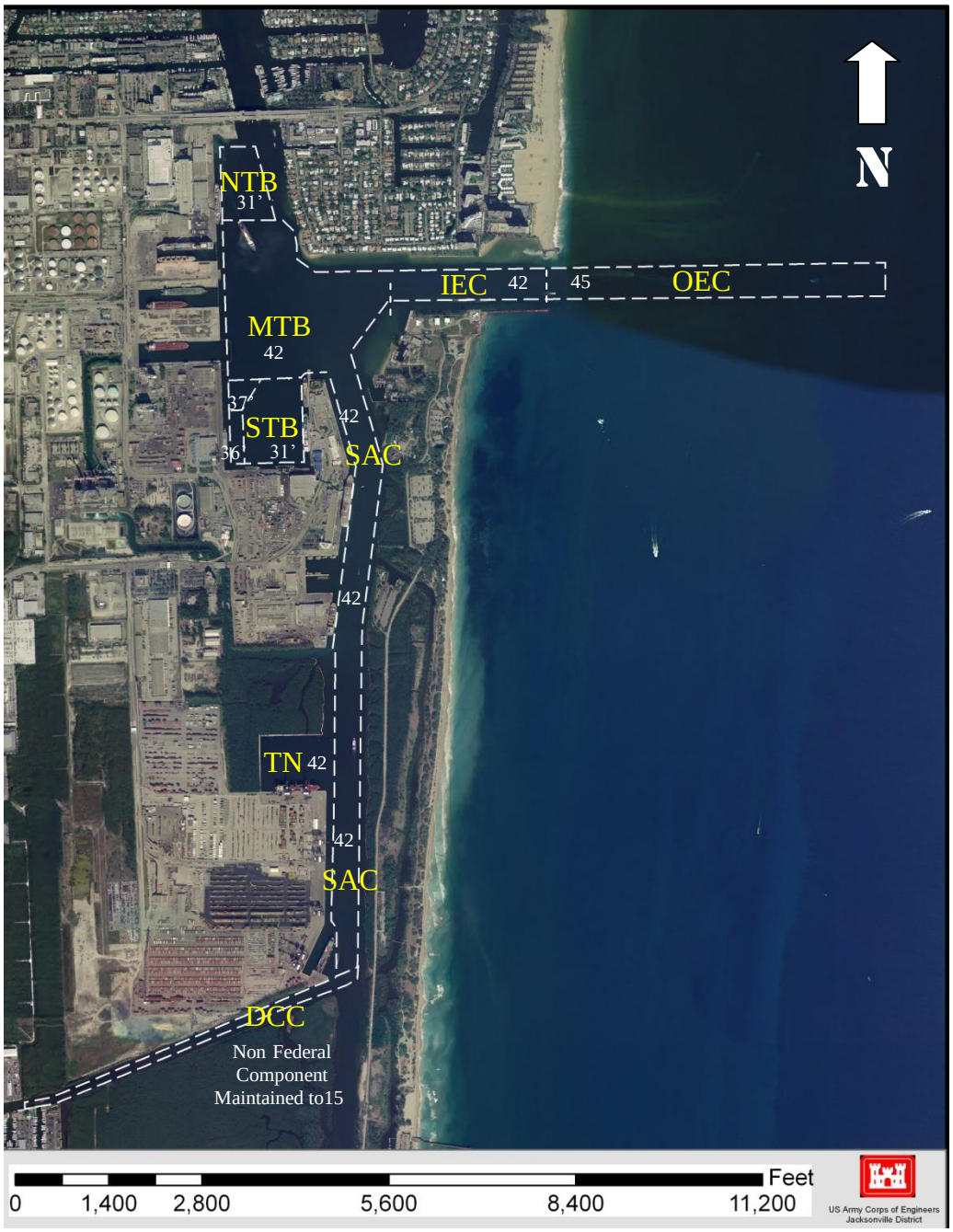

Figure 3: Existing Channel Components

*See Table 2 for definitions of project segment nomenclature.

1.4.2 Adjacent Facilities

Major transportation infrastructure is located west of the Port. This includes: the Fort Lauderdale/ Hollywood International Airport, two interstate highways, and the Florida Turnpike. The Port has access to the Florida East Coast Railway links, with construction of an intermodal container transfer facility underway, **Figure 4**.

PORT EVERGLADES
BROWARD COUNTY, FLORIDA
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Figure 4: Port Everglades Map

Located north of the Port are residential and commercial developments including an extensive array of private vessel marinas and docks. The Federal Intracoastal Waterway (IWW) project transits through the Port from north to south, along the Southport Access Channel.

East of the Port is a barrier island that contains the John U. Lloyd Beach State Park (John U. Lloyd SRA), a U.S. Navy facility (Navy), NOVA Southeastern University (NSU) Oceanographic Center, and a U.S. Coast Guard Facility (USCG). On the east side of the barrier island is a sandy beach/offshore reef system (**Figure 4**).

West Lake Park is a 1,500-acre nature preserve, considered one of the largest and last remaining mangrove ecosystems in the 85-mile coastal zone from Miamia Beach to West Palm Beach, and is located south of the Port, **Figure 5**.

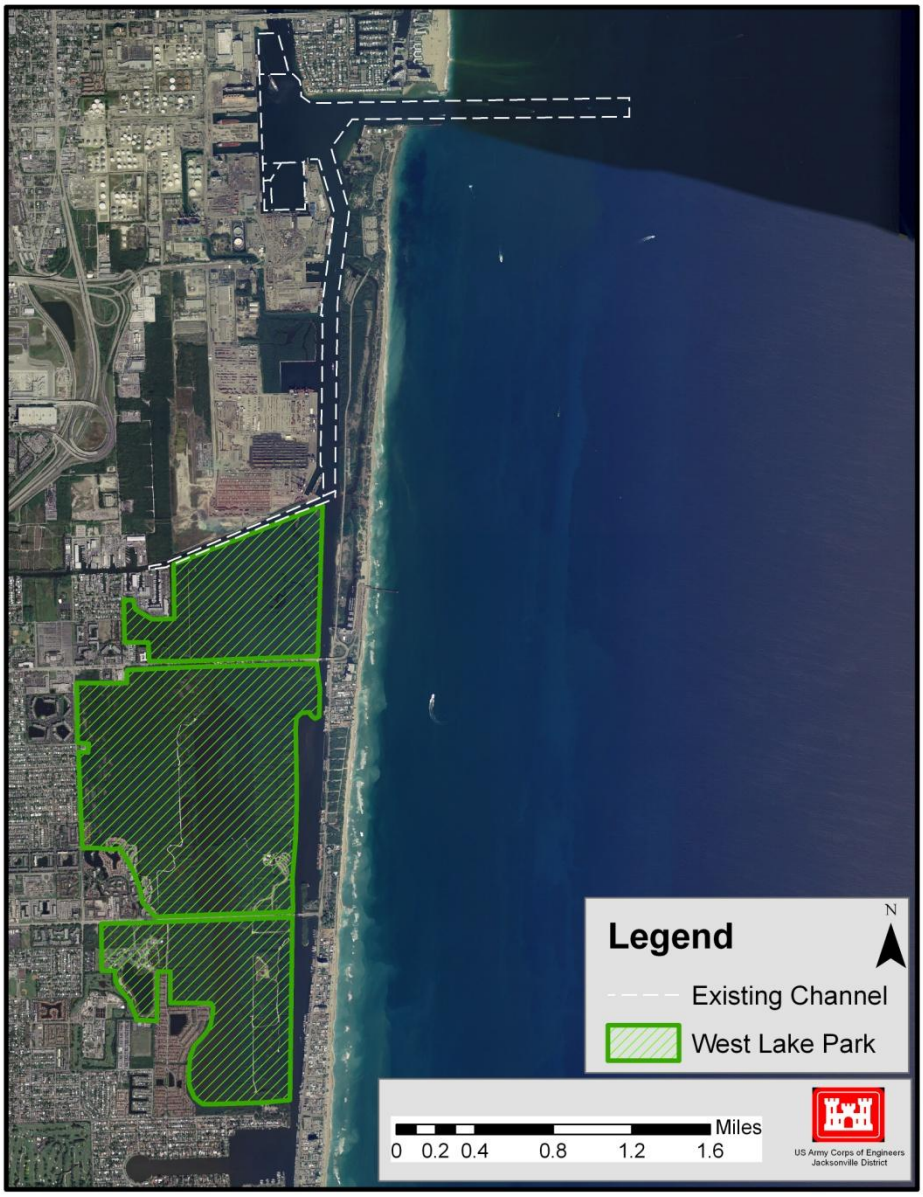

Figure 5: West Lake Park Area Map

1.4.3 Port Berthing Areas

The Port's commercial berths are designated as Berths 1 through 33C as shown in **Figure 4**. There are three main Port berthing areas; Northport, Midport, and Southport. The majority of bulk traffic includes cement and petroleum with the other major commodity being containerized cargo. More information is provided in **Section 2.4.1**: Existing Port Infrastructure.

1.4.4 Federal Intracoastal Waterway (IWW) Project

The Federal IWW project from Jacksonville to Miami, Florida is a major segment of the

Federal inland waterway system. It serves both commercial barges and recreational vessels. The portion of the IWW project that runs through Port Everglades is shown in **Table 3**.

Table 3: Intracoastal Waterway (IWW) Project

Reach or Segment	Nominal Depth (feet MLLW)		Nominal Channel Width (ft)	
	As Auth.	As Maint.[1]	As Auth.	As Maint.
IWW through Port Everglades	10	10' to >10'	125	125
Sponsor Information; *Florida Inland Waterway District (FIND)*				

[1] Portions of the IWW through Port Everglades are maintained at depths deeper than 10' as they lie within the Federal deep draft navigation project.

1.4.5 Federal Broward County Beach Erosion Control Project

Three segments totaling 24 miles are included in the Federal hurricane and storm damage reduction project for Broward County. The project was authorized by the River and Harbor Act of 1965 for non-federal construction with subsequent Federal reimbursement. **Table 4** provides additional information.

Table 4: Broward County Federal Beach Project

Reach or Segment	**Reach Extent** R Mon.	Length (mi)	**Berm Width** (ft)
Segment I	**R-1 - R-24**	4.37	varies
Segment II	**R-25 - R-85**	11.5	varies
Segment III	**R-86 –R-128**	8.1	varies
Sponsor Information			
Broward County			
City of Deerfield Beach			

Broward County has been working on a sand bypass study. The project is located along the north side of the entrance channel. The basic project purpose is to create new, and modify the existing, inlet infrastructure at Port Everglades to facilitate the economical collection of littoral materials that will be available for future mechanical bypassing to the beaches south of the inlet. The project would support the Broward County Comprehensive plan by protecting beaches and restoring altered beaches to the extent possible. The widening and deepening project considers beach and nearshore placement options if viable sand exists within the dredging template. The sand bypass project was noticed to the public and remains in the planning phase.

1.4.6 Dania Cutoff Canal

The Dania Cutoff Canal (DCC) is considered a non-federal project component that extends east-west along the southern extremity of the Port (**Figure 3**). The DCC acts as fresh water drainage for the neighboring watershed and regularly supports navigation of modest size vessels and pleasure crafts. About one mile west of the DCC/SAC confluence are small commercial ports. These ports handle small (200 feet in length) commercial freighters that move cargo in the offshore island trade. Approximately 4,200 linear feet of the easterly extent of the DCC was improved by the Port in 1987 (**Table 5**). Maintenance dredging of this portion of the DCC has not been necessary since the 1987 improvements were completed.

Table 5: DCC Project

Reach or Segment	Nominal Depth (feet MLLW)		Nominal Channel Width (feet)	
	Constructed	Maintained	Constructed	Maintained
DCC from SAC to Port LaDania	15	15	Varies (about 100 feet)	Varies (about 100 feet)
Sponsor Information				
Broward County represented by its Board of County Commissioners				

1.5 PRIOR STUDIES AND REPORTS

1.5.1 Federal Reports

Initial construction of Port Everglades began in 1925 and continued through 1928. Construction was accomplished through the excavation of Lake Mabel, a shallow water body separated from the Atlantic Ocean by a low sand ridge. Originally called Bay Mabel Harbor and later Hollywood Harbor, the port was the result of a cooperative effort between the cities of Hollywood, Fort Lauderdale, and a private investor. The Federal government became involved with the port after the passage of the Rivers and Harbors Act of 1930 which provided the locally constructed project with Federal maintenance (**Table 6**). The early harbor design was simple, consisting of a 7,300 foot long entrance channel; a single 1,200 foot long, 300 foot wide slip (Slip 1); two bulkheads; two jetties; two submerged breakwaters; and a single turning basin. Initial project depth was 35 feet. Since 1931, 11 Federal maintenance dredging projects at Port Everglades have been completed.

The USACE has completed several studies and reports focused on the Port Everglades Federal Navigation Project. **Table 6** contains a listing of these reports. **Table 1** provides a description of the authorized project features by Congressional Act.

Table 6: Port Everglades Federal Navigation Reports

Study Type[1]	Report Date	Congressional Documents				Authorizing Act	Summary
		Type	No.	Cong.	Session		
PA	1928	-	-	-	-	-	-
PA	1929	-	-	-	-	-	-
SR	1930	H	357	71	2	R&H 1930	Federal maintenance of entrance channel, turning basin, and jetties constructed by local interests.
PA	1932	-	-	-	-	-	-
SR	1933	-	-	-	-	-	-
SR	1935	H	25	74	1	30-Aug-35	Construction and maintenance of an enlarged entrance channel, and a 1,200 foot square turning basin to a depth of 35 feet.
SR	1937	H	545	75	3	20-Jun-38	Construction and maintenance of a 350 foot wide trapezoidal area on the north side of the main turning basin.
SR	1944	H	768	78	2	24-Jul-46	Construction and maintenance of a 200 foot northerly and 500 foot southerly extensions to the main turning basin.
SR	1946	-	-	-	-	-	-
SR	1958	H	346	85	2	3-Jul-58	Construction and maintenance of outer entrance channel deepening to 40 feet, inner entrance channel deepening to 37 feet, expanding the main turning basin to the north and south.
SR	1971	H	144	93	1	9 and 31 May 1974	Deepen outer entrance channel to 45 feet at a width of 500 feet, inner entrance channel to 42 feet at a width of 450 feet, main turning basin to 42 feet, channel opposite Pier 7 to 36 feet, maintain channel opposite Berth 18 to 36 feet.
FR	1991	H	126	103	1	WRDA 1992, Title I Sec 101(9)	Federal maintenance of locally constructed Southport Access Channel dredging to 42 feet, and locally constructed turning notch to a depth of 42 feet.
LRR[2]	1998	-	-	-	-	WRDA 2000 Sec 515	Reimbursment for Federal portion of WRDA 1992 authorized Southport Access Channel dredging to 42 feet, and Turning Notch construction to 42 feet.

[1] PA = Preliminary Assessment, SR = Survey Report, FR = Feasibility Report, LRR = Limited Re-Evaluation Report

[2] Reimbursement of $15,003,000 was authorized by Congress

Refer to Table 2 for a description of the Federal Components authorized.

1.5.2 Non-federal Reports

Table 7 provides a listing of recent non-federal studies and reports related to Port Everglades.

Table 7: Non-Federal Reports

Study Title and Date	Prepared By	Summary
Port Everglades Master Plan 1988-2000 -3/88	Broward Co. Dpt of Port Everglades and Consultants	Development of Southport Container Terminal, the purchase of a third gantry crane at Midport, and other improvements
ICTF[1] Feasibility Study Phase I-3/94	Broward Co. Dpt of Port Everglades and Consultants	Recommends an Intermodal Container Transfer Facility (ICTF) as both necessary and feasible
ICTF Feasibility Study Phase II-3/95	Broward Co. Dpt of Port Everglades and Consultants	Evaluation of 6 plan sites for ICTF construction.
Port Everglades Master Plan Update November 1995	Broward Co. Dpt of Port Everglades and Consultants	Southport purchase #4-#7 cranes, develop Berths 30&30a as containership. Midport purchase #3 cranes and relocates container operations at Berths 5, 6, 19, 20 to DCC. Deepen and widen DCC. Add slip between Berths 9 and 13. Target mid-week multi-day cruises. Traffic and airport issues. Acquire 172 acres.
Port Everglades Master Plan Update December 2007	Broward Co. Dpt of Port Everglades and Consultants	Recommendations were considered in preparation of the Draft Feasibility Report.
Port Everglades Master/Vision Plan Update March 2011	Broward Co. Dpt of Port Everglades and Consultants	Planning through 2029, with 5, 10 and 20-year plans. Infrastructure improvements to berth fully laden Post-Panamax vessels of 7,000 TEUs, rail to Southport and the proposed ICTF, new berth for crushed rock /aggregate, longer cruise berths, more and longer cargo berths, reconfiguration of Northport slips, and upland improvements to terminals and intermodal access.

[1] Intermodal Container Transfer Facility (ICTF)

1.6 STUDY PARTICIPATION AND COORDINATION

This feasibility study is performed as a 50-50 percent cost shared partnership between the USACE and the non-federal sponsor, Broward County represented by its Board of County Commissioners. The feasibility study was performed under the FCSA most recently updated in March 2013. The FCSA is dated April 17, 1997 and has been amended. The work was all done under the 1997 agreement, as amended.

The following agencies and stakeholders participated in the study and provided input at various levels throughout the history of the project. Federal agencies involved include the Unites States Coast Guard (USCG), the United States Navy (USN), the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS)

and the National Marine Fisheries Service (NMFS). State agencies include the Florida Department of Environmental Protection (FDEP) and the Florida Fish and Wildlife Conservation Commission (FWC). Local agencies include the Broward County Environmental Protection and Growth Management Department, Broward County Aviation Department (Fort Lauderdale/ Hollywood Airport), and the Broward County Department of Safety and Emergency Services. Non-government organizations/institutions (NGOs) include Nova Southeastern University (NSU), and the Port Everglades Pilots Association (Pilots). Private interests include Hvide Marine, Maersk-Sealand, Coastal Fuels Marketing, and the Simulation Training and Research Center (STAR), (**Table 8**).

The Florida Department of Environmental Protection (FDEP) continues to participate in the study process and has an existing Interagency Cooperation Agreement (ICA) with the USACE. The FWC, NMFS, EPA, USFWS and BCEPD were invited to participate as cooperating agencies under NEPA by letter dated September 11, 2007. All agencies, except USFWS, replied that they would serve as cooperating agencies for the EIS. Copies of correspondence regarding being a cooperating agency under NEPA can be found in the **EIS** Appendix A.

Table 8: Agency and Stakeholder Coordination

Federal Agencies	
U.S. Army Corps of Engineers (Corps)	U.S. Coast Guard (USCG)
U.S. Navy (Navy)	Environmental Protection Agency (EPA)
Fish and Wildlife Service (USFWS)	National Marine Fisheries Service (NMFS)
State of Florida Agencies	
Department of Environmental Protection (FDEP)	Fish and Wildlife Conservation Commission (FWC)
Florida Department of State Lands	State Historic Preservation Office (SHPO)
Broward County Agencies	
Department of Port Everglades (Port)	Department of Airports (Airport)
Environmental Protection Department (EPD)	Department of Parks and Recreation (County Parks)
Stakeholders; Non-Government Organizations/Institutions	
Nova Southeastern University (NSU)	Port Everglades Pilots Association (Pilots)
Hvide Marine Corporation	Maersk-Sealand Corporation
Simulation Training and Research Center (STAR)	

1.6.1 NEPA Scoping

The District has engaged the public and the resource agencies through the NEPA scoping and cooperating agency processes, and the non-federal sponsor has worked extensively to educate and engage the public through public workshops and meetings held in response to the Port's master plan (which incorporates the proposed Federal project). More than 50

meetings and workshops have been held with stakeholders since the project began scoping in 2000 (**Table 1 of the EIS**). Modifications to the proposed project have been made directly and indirectly in response to comments received from stakeholders and the public. Comments raised have included concerns about impacts on offshore reef resources and to mangrove and seagrass communities inside the Port inlet. The Department of Environmental Protection - State Parks Division raised concern with some of the original proposals that would have removed more than 50% of John U. Lloyd Beach State Park. Due to the comments (and other project factors including economic and engineering considerations), the project scope has been modified to greatly reduce adverse impacts to the State Park; remove all impacts to a local university's oceanographic research center; and minimize impacts to seagrasses by removal of the Dania cut-off canal component. Impacts to offshore reef resources have been minimized to the maximum extent practicable through ship simulation and coordination with the pilots from the originally proposed 1,000 ft wide cut in the offshore reef to an 800 ft wide cut.

The project would have no effect and would not influence any foreseeable future actions that could adversely affect minority and low-income populations as is stated in **Section 4.28.5 of the EIS** under Environmental Justice. The purpose of the proposed action is to provide increased maneuverability, efficiency, and lower costs for navigation while protecting the environment. 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 project would benefit shipping and the general economy; refer to the **EIS** for more information.

2.0 EXISTING CONDITIONS

2.1 GENERAL

Port Everglades is the third busiest multi-day cruise port in the world, with approximately 42 different cruise ships visiting in 2012, representing 15 cruise lines. Port Everglades is ranked 12th nationally for international container cargo trade. Port Everglades is ranked 32nd nationally in terms of tonnage. Port Everglades is the top distribution site for South Florida's gasoline, jet fuel, and other petroleum products.

This section summarizes existing physical, environmental, and economic conditions. Additional information regarding historic and existing physical conditions can be found in the Engineering Appendix (**Appendix A**). Additional detail regarding existing environmental conditions can be found in the Environmental Impact Statement (EIS). Additional information regarding historic and existing economic conditions can be found in the Economic Appendix (**Appendix B**).

The existing channel components and depths are presented in **Figure 3** and **Table 2**. There are existing navigation concerns for vesselmanueverability and routine operation of the Port. The Pilots' navigation concerns for Port Everglades include dangerously strong cross currents in the entrance channel that vary in strength and are unpredictable in direction. The currents generally run at right angles to the direction of the narrow entrance channel making transit hazardous. These strong and unpredictable currents have been reported to be as high as 5 knots. Ships approaching from the east should be cautious of strong easterly wind and wave energy in the entrance channel.

2.2 PHYSICAL CONDITIONS

2.2.1 General

General meteorological and oceanographic conditions are summarized in this section. These data are used to establish "existing" and "future with project" boundary and initial conditions as input parameters for the ship simulation model and cumulative impact analyses. The ship simulation model is essential in guiding future engineering design function for channel improvements.

2.2.2 Climate

The climate at Port Everglades is categorized as tropical. The annual mean temperature for the region is approximately 75 degrees Fahrenheit with an average humidity range of 60 to 87 percent. The average annual rainfall is 60 inches with about 65 percent occurring during the summer and early fall months (June to October).

2.2.3 Winds

During the summer months Port Everglades experiences predominantly east and southeast trade winds. This information is based on data collected as part of the National Data Buoy Center (NDBC) Coastal-Marine Automated Network (C-MAN) program. The nearest C-MAN station to Port Everglades is located at Fowey Rocks, Florida, approximately 13 miles southeast of Miami. Meteorological observations at Fowey Rocks cover a period from January 1991 to December 2009. Between December and March, frontal weather patterns driven by cold Arctic air masses can extend as far as South Florida. These fronts generate "northeaster" storms that typically generate northeast winds.

In addition to measured wind data, hindcast wind data are available from the USACE Wave Information Study (WIS) Program. WIS hindcast data are generated using the numerical hindcast model WISWAVE (Hubertz, 1993). WISWAVE is driven by wind fields overlaying a bathymetric grid. Model output includes significant wave height, peak and mean wave period, peak and mean wave direction, wind speed, and wind direction.

There are 523 WIS stations along the Atlantic Coast. WIS station 467 is considered to be the most representative of offshore deepwater wave conditions for Port Everglades. Station 467 is located at Latitude 26.08N and Longitude 79.92W, approximately 11 miles due east of the Port Everglades Harbor jetties. The WIS hindcast is provided at 1 hour intervals and covers a period from 1980 to 1999.

Appendix A provides a summary of average wind speeds and percentages of occurrence (based on direction) for both hindcast (WIS) and measured (C-MAN) data. Review of both measured and hindcast data reveal similar overall trends in direction and magnitude, relevant information as it pertains to ship navigation and maneuverability.

2.2.4 Hurricanes and Storm Surge

The Atlantic hurricane season runs from June 1 to November 30. During these months, hurricanes develop in the tropical and subtropical latitudes of the Atlantic Ocean and Caribbean Sea north of the equator. Hurricanes are characterized by low barometric pressure, high winds in excess of 75 miles per hour, large waves, heavy rainfall, and storm surges. Such events have historically had significant impacts on Port Everglades and the adjoining shorelines. Between 1889 and 2009, over 100 hurricanes have made landfall on the coastline of Florida, most noteably Hurricane Andrew in 1992 which hit as a category 4. See **Appendix A** for more information on hurricanes and storm surge.

2.2.5 Sea Level

The geologic record of historical sea level variations indicates that both increases and

decreases in global sea level have occurred. Both global cooling and warming contribute to sea level change. The National Ocean Service (NOS) has compiled long term records of measured water surface elevations along the Atlantic coast. This data is the basis for projecting future relative sea level rise at the Port Everglades Harbor. Information on sea level rise analysis can be found in Section 7.2.

2.2.6 Tides

Tides at Port Everglades are semi-diurnal (two high and two low daily). Mean tidal range in the harbor entrance and main harbor area is less than 2 feet. The usable tide for navigation purposes is approximately 1.5 feet. Storm tides can range from 7 feet to 11 feet above mean sea level during severe hurricanes. **Table 9** presents tide statistics at three locations within the Port.

Table 9: Tidal Information

Tidal Statistics Relative to Mean Lower Low Water (MLLW)			
	N. Turning Basin	Southport Access Channel	Dania Canal
Highest Observed Water Level	4.42 ft	----	3.26 ft
Mean Higher High Water (MHHW)	2.81 ft	2.78 ft	2.56 ft
Mean High Water (MHW)	2.69 ft	2.66 ft	2.47 ft
North American Vertical Datum – 1988	2.31 ft	2.28 ft	
Mean Sea Level (MSL)	1.43 ft	1.43 ft	----
Mean Tide Level (MTL)	1.42 ft	1.42 ft	1.32 ft
Mean Low Water (MLW)	0.16 ft	0.18 ft	0.17 ft
Mean Lower Low Water (MLLW)	0.00 ft	0.00 ft	0.00 ft
Lowest Observed Water Level	-1.27 ft	----	-0.19 ft

[1] For information on period of record see companion table in Engineering Appendix

2.2.7 Currents

Two types of currents affect Port Everglades: offshore currents and currents within the harbor itself. Offshore currents affecting Port Everglades Harbor include littoral currents, inlet-related tidal currents, and strong currents resulting from the proximity of the Florida Current, a component of the Atlantic Gulf Stream. The presence of the Florida Current creates a strong northerly current that acts perpendicular to vessels approaching and transiting the Port entrance channel. Port Everglades Pilots have historically noted strong and unpredictable currents in the harbor system as noted in the U.S. Coast Pilot 4. See **Appendix A** for more information on the Florida Current and the continental shelf that is documented as a cause for these hydrodynamic forces.

2.2.8 Waves

Wave conditions representative of Port Everglades were obtained using hindcast data available from the WIS station 467. Hindcast wave conditions cover the twenty-year period between 1980 and 1999. Similar to wind conditions, wave conditions in South Florida experience seasonal variability. Winter months show a marked increase in wave height due to northeaster activity. The intensity and direction of these winter wave conditions are reflected in the dominant southward sediment transport and seasonal erosion patterns. Summer months experience milder conditions with more normal shoreline propagation. For more information, refer to **Appendix A**.

2.2.9 Salinity

The Broward County Environmental Protection and Growth Management Department (BCEPD) maintains multiple monitoring stations throughout the waterways of Broward County. Three of these stations fall within Port Everglades, which is a salt saturated area. Salinity values at each station were measured 2 to 4 times annually between 1997 and 2007 and vary from 22.6 parts per thousand (ppt) to 37.2 ppt. Changes in salinity levels may be attributed to fluctuations in local rainfall levels as well as variations in freshwater discharge levels from New River and the Dania Cutoff Canal. For station locations see Section 2.3.8 of the **Engineering Appendix A**.

2.2.10 Littoral Processes

Littoral processes at Port Everglades are influenced heavily by the presence of man-made structures in the vicinity of the Port entrance channel. The natural shoreline sediment transport is from north to south. A shoal consisting of debris from a previous (1962) dredging event lies to the north of the inlet. This rubble shoal along with the inlet's jetties and the navigation channel itself lead to the occurrence of accretion and erosion at the adjacent shorelines. The rubble shoal and North Jetty act to impound sediment while the navigation channel and South Jetty act as a sediment sink for sediment that reaches the inlet. In June 2004, Olsen Associates Inc., under contract with Broward County, completed the Port Everglades Inlet Sand Management Phase I: Sand Bypassing Feasibility Study (Olsen Associates Inc., 2004). This study proposed that the shoreline north of the jetty be fully impounded to capture sand, as well as several bypassing alternatives to prevent annual sand transport moving past the jetty, which results in increasing shoaling within the Federal navigation channel. Phase II: Sand Bypassing Feasibility –Addendum (Olsen Associates Inc., 2007) proposed the most feasible and acceptable plan based upon logistical and environmental criteria. The project was noticed to the public in 2008, but the permit application for the proposed sand trap plan has been deactivated, as relayed by the USACE regulatory office on February 25, 2011. To date, Broward County has continued to move forward with the sand bypass project as a local effort. As of the time of this report, no project features have yet been implemented.

2.2.11 Historic Conditions

Construction in the project area began in 1927 with the creation of Port Everglades (originally known as Port Mabel) as a military facility. During the 1930s, the Port experienced steady growth in use from a growing trade business. In the 1940s the Port was heavily used by the military as steady growth in the south Florida region continued with expansion of the Port and creation of additional land based infrastructure. American settlement in south Florida began in earnest in the late 19th century. In the late nineteenth and early twentieth centuries, the Florida East Coast railway brought new settlers and tourists to Broward County's beaches. Land and agriculture were the economic backbone of south Florida. Today Broward County's industry includes cattle, agriculture, commercial and sport fishing, and tourism.

Since Port Everglades was adopted as a Federal navigation project in 1930, there have been infrequent Federally sponsored dredging events. Due to the location of Port Everglades and low shoaling rate, dredging of the harbor occurs on average every 8 years. More information can be found in the **DMMP (Appendix E)**.

2.2.12 Geology and Sediments

Hundreds of historic core borings have been obtained in and around Port Everglades Harbor. The historic core borings are of varying quality, depth, and usefulness. The Port contracted 36 new borings to USACE specifications as part of this study effort. The USACE also obtained 120 rock probes for use with this study, and results can be found in Section 3.7 of the **Engineering Appendix A**.

Based on historical data, materials generally encountered at Port Everglades are variable between core boring locations and elevations. A majority of subsurface materials encountered at the Port can be characterized as interbedded layers of sandstones, limestones, and sand. Also encountered are interbedded layers of peat, organic silts, sands, silty sands, gravelly sands, weakly cemented sands, moderately cemented sands, weakly cemented sandstones and limestones, occasional competent beds of sandstones and limestones, and deposits of hard massive sandstone and limestone. These deposits of hard massive rock at Port Everglades have been mapped. The majority exists within the Main Turning Basin (MTB) and South Turning Basin (STB). Additional formations of hard massive rock may be found in the Inner Entrance Channel (IEC) and Outer Entrance Channel (OEC), Dania Cutoff Canal (DCC), and in limited isolated deposits, throughout the Port.

Historical cross sections and core borings were analyzed to determine angle of repose for soils at various locations. Along the SAC, TN, and DCC the estimated angle of repose for loose material is 2H (horizontal) to 1V (vertical). All other areas have an estimated angle of repose of 3H:1V. Regardless of location, areas of rock are expected to hold a slope of 0.5H:1V. Knowing the side slopes of a channel is important for the following reasons:

(1) side slopes are critical in generating an accurate quantity estimate of spoil material that will be generated,
(2) side slopes allow an accurate estimate of potential upland impacts (structural and/or environmental), and
(3) side slopes play a vital role in determining potential ship response scenarios, including ship squat requirements, due to their effect on the cross-sectional area of project channels, particularly entrance channels.

2.3 ENVIRONMENTAL RESOURCES

Many of the natural resources in the project area are considered significant under USACE planning guidance ER 1105-2-100. The mangroves, seagrasses and coral/hardbottom communities in the project area have institutional recognition as Essential Fish Habitat-Habitat Areas of Particular Concern under the Magnuson-Stevens Fisheries Management Act's Essential Fish Habitat Provisions. Additionally, Acroporid corals and their designated critical habitat, Johnson's seagrass, Florida manatee, smalltooth sawfish and sea turtles in the project area are all listed as either endangered or threatened species under the Endangered Species Act of 1973, as well as the Florida Endangered Species Act (F.A.C. Chapter 379.2291). Coral and hardbottom habitats are also protected under Florida's Coral Reef Protection Act of 2009. A detailed analysis associated with the Institutional Significance of these resources is included in the Environmental Impact Statement (EIS).

Public recognition of resources in the project area include the recognition of the value of coral and hardbottom habitats offshore of Broward County through the efforts of non-government organizations (NGOs) like the Sierra Club, Reef Rescue, and Cry of the Water. Additionally, West Lake Park, where the mitigation for mangrove and seagrass impacts are proposed, is historically a focus area for local environmental NGOs, including local chapters of the Audubon Society, Sierra Club, and Friends of West Lake. John U. Lloyd State Park is very important to the public as an access location to many of the natural resources and is one of the top ten state parks (based on annual attendance) in Florida. Details concerning coordination efforts with the public for the project are detailed in the EIS.

Mangrove and seagrass habitats are significant in Broward County as they have been limited throughout history as the county has developed. They have become scarce, and connectivity between mangrove and seagrass areas has declined, historically. These habitats are not designated critical habitat for any listed species in the area; however, they do serve as important habitat for endangered smalltooth sawfish and manatee, as well as foraging and nursery habitat for a variety of commercially managed fish species. The hardbottom communities offshore of Broward County are technically significant as they are designated critical habitat for threatened Elkhorn and Staghorn corals. More detail concerning these habitats and their significance is included in the EIS.

The **EIS** has ten accompanying appendices providing data, analysis, consultations, and

evaluations on environmental resources within the project area and surrounding habitats.

These appendices include;

Appendix A: Scoping Pertinent Correspondence
Appendix B: Clean Water Act Section 404(b)(1)
Appendix C: CZMA Determination
Appendix D: Natural Resource Reports
Appendix E: Mitigation Plan Incremental Analysis
Appendix F: Endangered Species Consultations
Appendix G: Fish and Wildlife Coordination Act Report
Appendix H: Essential Fish Habitat Planning Report
Appendix I: State Historic Preservation Officer Determination
Appendix J: HTRW Tier 1 Analysis
Appendix K: Recipient List

The following sections provide a general overview of the information contained in the above. For more detailed analysis of environmental resources, please refer to the EIS and accompanying appendices.

2.3.1 Land Use and Biotic Community Cover Types

Broward County is the second most populous county in the State of Florida, with over 1.8 million citizens (U.S. Census Bureau 2013). Adjacent Miami-Dade County, to the south, is the most populous (well over 2 million). Port Everglades lies within the urban, eastern section of Broward County. As was perviously discussed, to the east of the Port is a barrier island that contains the U.S. Navy facility, the Nova Southeastern University (NSU) Oceanographic Center, U.S. Coast Guard (USCG) Station Ft. Lauderdale, and John U. Lloyd Beach State Park and adjacent beaches. South of the Dania Cutoff Canal (DCC) is an undeveloped coastal system encompassed by West Lake Park. West of the Port is a Federal Highway, which is flanked by the Fort Lauderdale/Hollywood International Airport. North of the Port is a mixture of small craft waterways and commercial and residential development.

2.3.2 Wetland Areas

Jurisdictional wetlands within the boundaries of the project occur as either fringing mangrove habitat, mixed wetland hardwoods, or cattail marsh. As part of the Essential Fish Habitat (EFH) analysis, NMFS characterized seven mangrove assessment areas that were defined based on similarities in water depth, water quality and clarity, and landscape position, **Figure 6**. The **EIS**, **Section 3.5.2** provides a detailed discussion of these assessment areas analyses.

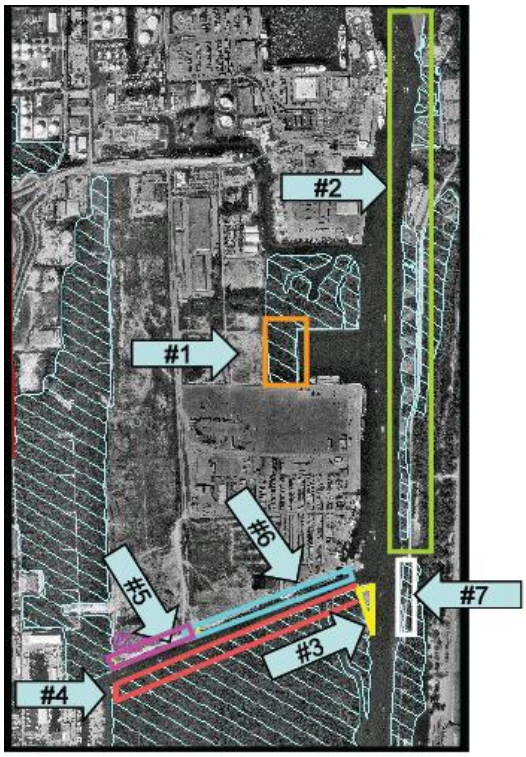

Figure 6: NMFS Mangrove Assessment Characterization Areas

2.3.3 Local Areas of Particular Concern

A number of areas currently exist within the project boundaries that require special consideration with regard to natural resources. Areas of environmental impact within the study area are shown in **Figure 7**. Also shown are potential areas for mitigation including West Lake Park (mostly owned by the state but managed by the county), and Broward County borrow holes offshore and north of the project area. These areas are discussed in more detail in **Section 7.2**. The nearshore bottom and offshore reef habitats of southeastern Florida have been designated as Essential Fish Habitat Areas of Particular Concern.

Figure 7: Resource Impact Areas

2.3.4 Seagrass Communities

Seagrass communities within the Port Everglades study area have been investigated on numerous occasions (see discussion of seagrasses in **Section 3.0 of the EIS**). The seagrass occurs mainly as isolated patches adjacent to deeper water of the Federal channel (i.e., on the channel sideslopes) and are particularly prominent in the IWW adjacent to and south of the DCC which is outside the study area as well as both north and south of the USCG basin. Since the 1999-2000 seagrass survey noted in **Section 3.6 of the EIS**, seagrass coverage has increased from 8.71 acres in the project area to 11.98 acres, **Figures 8-10**.

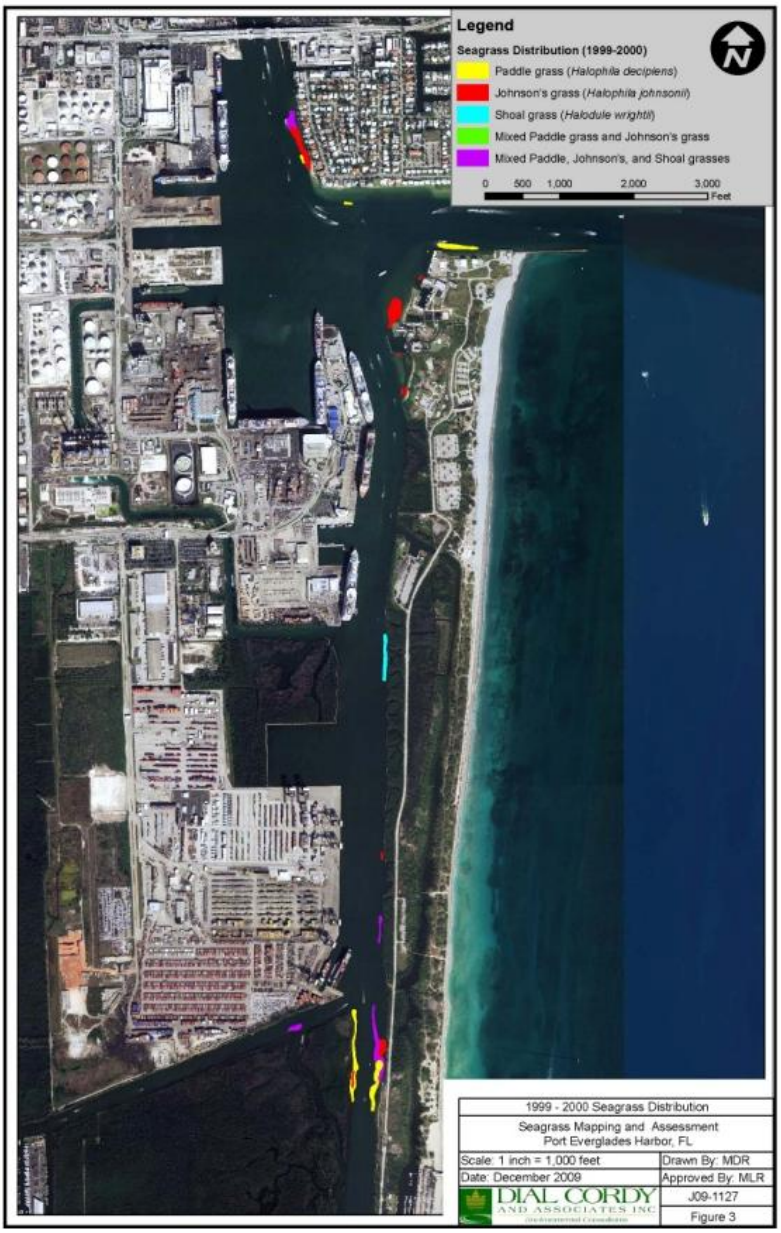

Figure 8: Seagrass Distribution Mapped in 1999-2000

Figure 9: Seagrass Distribution Mapped in 2006

Figure 10: Seagrass Distribution Mapped in 2009

2.3.5 Nearshore Hardbottom and Reef Distribution

The Outer Entrance Channel (OEC) has an inner, middle, and outer reef system. Site mapping and analysis has been conducted.

The nearshore ridge complex runs parallel to the shore and is made up of carbonate/quartz sandstone and coquina rock. The nearshore ridge complex occurs in 0-12 feet (0-4 m) of water and hosts a hardbottom community of algae, sponges, encrusting octocorals, and hard corals.

The nearshore hardbottom communities typically exist in a physically stressed environment. Nearshore hardbottom areas offshore of the downdrift beaches from the channel inlet have been characterized using multi-spectral image analysis classification, towed video and in-situ diver verification. The EIS provides a detailed discussion of the hardbottom and reef communities and the associated fish species found there.

Seaward of the nearshore hardbottom area are three separate parallel reef tracts. The inner reef occurs from approximately 100 to 2,000 feet from shore; the middle reef is located 3,000 to 6,000 feet offshore; and the outer reef is approximately 8,000 feet or more offshore. **Figure 11** depicts the locations of habitat in the study area.

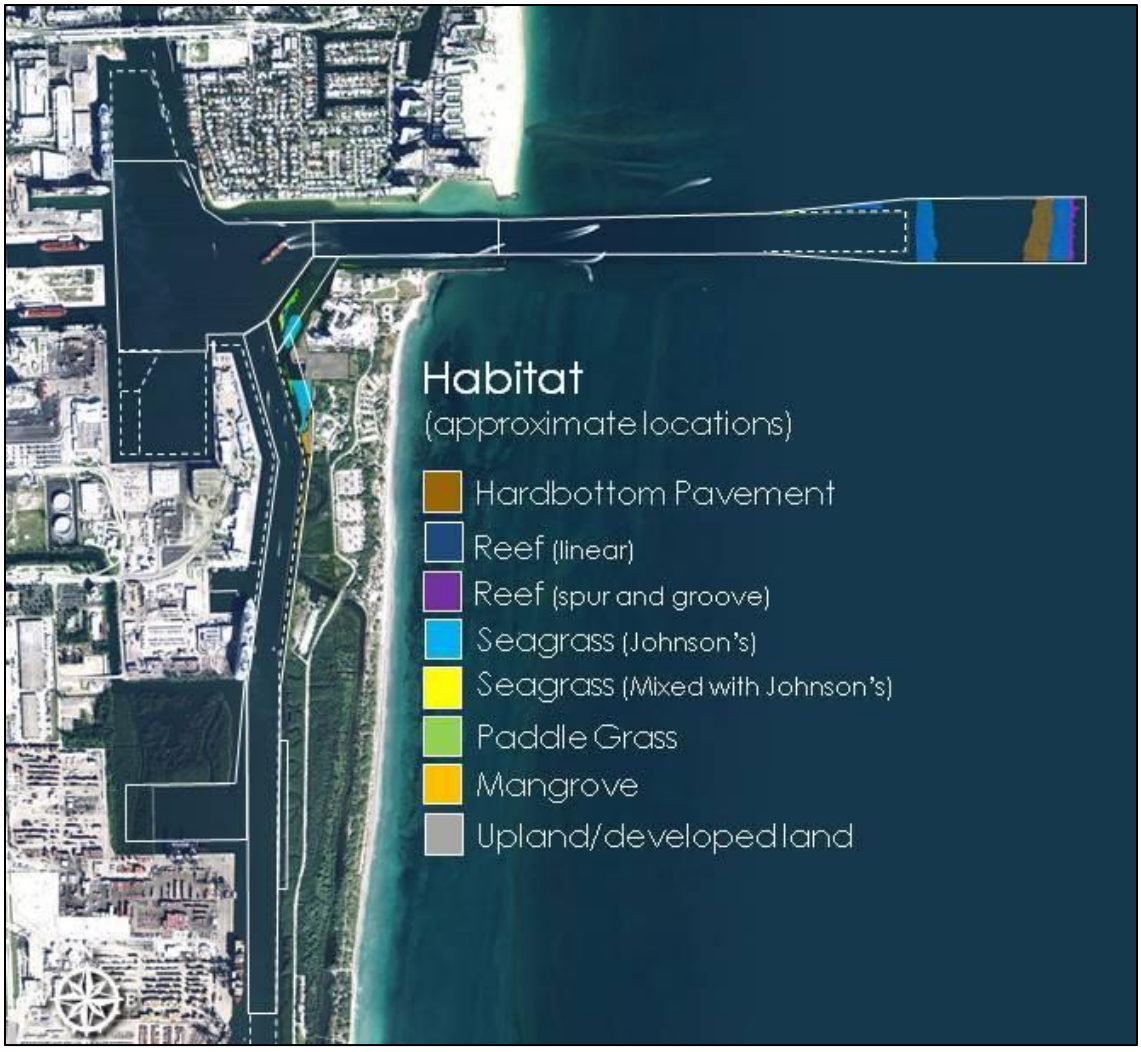

Figure 11: Offshore Reef Tracts

Based on the integrated video mapping survey conducted, marine resources in the project area were classified and a resource mosaic prepared. Resources within the OEC included sand, low-relief reef, high relief reef, scattered rock/rubble, and patchy sparse *H. decipiens.* During investigations of the outer two parallel reef tracts, a total of 41 sampling stations were assessed. Benthic organisms were assessed using in situ visual evaluations of the organisms and the reef fish in addition to underwater video. There is significant variability in the benthic communities between the second and third reefs. The third reef has been found by numerous studies to be more biologically developed than the second reef. This difference can be attributed to recurrent tidal inlet discharge dynamics, groundwater seepage, freshwater inputs, sedimentation rates, and high variability in species complexity and composition. The resource coverage, complexity, and species found throughout the various sampling events have been consistent over time, however. Refer to **Figures 12** and **13**.

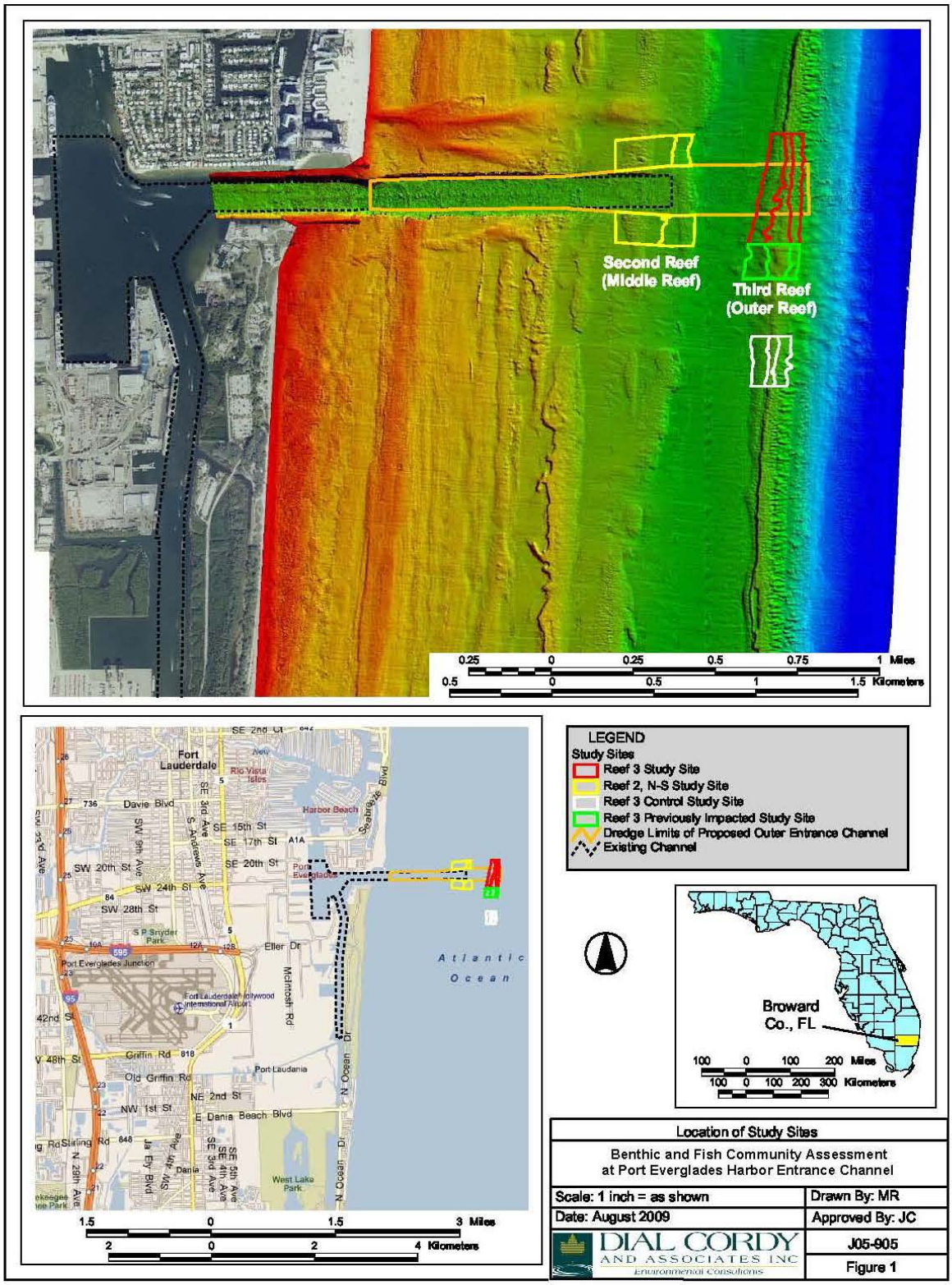

Figure 12: Benthic and Fish Community Assessment

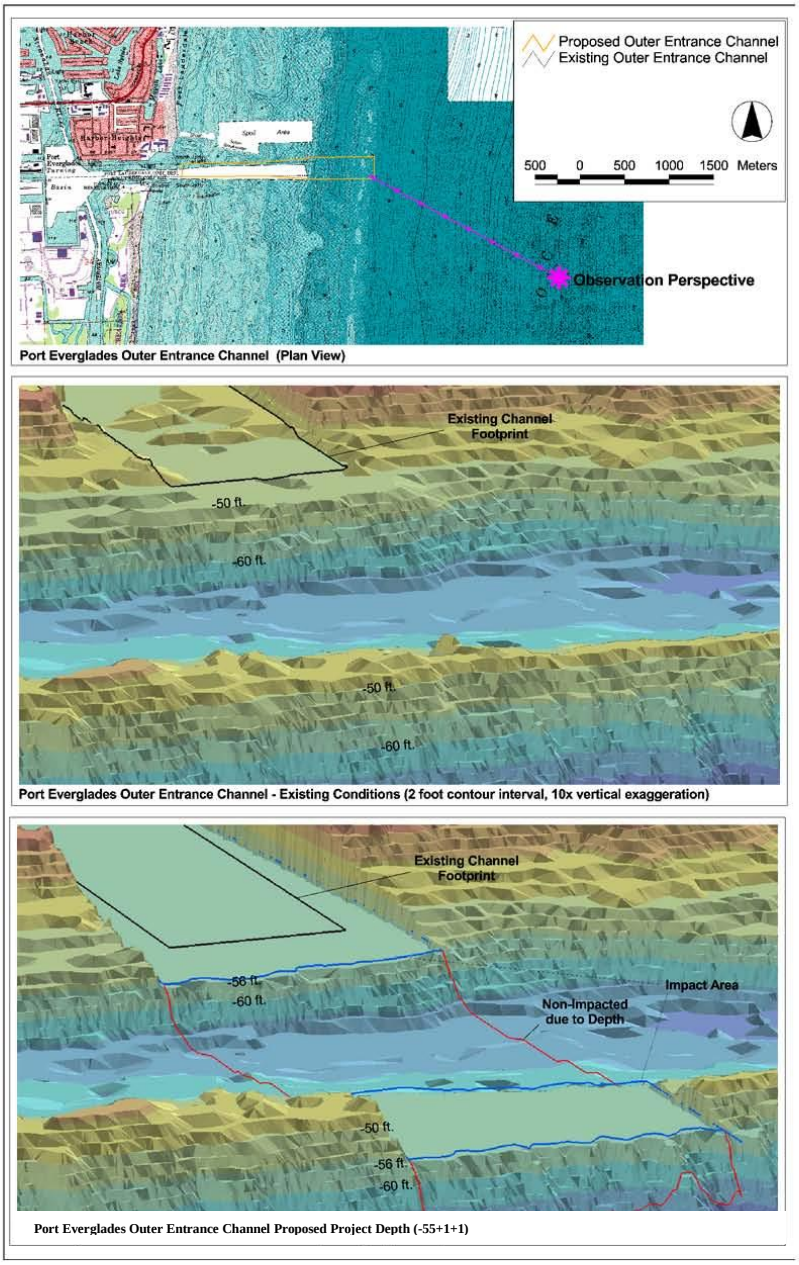

Figure 13: Middle and Outer Reef Bathymetry

2.3.6 Un-vegetated Bottom Communities

Within the harbor, the Southport Access Channel has shallow unvegetated communities. These communities have been extensively surveyed in relation to monitoring of past maintenance dredging within the Port area. This area consists of softbottom benthic communities interspersed with rubble left from previous dredging activities.

2.3.7 Essential Fish Habitat

The South Atlantic Fishery Management Council (SAFMC) has designated mangrove, seagrass, nearshore hardbottom, offshore reef areas, and any areas within the water column as Essential Fish Habitat (EFH). The nearshore hardbottom and offshore reef habitats of southeastern Florida have also been designated as Essential Fish Habitat Habitat Areas of Particular Concern (SAFMC 1998).

2.3.8 Threatened and Endangered Species

Threatened and endangered species that frequent the project area include threatened *H. johnsonii* seagrass; the West Indian manatee; loggerhead, green, leatherback, hawksbill, and Kemp's Ridley sea turtles; smalltooth sawfish; acroporid corals; and American crocodile. **Appendix E of the EIS** includes the Biological Assessments and concurrence to both NMFS and USFWS for consultation under the Endangered Species Act (ESA) and NMFS' Biological Opinion.

2.4 ECONOMIC CONDITIONS

2.4.1 Existing Port Infrastructure

Port Everglades infrastructure is divided into three Port terminal areas, each with individual characteristics and use: Northport, Midport, and Southport (**Figure 4**). The Port's 33 berths are divided amongst the three terminal areas. Total berthing space measures 25,222 linear feet. Berth services available include:

- Portable brows, including six 30 and 32-foot straight brows (cruise terminals offer hydraulic passenger loading bridges)
- Pipeline hose connections for bunker fuels at berths 1 through 27, with all berths accessible by tank truck and barge
- Linehandler services for docking, undocking and/or shifting of vessels, with a shift counting as two movements
- Dockside lighting/high-mast lights for night operations at all berths (external suppliers offer portable diesel power generators)
- Shoreside metered hose connections for fresh water at berths

- Complete chandler and provision services from external suppliers
- Public telephones at all cruise terminals and most berths

The Northport region covers Berths 1-13. **Table 10** provides the breakdown of dimensions and usage for berths in Northport. Northport has 9 acres of open yard facilities for containers. The Northport area has oil product storage tanks, cement silos, railroad spur access, road access, and airport access nearby. There is also one daily cruise vessel that berths in this area.

Table 10: Specifications for Northport Berths

Berth No.	Length (feet)	Depth (feet)	Width (feet) [1]	Use(s)
1A	180	12	125	Lay-in
1B	220	23	125	Lay-in
1-2-3	1,601	31	125	Cruise, Cargo, RO/RO, Navy
4	900	43	156	Cargo, RO/RO, Cruise
5	900	43	156	Tanker, Cargo, RO/RO
6	380	38	125	Container, Cargo, Lay-in
7-8	1,200	38	156	Tanker
8A-9A	300	38	156	Miscellaneous
9-10	1,200	38	156	Tanker
11	763	38	125	Barge
12A-13A	300	38	156	Miscellaneous
12-13	1,226	38	156	Tanker

Source: Port Everglades Guide, 2010 Guide and Directory, Broward County, Florida.
[1]Linear distance perpendicular to the berth bulkhead. Based on the extreme breadth of the largest vessel using the berth, plus an amount for mooring fenders and cargo discharging equipment.

The Midport region, like Northport, is a multi-use facility (**Figure 4**). Midport berthing serves cruise industries, lift-on/lift-off ("lo/lo") cargo, ro/ro cargo, naval ships, harbor tugboats, and smaller lay-in vessels (a lay-in vessel is one in an idle status, neither loading or unloading cargo). Primary cargos handled in this area of the Port include containers, bulk cement, lumber, and steel. Midport has 51 acres of open yard container storage. The Midport region covers Berths 14-29. **Table 11** provides the breakdown of dimensions and usage for berths in Midport.

Along with berthing, Midport provides: one Panamax gantry crane, one mobile harbor crane, a refrigerated warehouse, several acres of open yard area for containers and neobulk storage, and eight dockside terminal buildings that are used for passenger facilities. The berth areas adjacent to these terminals are used for both cruise and cargo operations.

Table 11: Specifications for Midport Berths

Berth Number	Length (feet)	Depth (feet)	Width (feet) [1]	Use(s)
14-15	1,400[2]	38	156	Bulk Cement, General Cargo
16-17-18	1,650	38	125	Container, RO/RO, Cruise
19-20	1,300	38	125	Cruise, Navy, RO/RO
21-22	1,707[2]	38	125	Cruise, General Cargo, Navy
23	240	38	125	Miscellaneous
24-25	1,600[2]	40	125	Cruise, Navy, Lay-in
26-27	1,340	40	125	Cruise, General Cargo, Navy
28A	480	27	125	Tugboats
28B	275	27	125	Lay-in
28C	350	27	125	Lay-in
28D	350	27	125	Lay-in
28E	275	27	125	Lay-in
28F	615	27	125	General Cargo, Container
29	1125	40	257	Container, Cruise

Source: Port Everglades Guide, 2010 Guide and Directory, Broward County, Florida.
[1] Linear distance perpendicular to the berth bulkhead. Based on the extreme breadth of the largest vessel using the berth, plus an amount for mooring fenders and cargo discharging equipment.
[2]Berth lengths reflect an extended length commonly encountered when accommodation of a ship that is longer than the berth is allowed by letting ship extend out past end of berth area, on the order of 200 feet.

The Southport region is dedicated to cargo traffic and maintains both lo/lo and ro/ro operations. The Southport terminal has 215 acres of open yard facilities for containers/trailer storage and operations. Soutport extends from Berths 30-33C. **Table 12** provides the breakdown of dimensions and usage for berths in Southport. Along with berthing, Southport offers seven low-profile Post-Panamax gantry cranes. These cranes are mounted on a rail which extends from Berth 30 at the Turning Notch to Berth 33 just north of the Dania Cutoff Canal, **Figure 14**.

Table 12: Specifications for Southport Facilities

Berth No.	Length (feet)	Depth (feet)	Width (feet)[1]	Use(s)
30	900	44	132	Bulk, Container
31-32	2,000	44	132	Container, LO/LO
33A	800	44	125	Container, RO/RO
33B	700	44	125	RO/RO
33C	700	44	125	RO/RO

Source: Port Everglades Guide, 2010 Guide and Directory, Broward County, Florida.
[1] Linear distance perpendicular to the berth bulkhead. Based on the extreme breadth of the largest vessel using the berth, plus an amount for mooring fenders and cargo discharging equipment.

Figure 14: Turning Notch and Southport (view looking south)

2.4.2 Cargo Movements and Fleet Composition

Port Everglades handles liquid bulk, dry bulk, general cargo, ro/ro cargo, neobulk, breakbulk, cruise ship passengers, and containerized cargo. Total vessel calls during the period of 1993 to 2010 have declined primarily due to a reduction in passenger cruise ship calls. The Port documents 8,203 ship calls in 1993; 11,722 in 2006; 5,496 in 2007; 5,226 in 2008; 4,251 in 2009; 4,079 in 2010; and 4,000 in 2012. Vessel call data from 2012 was made available for use and is shown in **Figure 15**.

In addition to the cargo traffic, Port Everglades is a homeport Port for the major cruise

ship lines. Multi-day cruise lines include: Princess Cruises, Holland America Line, Celebrity Cruises, Carnival, and Royal Caribbean International. Daily cruises include the Balearia Caribbean service to Freeport, Bahamas. Traditionally, Port cruise vessels have supported smaller day cruises accomodating 1,200 passengers or so. Cruise ship trends at Port Everglades are changing and are trending toward larger capacity vessels on the order of 3,000 to 6,000 passengers. Total annual cruise calls is projected to remain around 800-900 annually.

The cruise market has been shifting from day trips to longer voyages and larger vessels. As such, this is not a sign in market decline, but rather a market shift in the type of cruising to higher value, multi-day cruises on the largest, newest vessels deployed in the cruise industry.

There is a U.S. Navy testing facility and a U.S. Coast Guard Station at Port Everglades. Their vessels range in size up to aircraft carriers. The Navy/USCG vessel calls represent on average about 0.4 percent of all calls.

Other vessel calls include tugs and lay-ins (fuel and water bunkering). This type of vessel traffic represents on average about 12 percent of all vessel traffic at the Port.

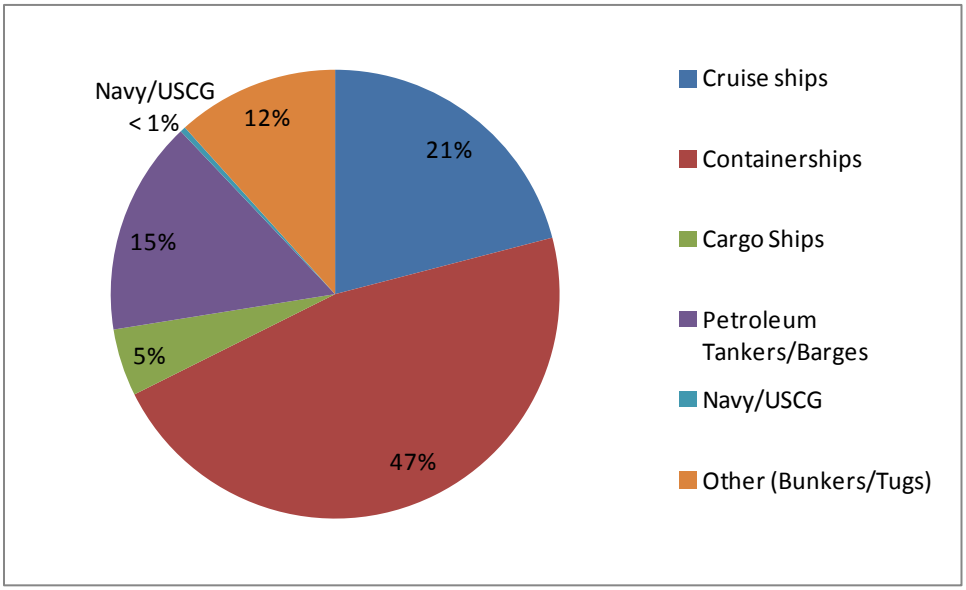

Figure 15: 2012 Annual Vessel Call Characterization

Container vessels are calling at deeper sailing drafts inbound and outbound. For example, container vessel calls with 35-foot sailing draft or greater increased from 35 in 2004 to 104 in 2008, to 190 in 2012. The increase in deeper draft vessels correlates with the increase in number of larger Panamax and Post-Panamax container vessels calling the Port. The liquid bulk fleet (tankers) is primarily Large Range 1 (LR1) in size (45,000 to

79,999 dwt[1]), with a few Aframax vessels (80,000 to 120,000 dwt with Post-Panamax beams[2]). The bulk fleet is typically sailing at or near a 37-foot draft. The dry bulk fleet ranges between 40,000 and 60,000 dwt and is typically all cement or cement production input materials. Section 4.2 of the **Economic Appendix B** discusses the fleet composition in more detail.

The major global services for container vessels calling on Port Everglades are deployments to and from the Far East (FE), Europe (EU), the Mediterranean (MED), and South America (SA). Most of the larger container vessels' calls were either associated with services for the Far East, Mediterranean, Europe, or South America. The FE and MED calls declined in number from 2006 to 2008 due to the global recession, however the larger vessels on EU and MED routes have increased in recent years. The AUST calls in the same time period remained the same, and the SA calls increased.

Analysis of Port Everglades annual tonnages from 1998 to 2012 showed petroleum tonnages peaking in Fiscal Year (FY) 2005 at 18.3 million short tons, and then declining after 2005 to 14.8 million short tons in FY 2012. Cement and other dry bulk peaked in FY 2006 at approximately 2.9 million short tons, and then declined to approximately 500 thousand short tons in FY 2010, but it has increased to approximately 970 thousand short tons in FY 2012. Container tonnage has been resilient at Port Everglades over the past decade despite the economic recession, which elsewhere caused a decline at many major domestic container ports. The growth rate for containerized cargo tonnage at Port Everglades was nearly double the rate of south Florida population growth over the period from 2000 to 2010[3].

Economies of scale (declining cost per unit as volume increases) typically arises for a variety of reasons. Having a large local market share is an important driver of economies of scale in terminal operations. When a high share of the volume originates in and/or is destined for a local market, this lowers container terminal costs per unit thereby enabling larger, more efficient and more intensively utilized facilities. Origin and destination market share, unique to transportation, produces traffic density on an intercontinental route, using the same ocean leg. This enables carriers to operate larger vessels that naturally optimize at lower per slot costs than smaller ships. With the continued long term population growth in south Florida, Port Everglades will continue to be a busy port of call. Commerce data for 2012 are displayed in **Table 13** and portrayed in **Figure 16**.

[1] dwt = deadweight tonnage; most of the LR1 class vessels calling Port Everglades are in the 45,000 to 60,000 dwt size range
[2] Post-Panamax beam is greater than 106 feet
[3] 2.46% vs. 1.25% compound annual growth rates; sources: Port Everglades and U.S. Census Bureau

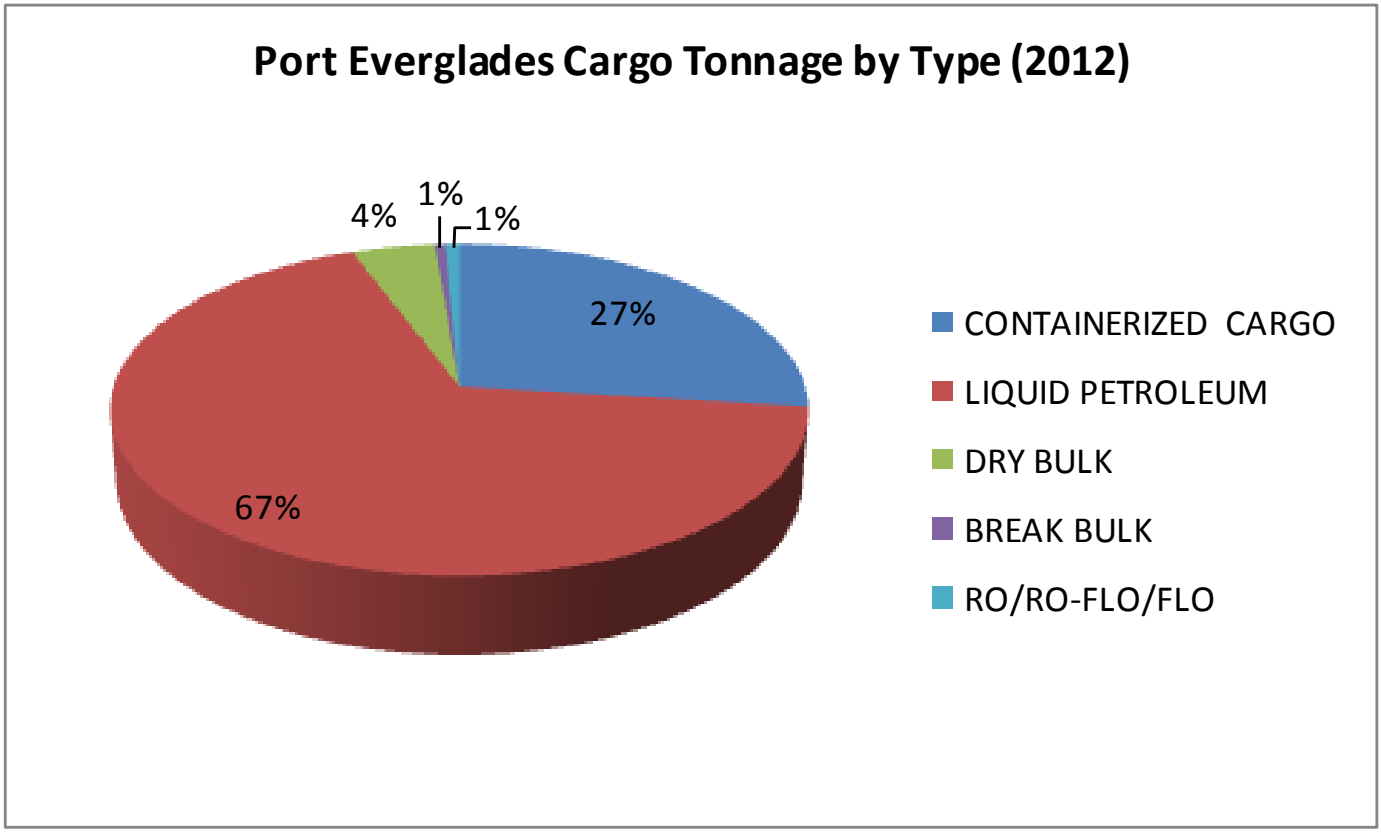

Figure 16: Port Everglades Commerce for Fiscal Year 2012

Table 13: Cruise Passengers and Total Tonnage by Type (2003-2012)

Port Everglades Waterborne Commerce Chart for the Ten Fiscal Years 2012 through 2003 (Unaudited)

FISCAL YEAR	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
Operating Revenue	$ 142,931,312	$ 139,177,090	$ 124,653,452	$ 114,441,818	$ 121,169,061	$ 112,500,017	$ 107,577,863	$ 105,858,262	$ 112,476,658	$ 89,386,458
Expenses	$ 72,604,326	$ 74,182,360	$ 73,950,966	$ 73,235,677	$ 73,093,351	$ 72,111,017	$ 69,117,148	$ 65,232,415	$ 56,488,710	$ 53,817,229
Gross Margin	$ 70,326,986	$ 64,994,730	$ 50,702,486	$ 41,206,141	$ 48,075,710	$ 40,389,000	$ 38,460,715	$ 40,625,847	$ 55,987,948	$ 35,569,229
TOTAL WATERBORNE OPERATING REVENUE	$ 122,018,332	$ 118,021,876	$ 103,312,041	$ 92,665,832	$ 96,958,452	$ 90,737,653	$ 85,850,912	$ 84,828,184	$ 81,516,312	$ 68,969,934
Cruise Revenue	$ 60,159,964	$ 56,754,102	$ 45,724,190	$ 37,428,549	$ 35,217,120	$ 31,483,362	$ 28,146,431	$ 30,000,619	$ 30,601,167	$ 25,223,188
Containerized Cargo Revenue	$ 31,321,019	$ 31,669,031	$ 29,473,963	$ 28,711,223	$ 33,867,064	$ 28,556,927	$ 25,393,178	$ 24,192,949	$ 20,487,292	$ 18,106,809
Petroleum Revenue	$ 25,656,369	$ 25,771,885	$ 25,486,535	$ 23,537,174	$ 23,620,073	$ 23,756,489	$ 22,946,933	$ 22,945,117	$ 22,734,391	$ 19,803,802
Bulk Revenue	$ 2,003,023	$ 1,378,516	$ 925,567	$ 1,090,407	$ 1,599,476	$ 3,251,766	$ 5,661,670	$ 4,836,366	$ 4,595,168	$ 3,986,867
Break Bulk Revenue	$ 1,552,505	$ 1,283,503	$ 872,967	$ 886,826	$ 1,670,354	$ 2,803,198	$ 2,798,064	$ 2,228,132	$ 2,147,521	$ 1,318,299
Lay-In Revenue	$ 1,078,394	$ 806,288	$ 467,858	$ 736,089	$ 692,866	$ 384,696	$ 468,490	$ 388,664	$ 534,936	$ 422,734
Navy Revenue	$ 247,058	$ 358,551	$ 360,961	$ 275,564	$ 291,499	$ 501,215	$ 436,146	$ 236,337	$ 415,837	$ 108,235
TOTAL SHIP CALLS	4,000	4,183	4,079	4,251	5,226	5,496	5,510	5,901	6,389	5,853
Cruise Ships	838	969	1,015	1,007	1,676	1,852	1,763	2,362	2,854	2,215
Container Ships	1,867	1,861	1,830	1,980	2,197	2,270	2,185	1,988	1,890	1,880
Cargo Ships	194	180	113	105	157	202	268	247	231	213
Petroleum Tankers/Barges	618	630	661	683	727	732	744	751	763	798
Navy/USCG	16	26	29	34	22	39	29	18	25	17
Other (Bunkers/Tugs)	467	517	431	442	447	401	521	535	626	730
TOTAL CRUISE PASSENGERS	3,757,320	3,952,843	3,674,226	3,139,820	3,227,770	3,409,946	3,239,154	3,801,464	4,075,406	3,375,671
Single Day	68,298	288,740	360,018	302,866	591,059	719,888	779,470	1,113,101	1,400,110	1,050,174
Multi-Day	3,689,022	3,664,103	3,314,208	2,836,954	2,636,711	2,690,058	2,459,684	2,688,363	2,675,296	2,325,497
TOTAL CONTAINERIZED CARGO (tons)* **	5,944,513	5,787,961	5,216,831	5,204,103	6,584,747	6,060,149	5,688,442	5,076,403	4,145,394	3,633,610
TEUs Loaded	655,046	621,632	552,781	551,862	697,808	665,729	624,524	572,342	486,598	415,186
TEUs Total	923,600	880,999	793,227	796,160	985,095	948,680	864,030	797,238	653,628	569,743
TOTAL PETROLEUM (tons)*	14,830,384	15,325,199	15,483,856	15,337,063	16,143,971	17,486,726	17,566,394	18,338,378	17,585,603	16,958,171
Barrels	104,819,812	108,262,845	109,380,437	108,356,216	113,941,485	122,979,685	123,479,901	128,842,410	123,734,414	119,100,503
TOTAL BULK (tons)*	973,191	531,572	511,467	566,820	895,147	1,752,974	2,954,310	2,848,333	2,854,588	2,535,057
Bulk Cement	613,051	375,050	264,211	306,727	494,054	1,432,837	2,465,753	2,222,492	2,333,142	2,164,610
Dry Bulk	346,976	141,189	234,068	246,988	387,383	307,825	475,084	607,063	509,891	354,444
Liquid Bulk (Non-petroleum)	13,164	15,333	13,188	13,105	13,710	12,312	13,473	18,778	11,555	16,003
TOTAL BREAK BULK (tons)* **	120,812	94,921	69,960	67,462	91,007	302,301	376,535	279,139	297,678	161,195
Steel/Coils/Rebar	53,055	27,180	15,192	15,523	17,660	175,361	256,271	159,353	150,951	76,471
Other Break Bulk	67,757	67,741	54,768	51,939	73,347	126,940	120,264	119,786	146,727	84,724
TOTAL VEHICLES & YACHTS (tons)* **	166,237	180,986	181,169	172,361	240,129	196,014	152,549	125,166	104,167	87,862
Trucks/Trailers	28,222	28,112	34,105	40,903	69,712	57,390	28,729	23,400	18,536	17,454
Tractors	76,163	83,337	79,210	65,255	69,552	52,089	45,462	26,630	18,812	14,160
Yachts/Boats	55,198	60,812	54,396	53,871	75,729	63,999	57,668	32,866	42,940	37,310
Autos	4,307	7,253	12,972	11,314	23,845	20,184	16,983	23,491	22,104	14,393
Buses	2,347	1,472	485	1,018	1,291	1,720	3,708	1,917	1,775	2,223
TOTAL WATERBORNE COMMERCE (tons)* ***	22,116,275	22,087,515	21,640,144	21,503,720	24,227,435	26,400,271	27,114,362	27,159,194	25,462,798	23,870,023

*Tonnage is measured in 2,000-pound short tons.
**Vehicles & Yachts tonnage is presented in detail in its own section for informational purposes, but this tonnage is accounted for in other areas above.
***Total includes other amounts that are not part of the tonnage presented above for the primary revenue centers.

Source: Port Everglades Commerce Report FY2012
Notes: Short tons. Cruise Passengers are counted at embarkation and debarkation.

3.0 FUTURE WITHOUT-PROJECT CONDITIONS

3.1 BASE YEAR AND PROJECT LIFE

USACE guidance requires forecasting of without-project conditions throughout the 50-year period of analysis. The Base Year is 2023 and is defined at the time when project construction will be complete. The 50-year period of analysis is 2023 to 2073.

3.2 PHYSICAL CONDITIONS

Most of the physical conditions that were outlined in the existing conditions section are expected to remain the same under the future with and without-project scenarios. This includes the current trends for climate, winds, waves, tides, currents, salinity, littoral processes, geology and sediments. It is assumed that these trends will not impact the design of the project nor any mitigation activities. One aspect of the physical conditions that is expected to change under the future without-project condition is the sea level. A range of sea level rise estimates were determined based on the local historic sea level rise rate, the construction (base) year of the project, and the design life of the project. Based on a 50-year period of analysis, the low, intermediate, and high sea level rise values are projected to be 0.39 feet, 0.84 feet, and 2.25 feet, respectively. A description of this analysis is presented in section 7.2.4 of this report. Further details can be found in the **Engineering Appendix, Section 1.1.1** and the **EIS Section 4.26.3**.

3.3 ENVIRONMENTAL RESOURCES

In the future without-project scenario, the physical conditions are expected to remain consistent, so limited impacts to the environmental resources are expected. As previously discussed in accordance with ER 1110-2-8162, a sea level rise analysis was conducted and a low, intermediate, and high rate for anticipated increase in the sea level was produced. In the low and intermediate rate, no impacts to environmental resources are expected due to the insignificant rise in sea level. For the high rate the increased water depth could potentially have a negative impact on sea grasses. The proximity of the project to open ocean leads to no significant change in salinity and therefore no effect to environmental resources are expected due to a change in salinity.

3.4 ECONOMIC CONDITIONS

One indicator of the future economic conditions for the project area is population growth. Population growth in the area has been rapid since 1950. This growth can be attributed to Florida's ideal climate, historically low property costs, and abundant recreation opportunities. Over the last 60 years Broward County population increased from 83,933 in 1950 to 1,748,066 in 2010, an increase of over 2000%. Due to a more established

community, Miami-Dade County achieved less growth than Broward County, or the State as a whole. Florida population grew over 500% in the 60-year span.

As a subset of Florida population, the summed total of the nine counties in the project hinterland comprises a slowly increasing percentage share of the Florida state population over most of the period. Although the populations of the counties were increasing in absolute numbers from 1970-2000, their share of Florida's population did not change substantially over this period. However, from 2000 to 2010, the South Florida regional share of Florida state population increased to its highest percentage share ever at 40.6%. More detail on the projected growth rates and population can be found in the **Economic Appendix B Section 2.**

The majority of the Port's annual total commodity tonnages come from petroleum, cement, and containers. The growth rates for cement were affected by the economic slowdown that has characterized south Florida since 2006. Petroleum and container tonnage continued to grow through 2012. The container tonnage historical growth rates, further discussed in the **Economic Appendix Section 3**, were generally more conservative than other major U.S. container ports, reflecting that Port Everglades is historically a regional hinterland largely confined geographically to the southern part of Florida. The newly constructed Intermodal Container Transfer Facility (ICTF) will allow the Port to move cargo more efficiently.

The projected near-term annual growth rate for containerized cargo range from 3.81% to 4.27%, as outlined in the **Economics Appendix B Section 5**. A factor that will affect this rate is the resumption of discontinued container services by Panamax vessels.
The design vessels used for the formulation of measures are shown in **Table 14**. There were two categories of design vessels, the vessels for which the channel measures were specifically designed, and the vessels that were used as berthed vessels and test case vessels to improve the reality of ship simulation modeling. The primary Post-Panamax container design vessel is an S-Class. Refer to the **Engineering Appendix** A for a more detailed discussion. In order to accommodate projected growth in containerized cargo traffic at Port Everglades, it was determined that regions of the harbor require deepening and widening. The design vessels are the primary tool used in the evaluation of structural measures for Port improvement.

The containership fleet is expected to shift towards larger vessels. Over time, more new builds of Post-Panamax container vessels are expected to come into service. These vessels will be deployed on strings that call Port Everglades, as they do now, in a draft-constrained condition, without being able to fully utilize vessel capacity. Additionally, container liners would not be able to fully utilize the vessel fleets that will be available to them. The liners are not anticipated to deploy as many Generation 2 Post-Panamax vessels onto strings that service Port Everglades in the future without-project condition.

Table 14: Design Vessels

Design Vessel	Beam (ft)	Draft (ft)	Length (ft)	Project Component
Post Panamax"S-Class"	141	48	1,139	OEC, IEC, MTB, Widener, SAC, TN
Liquid Bulk	≤ 142	≤ 55	≤ 900	OEC, IEC, MTB
Future Cruise "Voyager"	156	28	1,020	OEC, IEC, MTB, Widener, SAC
Panamax "Bellatrix"	82	29	524	DCC
South Turning Basin	106	43	926	STB
Pleasure Craft[1]	20	N/A	N/A	All
[1] Pleasure Craft design vessels were used as "passing vessels" in the determination of channel and turning basin dimensions				

Mediterranean Shipping Company's MSC Maeva, a 1,066-foot-long, 140-foot wide, 105,007 dwt containerized cargo ship (**Figure 17)** is the first of three ships in its class that will carry cargo to and from Port Everglades as part of a weekly ocean shipping service. The first transit of this 8100 TEU capacity vessel to Port Everglades was reported to have occurred on March 29, 2011. As a result of this service, Pilot restrictions have been increased for vessels of this size. Under future without-project conditions, the extent of this service would be restricted due to traffic congestion; wind, wave and outer channel cross-current limitations; and existing insufficient channel depths for fully loading.

Figure 17: MSC Maeva

3.5 Without-Project Assumptions

Based on ER 1105-2-100 (USACE 2000), the following assumptions are made regarding without-project conditions:

- The period of analysis is 50 years.
- The use of navigation restricitons as set by the port pilots (use of tide, additional tugs) will continue to be used under the without-project condition.

- Normal operation and maintenance practices are assumed to be performed over the period of analysis.
- In projecting commodity movements involving intermodal movements and in projecting traffic movements on other modes, sufficient capacity of the hinterland transportation is assumed (a hinterland analysis can be found in the **Economics Appendix B Section 2**).
- Infrastructure planned to be implemented by the Port will be constructed on schedule including the extended expansion of the Turning Notch which is currently underway.
- The existing quality and extent of environmental resources is assumed remain consistent throughout the period of analysis.

The Port conducted an indepth analysis of Turning Notch (TN) expansion alternatives independent of this study, and arrived at an optimum length of the TN that would result in maximum additional throughput at minimum construction costs. Extension of the TN is an important port infrastructure improvement to increase the number of cargo berths in Southport. This extension involves moving ships and cranes closer to the Ft. Lauderdale Airport runway.

The Port is currently moving forward with the Turning Notch (TN) extension project. Planning, design, permitting, and engineering for this expansion is underway. This project will lengthen the existing TN from 900 feet to 2,400 feet at the existing depth of 42 feet (+2). The project will provide for up to five additional berths. A critical part of the TN extension project includes replacing approximately 8.7 acres of an existing mangrove conservation easement with an approximately 16.5-acre upland enhancement of approximately 70,000 new mangroves and transitional plants, as well as completing additional mitigation in West Lake Park. The Port worked closely with port users, the environmental community, and the Florida Department of Environmental Protection (FDEP) to develop a plan for the new mangrove habitat. This effort resulted in an agreement between Broward County's Port Everglades and the FDEP for the partial release of the conservation easement which was executed on September 3, 2010.

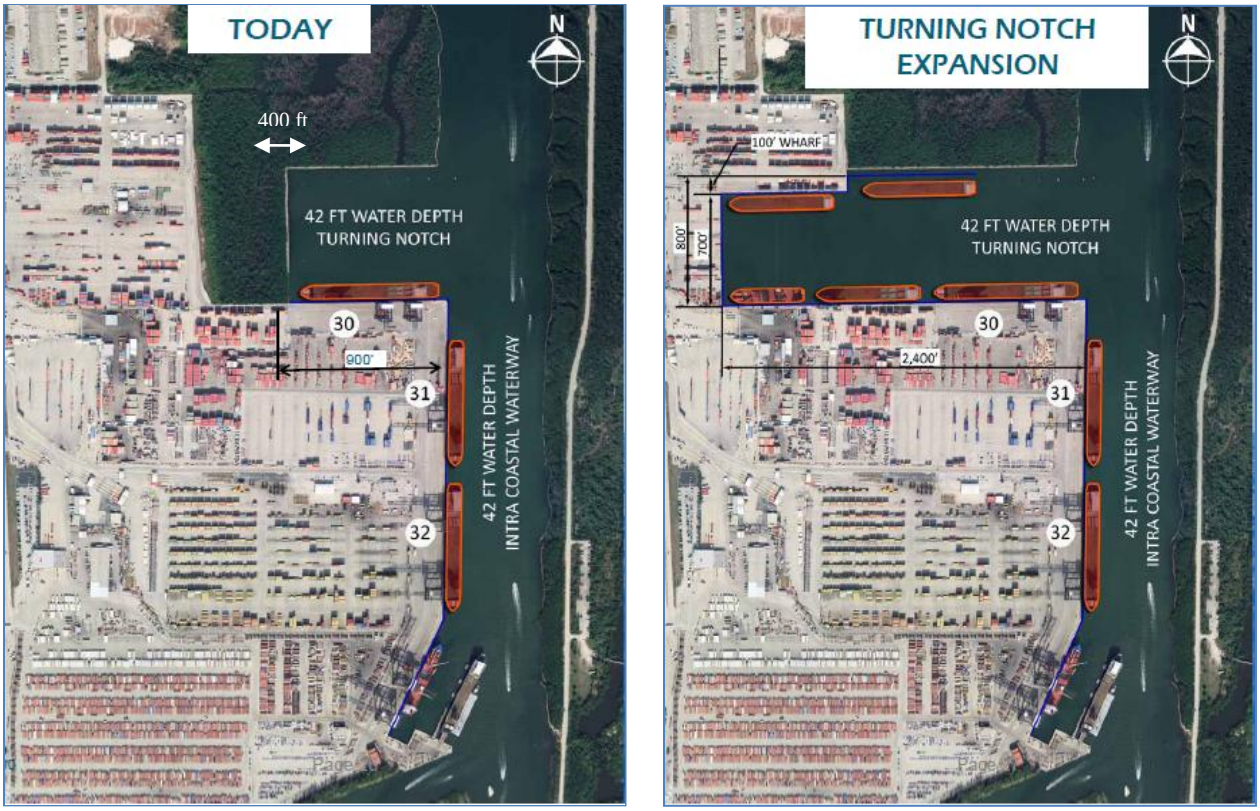

Figure 18: Sponsor's Turning Notch Expansion

4.0 PROBLEMS AND OPPORTUNITIES AND FORMULATION

The following paragraphs present the culmination of the iterative plan formulation process.

4.1 THE PLANNING PROCESS

The USACE planning process follows the 6-step process defined in the Principles and Guidelines. This process is used for all planning studies conducted by the USACE, provides a structured approach to problem solving, and provides a rational framework for sound decision making. The six steps are:

Step 1: Identify problems and opportunities
Step 2: Inventory and forecast conditions
Step 3: Formulate plans
Step 4: Evaluate plans
Step 5: Compare plans
Step 6: Select a plan

4.2 PROBLEMS AND OPPORTUNITIES

Meetings and coordination with the non-federal sponsor (Broward County represented by its Board of County Commissioners), terminal operators, Port Everglades Pilots Association, the U.S. Coast Guard (USCG), Florida Department of Environmental Protection (FDEP), NOAA Fisheries, Florida Fish and Wildlife Conservation Commission (FWC), Nova Southeastern University, National Marine Fisheries Service (NMFS) Habitat Conservation Division (HCD), and additional environmental resource agencies provided valuable information related to existing problems and opportunities.

Representatives from the Port, Port Pilots' Association, USCG, Navy, and USACE met to discuss the problems investigated by this study. Two categories of problems were identified: (1) navigation problems occurring under existing conditions, and (2) existing channel design as a factor limiting Port expansion and promotion of additional business growth. The Pilots resolved that before comprehensive port expansion and growth can occur, congestion, restricted manueverability, turning, passing, and lightloading problems due to insufficient depths and widths must be solved.

Existing problems include;

i Outer Entrance Channel (OEC) existing dimensions and strong unpredictable cross currents combine to make entrance transit difficult under conditions of increased winds, waves, and currents. Pilots must increase vessel speed to negotiate the currents and compensate under crabbed conditions to remain aligned within the channel. Vessel delays

due to often difficult conditions in the OEC result in increased transportation costs. (**Figure 19**);

ii The Knuckle area configuration restricts maneuverability and transiting operations, especially when vessels are at Berths 25 and 26. Delays due to these restrictions result in increased transportation costs. (**Figure 20**);

iii The shoal in the area of the USCG facility restricts maneuverability and passing operations for transit down the Southport Access Channel (SAC), especially when vessels are at Berths 24 and 25, (**Figure 20**);

iv The existing Southport Access Channel (SAC) width restricts transiting past berthed cruise ships which causes vessel delays due to these restrictions;

v Turning Notch (TN) dimensions limit the size of vessels that can be turned and berthed;

vi Depth and width of channels and basins constrains fully loaded vessel realization for both existing and future fleet;

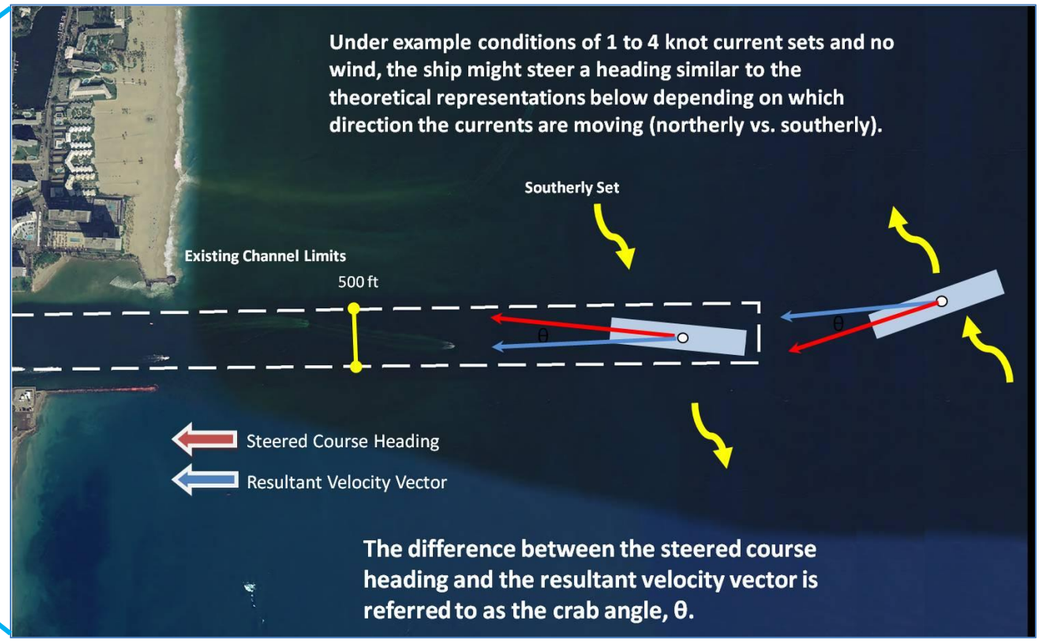

Figure 19: Port Everglades OEC Crabbed Conditions During Transit

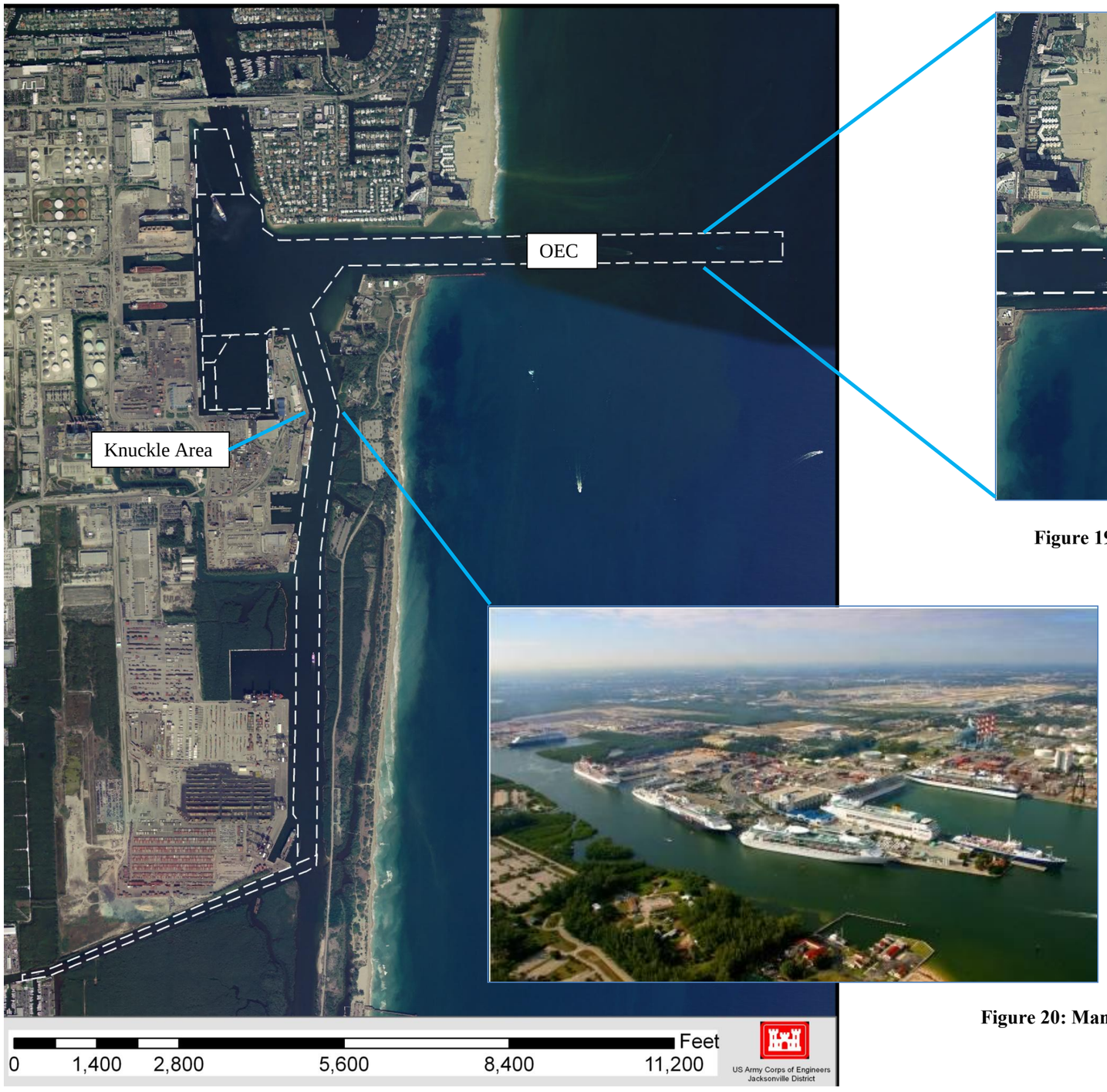

Figure 20: Maneuverability and Passing Restrictions in the Knuckle and SAC Area

The problems identified stem from the fact that the existing Federal navigation channel at Port Everglades was designed in the 1970's for use by sub-Panamax vessels. Under existing conditions, Panamax and Post-Panamax vessels use Port Everglades daily with restrictions. Both the proportion and sizes of Post-Panamax vessels at Port Everglades are projected to increase over time.

The most impacted vessel type is the container ships which transit the Federal navigation channel leading to the Southport container terminal. Cruise ship operations are restricted in the Federal navigation channel leading to two of the Port's cruise terminals. Petroleum vessels transit light loaded. In addressing existing problems, the Port has developed operational rules and restrictions which increase transportation costs for the cargo and cruise ship industries.

The primary problems identified in this analysis relate to the inefficient operation of containerships, petroleum vessels, and cruise ships in the Federal channel at Port Everglades which affect the Nation's international trade transportation costs and cruise industry operating costs. Inefficiencies include the following:

1. Transportation cost inefficiencies due to light loading, congestion delays, currents, and tidal delays;
2. Light loading, congestion delays, and tidal delays will increase as present harbor users increase their annual tonnage and as larger, more efficient ships that require deeper and wider channels replace older, smaller ones;
3. Existing ships are experiencing maneuverability and efficiency problems in the Federal navigation channel associated with restricted access to portions of the Federal navigation channel during typical port operations;
4. The severity of problems associated with maneuverability and restricted access to the Federal navigation channel will increase as vessel size and the proportion of larger vessels increases.

The inefficient operation of cargo vessels, petroleum vessels, and cruise ships at Port Everglades directly result from insufficient depth and width of the Federal channel. The existing channel depth constraint causes some carriers to light-load vessels and restricts the efficient vessel size used by carriers. Examples of light loading are exhibited in containership operations. Restrictions on efficient vessel size are exhibited by liquid bulk and dry bulk operations, which have the landside capacity to use larger vessels, but the existing channel depth restricts the efficient use of these larger vessels. Containership size is also restricted by the existing Federal navigation channel depth (and width). Some of the largest containerships calling at Port Everglades have been pulled and redeployed elsewhere because of the restrictions on vessel operations imposed by existing channel constraints. Light-loading, restricted vessel size, and pulling large vessels from Port Everglades may increase cargo transportation costs.

The Port has developed restrictive operational rules in response to the difficulties associated with navigating a modern fleet in outdated narrow channel conditions. There are by-passing restrictions on vessels transiting the Southport Access Channel, which stop all Panamax and Post-Panamax vessel traffic in the Southport Access Channel, when

Panamax vessels are moored alongside berths 25, 26/27, and 29. Additional tugs are required for Panamax and Post-Panamax vessels transiting the Southport Access Channel if sub-Panamax vessels are moored alongside. Additional tugs are required for all Post-Panamax containerships with a beam greater than 140 feet. These operational rules increase cargo and cruise ship transportation costs by causing delays, increasing fuel consumption, and by requiring additional tugs. These existing problems are projected to increase as future cargo tonnage and vessels sizes increase at the Port.

Navigation improvements will provide the following opportunities:

i. Accommodate transit of larger Post-Panamax class containerized cargo vessels
ii. Accommodate transit of deeper draft bulk cargo vessels
iii.
iv. Accommodate new generation cruise ships
v. Allow for more efficient transit of existing and future fleets
vi. Accommodate future vessel demands

4.3 PLANNING OBJECTIVES AND CONSTRAINTS

4.3.1 Federal Objective

The Federal objective of water and land resource planning is to contribute to national economic development (NED) consistent with protecting the nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to the NED outputs are increases in the net value of the national output of goods and services, expressed in monetary terms. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

The objective of this feasibility study is to provide solutions to the previously defined problems in accordance with the Federal objective, and objectives of the non-federal sponsor and other interested parties. The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of alternatives. The planning objectives represent the desired positive changes from the without project conditions.

Four accounts are established in the Principles and Guidelines (P&G) to facilitate the evaluation and display of effects of plans. The accounts are:

1. NED: The national economic development account which displays changes in the economic value of the national output of goods and services;
2. EQ: The environmental quality account displays non-monetary effects on ecological, cultural, and aesthetic resources including positive and adverse

effects of ecosystem restoration plans;

3. RED: The regional economic development account displays changes in the distribution of regional economic activity (i.e. income and employment);
4. OSE: The other social effects account displays plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation, and others.

4.3.2 Planning Objectives

The planning objectives are shown in **Table 15**. Incorporation of the USACE seven Environmental Operating Principles (EOP) is an incorporated component of the project. USACE feasibility studies aim to protect the environment to the maximum extent practicable, while meeting the stated goals of the applicable feasibility study.

Table 15: Study Objectives

Objective 1	Decrease costs associated with vessel delays from congestion and channel passing restrictions at Port Everglades through the 50-year period of analysis.
Objective 2	Decrease transportation costs through increasing economies of scale for cargo and petroleum vessels at Port Everglades through the 50-year period of analysis.
Objective 3	Increase channel efficiency and maneuverability at Port Everglades for the existing fleet and larger vessels through the 50-year period of analysis.

4.3.3 Planning Constraints

Constraints are restrictions that limit the planning process. Acceptable plans are those that will achieve the study objectives without violating the constraints. The following constraints were identified to be relevant to this study:

- Sensitive environmental resources exist within the study area. The sensitive environmental resources in the area, presented in **Section 2**, include wetlands, seagrass communities, nearshore habitat, essential fish habitat, and threatened and endangered species. Any impacts to these resources will be avoided or minimized to the extent practical.

- State park lands (John U. Lloyd Beach State Park) border the project area. There is a large area of mitigation (mangroves) along the SAC that was constructed as part of the Port's dredging of the TN in 1989. Additionally, impacting John U. Lloyd state park lands would require going before the Governor/Cabinet for a permanent release of state lands. The state sent USACE a letter in 1999 stating they would not support this. The project will seek to avoid impacts wherever practicable.

- FAA flight surface restrictions are due to the relatively low flight patterns of aircraft as they prepare to land or have just taken off from the Ft. Lauderdale International Airport. Any new post-Panamax cranes may not infringe on this flight surface.

- The U.S. Coast Guard station is within the project area. This facility is necessary and cannot be removed. All project alternatives include keeping the station active.

- Nova Southeastern University (NSU) property is within the project area. All project alternatives are formulated to ensure there are no impacts to NSU.

An iterative process was used to formulate, scope, design, screen, and refine plans. A no-action plan, non-structural plans, and structural plans were considered throughout the process. A series of meetings with interested stakeholders were held to facilitate an open planning process. A web page was created to make meeting information available. The study takes into account all applicable county, state and Federal laws, permitting requirements, regulations, and environmental guidance.

4.4 ENVIRONMENTAL OPERATING PRINCIPLES

The USACE Environmental Operating Principles (EOP's) were developed in 2002 to help provide direction on how to better achieve stewardship of air, water, and land resources, and to demonstrate a positive relationship between management of these resources for the protection and improvement of a sustainable environment. These EOP's were later revisited with more emphasis on proactively implementing these principles.

The EOP's are:

1. Foster sustainability as a way of life throughout the organization.
2. Proactively consider environmental consequences of all USACE activities and act accordingly.
3. Create mutually supporting economic and environmentally sustainable solutions.
4. Continue to meet USACE corporate responsibility and accountability under the law for activities undertaken by the USACE which may impact human and natural environments.
5. Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs.
6. Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
7. Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

The EOP's were considered during each step of the plan formulation process. The Jacksonville District USACE and the non-federal sponsor recognize the high quality of

the reef system within the project area and the diverse marine life that it supports, including threatened and endangered species. Accordingly, interagency meetings were held on potential coral reef impacts, recovery and mitigation. Taking into consideration the views expressed by stakeholders, and in conformity with the EOP's, the project delivery team (PDT) selected a plan which provides the best balance of environmental sustainability and efficient use of navigation. Some of these principles are presented below.

- Blasting protection protocols to protect marine mammals and sea turtles
- Use of the standard manatee protection protocols during construction
- Pre-construction (baseline), during construction, and post-construction monitoring of coral and hardbottom habitats adjacent to the channel
- Monitoring of impacts to fishes associated with blasting events
- Relocation of hard corals from the 3rd reef entrance channel extension to mitigation site artificial reef
- Sustainability of proposed mangrove and seagrass restoration by coordination with a larger mangrove and seagrass restoration project within Broward County, inside a county park that will ensure long term protection of the created habitats.

4.5 PLANNING PROCESS

Figure 21 shows the planning process from formulation to selection of the Recommended Plan.

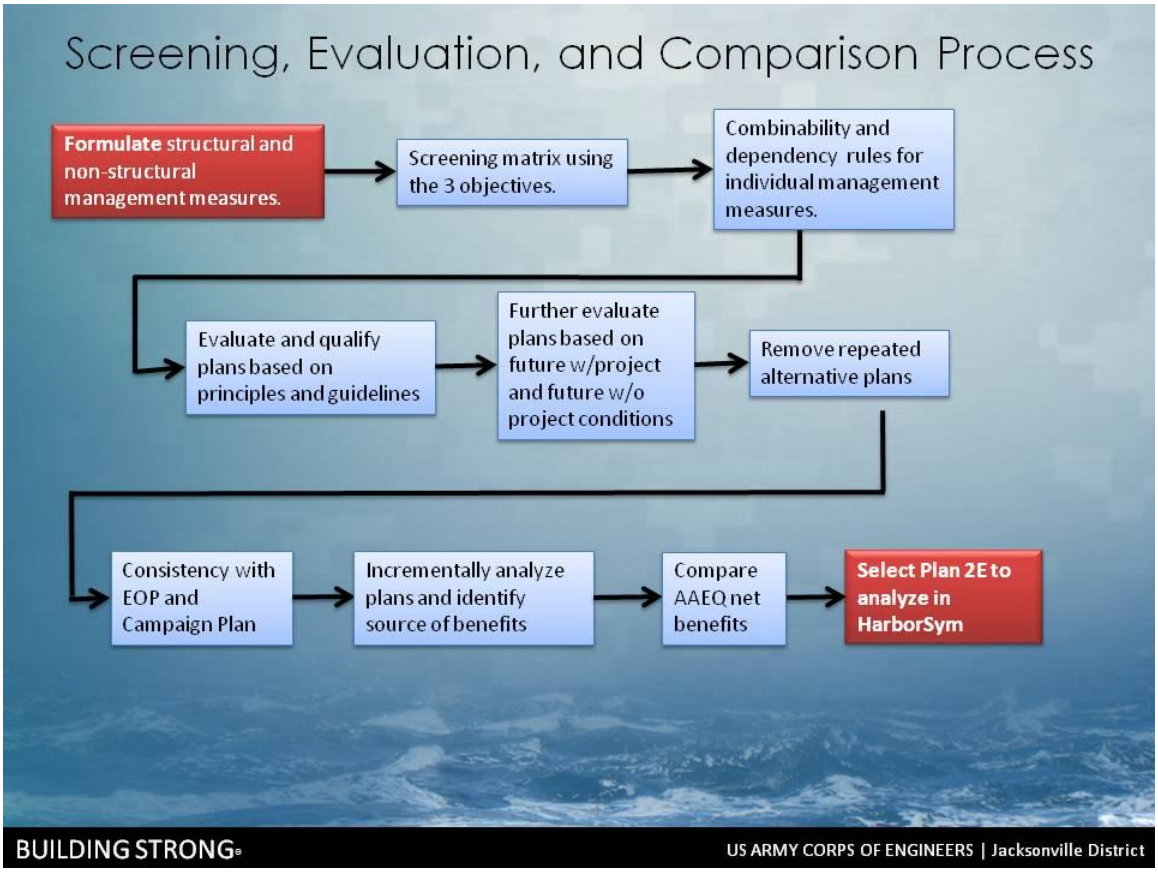

Figure 21: USACE Planning Process

4.6 MANAGEMENT MEASURES

A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. Management measures are used to create plans and can be categorized as non-structural or structural. Non-structural measures includes measures that can be implemented by non-federal agencies and project users that reduce or eliminate the need for a Federal project investment. This can include operational practices or structural alternatives that are implemented by project users. Non-structural measures do not require physical alteration of the Federal channel. Non-structural measures are listed in **Table 16**. Structural measures involve the physical alteration of the Federal waterway. Structural measures that were proposed and considered are listed in **Table 17**.

Table 16: Non-Structural Measures

Measure	General Description
1. No-Action	Allow Port to continue to operate the same
2. Additional Tugs	Add more "Ship Docking Module" tugs
3. Clear Berthed Vessels	Transit large vessels when no vessels are berthed at 24-29
4. Bypass Port	Import commodities to another port and truck as needed
5. Off-loading Cargo	Completely off-load cargo before entering the Port to a smaller vessel or vessels from vessels with greater than allowable drafts.
6. Light-loading Vessels	Light-load larger vessels to achieve lesser drafts that allow port entry
7. Lightering	Partially off-load larger vessels offshore onto smaller vessel to allow port entry at existing channel depths
8. Off-Shore Petroleum	Create an offshore petroleum facility to unload tankers with deeper drafts prior to entering the Port. Use pipelines to transport products.
9. Rail Alternative	Transport petroleum materials into Port Everglades by rail rather than ship.
10. NOAA Ports	Use the NOAA Physical Oceanographic Real-Time System to predict current direction and magnitude.

4.6.1 Non-Structural Measures

1. No-Action

This measure is equal to the without-project condition. This measure assumes no project would be implemented by the Federal Government or local interests to achieve planning objectives. The Port operations will continue current operations. The OEC will continue to be affected by strong and unpredictable cross currents that create hazardous and unreliable conditions. Maneuverability and passing operations of larger vessels will continue to be restricted. Channel and basin depths will restrict future vessel sizes, and the amount of goods that some vessels can carry. Pilot induced restrictions will continue to increase as vessel sizes also increase. Vessels will continue to be inefficiently distributed throughout Port Everglades or be unable to call. The no action plan may hinder opportunities for development and growth. The no action plan does not provide a solution to the study problems. The no action plan is carried forward in the analysis for comparison purposes however it is not recommended.

2. Additional Tugs

More tugs could be added to the Port with Ship Docking Module (SDM) technology. These tugs are an innovation tractor tug technology that can move in any direction with full power. They have the ability to safely maneuver ultra-large vessels within narrow channels and environmentally sensitive waterways, due to the specifically designed

manatee guards. Upon analysis, the Port indicated that currently there are sufficient SDM's and similar functioning tugs at Port Everglades to handle the existing fleet. It is the Port's intention to have sufficient SDM's and tractor tugs to handle the future fleet. It was determined that the Port was already using additional tugs and this measure would provide no added benefits.

3. Clear Berthed Vessels

Larger vessels have trouble transiting the SAC when vessels are berthed along the knuckle area. Berths 24 through 29 need to be cleared to allow safe transit. This is a current Pilot imposed restriction. This measure occurs under the without-project condition.

4. Bypass Port Everglades

Vessels that cannot be accommodated at the Port would be redirected to other ports. The commodities would then be trucked as needed or shipped on smaller vessels with use of a trans-shipment facility (such as Freeport). This measure is currently being implemented on container services that have recently left Port Everglades due to channel depth restrictions. This measure could reduce port congestion so it met objective 1, but increases transportation costs by added trucking costs or additional costs of another port.

5. Off-Loading Cargo

Vessels with a draft greater than the entrance channel allows would be off-loaded. The most common practice of off-loading involves the larger vessels to visit alternative deep water ports to transfer its cargo to smaller vessels. Congestion in the harbor would be increased as additional vessels would be entering rather than the original, larger vessel. Additional vessels causes increased delays and operating expenditures, therefore existing conditions indicate a preference to light-load large vessels rather than off-load them. This measure does not meet the study objectives.

6. Light-Loading Vessels

This measure would limit the ability of vessels entering the Port to load to their optimum capacity. Some vessels, despite any loading alternatives, would not be able to enter the Port without enlarging the entrance channel. With this measure, some larger vessels would still enter the Port at the existing drafts by light-loading; that is to not load the vessel to its most efficient capacity and thereby reduce the required channel depths. This would be similar to the no-action plan and is assumed to occur under the future without-project condition. The likely effect is to increase transportation costs due to additional transits required and resulting congestion. Larger container vessels are difficult to bring into the Port under current conditions. It would take additional time to turn and transit these vessels. Additionally, these vessels would create delays and block other vessels from passing. Light-loading vessels does allow for larger vessels to transit the harbor however restricts the optimal loading which may be partially loaded as is normal operating practices for container vessels.

7. Lightering Vessels

Lightering vessels is off-loading part of the cargo onto a smaller vessel outside of the

Port to allow entry into shallower ports. The reduced load of the original vessel reduces the required depth and thus allows entry into port. Both the smaller and larger vessel would enter the Port and unload there. Lightering is typically done at a designated anchorage or protected offshore area, neither of which are in close proximity to Port Everglades. This measure could increase channel efficiency and improve maneuverability so it met objective 3, but increases transportation costs due to double handing of cargo.

8. Off-Shore Petroleum

This measure would build an offshore facility for the petroleum vessels. Deeper tankers would unload oil at this platform to reduce its draft and enable entry to the Port. Tankers could possibly avoid entering port if all petroleum is unloaded at this platform. A pipe could be run along the ocean floor or micro-tunneling used to transport the petroleum to shore. Significant environmental concerns would be likely over the siting of the facility, pipeline routes, and operations. This measure meets objective 2 to decrease transportation costs, but would significantly increase landside costs and increase adverse impacts to the environment.

9. Alternative Rail

This measure was considered but discarded immediately because there is no rail infrastructure in South Florida to deliver the high volume required, therefore, this is not a feasible non-structural measure. More information on this measure is included in the **EIS** Section 2.5.

10. NOAA Ports

This measure was considered but discarded immediately as the USACE has no mechanism to require the Port or the pilots to adopt and implement PORTS. This alternative partially addresses Objective 3, however it does not address Objectives 1 or 2, and USACE's mission as provided by Congress does not comprise such actions. As a result of these factors, it does not meet the evaluation criteria for a reasonable alternative, and as such this plan was eliminated from further detailed analysis. More information on this measure is included in the **EIS Section 2.5**.

Table 17: Structural Measures

Measures	General Description
a. Widen OEC	Widen the existing Outer Entrance Channel
b. Deepen OEC, IEC	Deepen the Outer and Inner Entrance Channel, and associated berths
c. Widen MTB	Increase Main Turning Basin footprint
d. Deepen MTB	Deepen Main Turning Basin and associated berths
e. Deepen NTB	Deepen north extension of Main Turning Basin and berths
f. Deepen STB	Deepen the western portion of the south extension of Main Turning Basin and berths
g. Widener	Deepen and widen the channel where it connects the Inner Entrance to the Southport Access Channel
h. Widen SAC	Widen the Southport Access Channel
i. Deepen SAC	Deepen the Southport Access Channel and associated berths
j. Widen TN	Widen the Turning Notch and associated berths
k. Deepen TN	Increase depth to match Southport Access Channel deepening
l. DCC TB	Create a southern turning basin at the confluence of the Dania Cut-off Canal and the Southport Access Channel
m. Widen and Deepen DCC	Widen and deepen the Dania Cut-off Canal
n. Extend North Jetty	Extension of north jetty could prevent adverse cross-currents, reduce northwest waves in the channel, and limit adverse conditions to deeper water where vessels have more maneuvering room.

4.6.2 Structural Measures

a. Widen and Extend Outer Entrance Channel (OEC)

This measure would widen and extend the existing OEC. Under conditions of strong, variable currents, the 500-foot existing OEC presents a hazard to the existing and future design fleet for large vessels, **Figure 22**. Presently, pilots are required to line up with the

channel early and transit into the Port at increased speeds to remain aligned within the channel, as was learned during the ship simulation studies with the Pilots. Rapid deceleration of the vessel is then required for safe negotiation of the entrance jetties. Several tugs assist in stopping the vessel. To alleviate the need for potentially dangerous maneuvering for the existing and future design fleet, the OEC should first be widened to a a maximum width of 800 feet at its present outer most limit and then extended 2,200 feet offshore past the third outer reef. The extension is necessary to to achieve the required channel depth for the design fleet. It also reduces the affects of the difficult crosscurrents in this area. This measure should be combined with the Deepen OEC measure to accommodate the design vessel. The measure would increase efficiency and maneuverability for vessels, satisfying objective 3. This measure only meets objectives 1 and 2, if combined with the Widen SAC (i) and Widener (h) measures. This combination of measures would provide ample turning space for the design vessel to transit from the OEC to the SAC berths.

Figure 22: Radisson Diamond Cruise Vessel in the OEC (looking south)

Figure 23: View Looking South at Port Everglades with Measures Labeled

b. Deepen OEC and Inner Entrance Channel (IEC)

This measure would deepen the existing outer and inner channels to allow deeper draft vessels to enter. Presently the depths in the Main Turning Basin (MTB) restrict the size of bulk carriers and draft of container ships for transit to berths in the midport and southport regions. Deeper draft vessels can carry the same cargo on fewer vessels. This reduces port congestion delays and transportation costs through economies of scale. However, this measure only meets objectives 1 and 2, if the Widen OEC, Deepen MTB and/or the Deepen SAC with Widener measure are combined with deepening of entrance channels (**Figure 23**). A deeper channel also increases vessel maneuverability; therefore, objective 3 is met.

c. Widen MTB:

This measure would eliminate some shoals adjacent to the existing turning basin. Smaller vessels would then have sufficient depth in this area to avoid larger vessels and potential collisions. This would also clear up congestion because vessels could turn and pass more easily. Larger vessels could be brought into port at the existing drafts to gain economies of scale if combined with other measures. This meets objectives 1 and 3, and 2 when combined with other measures.

d. Deepen MTB:

This measure would deepen the MTB and associated berths. Presently the depths in the MTB restrict the size of bulk carriers able to transit to berths in the main harbor. This measure would meet objectives 1 and 2; decreasing costs associated with vessel delays from congestion and channel passing restrictions, if combined with deepening of IEC and OEC. In addition, this measure would improve maneuverability and economies of scale when combined with these measures to meet objective 3.

e. Deepen NTB:

The deepen NTB measure is a north extension of the MTB and would be deepened for future cruise vessels. However, further research showed that the current depth of 31 feet MLLW was anticipated to be sufficient to accommodate future cruise ships. The present design depth of 31 feet in the NTB is adequate to accommodate the full draft of an Statendam (S) Class cruise ship (average length 712 feet) with an accepted underkeel clearance of 3 feet. Additionally, the existing fleet is not likely to rely on the NTB measure for additional maneuverability or expansion due to port traffic patterns and current configurations.

f. Deepen STB:

The western portion of the STB, which is the south extension off of the MTB, would be deepened under this measure. The Navy uses the eastern berths and Navy vessels do not require any additional depth over the existing condition. The existing depth is less than the MTB and the Navy's future vessels are not likely to benefit from any depth greater than the existing depth. Therefore, the depth would be equal to or less than 42 feet. Deepening would accommodate smaller container vessels and reduce congestion in the SAC. This measure may improve maneuverability by adding additional turning room that could improve maneuverability for some vessels. This measure would not induce any cost savings from economies of scale. This measure meets objectives 1 and 3. **Figure 24** shows the STB location.

g. Widener (WIDE):

This measure would remove the shoal located at the confluence of the SAC, MTB, and IEC. The shoal restricts the amount of maneuvering room a vessel has when turning into the MTB in preparation for backing down the SAC (a common method of transit) or turning into the channel (**Figures 25** and **26**). The shoal also prohibits other traffic from transiting and exiting the SAC while another vessel is in the MTB. This measure would eliminate the hazards in maneuvering around the shoal, berthed vessels, and the Knuckle at the same time. The Knuckle is the area just south of Berth 25, within the SAC, which creates transit problems **Figure 26**. This measure would create a straighter channel which is more safe and efficient. Post-Panamax container vessels would also be able to safely turn into the SAC with this feature which contributes to economies of scale. It would also allow for two-way traffic in the MTB. This measure meets the study objectives.

Figure 24: Northern Channel Improvement Areas Looking Southwest

Figure 25: Inner Entrance Channel and Main Turning Basin Improvement Areas

h. Widen SAC:

Widening the SAC would allow vessels to safely transit and pass berthed vessels along the channel (**Figure 26**). It would also allow for larger vessels to safely transit and pass, which is currently a risky to nearly impossible manuever for larger vessels. Transportation costs would decrease from larger container vessels having economies of scale. Fewer vessels would be necessary if larger vessels carried additional cargo. This measure requires that the Widener measure be in place in order to turn the large vessels into this section. The Widen TN measure should also be in place to allow safer and easier turning for these vessels. This measure meets the study objectives when combined with other measures.

i. Deepen SAC:

Deepening the SAC would have the same general benefits and objectives as the Widen SAC measure; however, it would likely be more efficient in achieving the objectives. This measure requires the Widener measure to be in place in order to turn the large vessels into this section. The Widen TN measure should also be in place to allow safe and easier turning for these vessels. This measure meets the study objectives when combined with other measures.

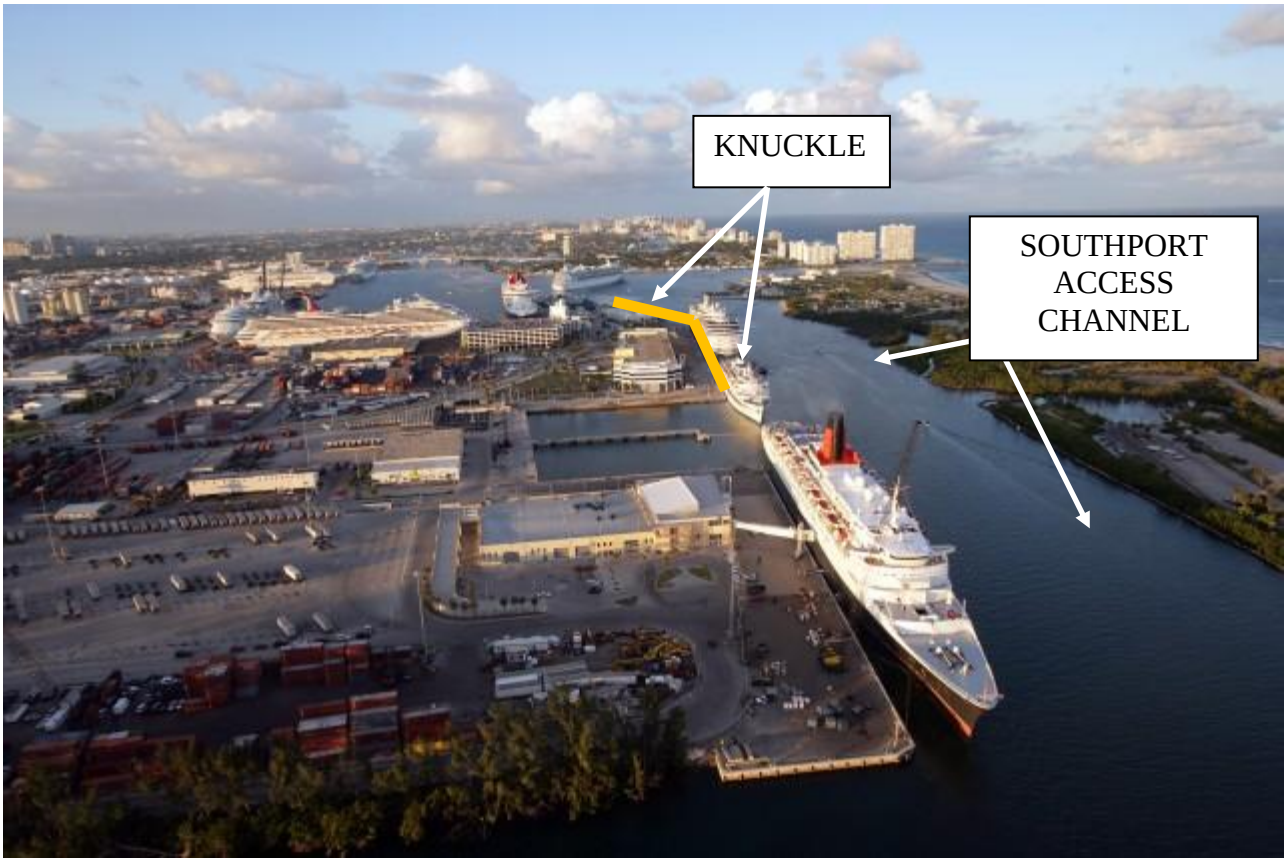

Figure 26: Southport Access Channel (View looking north)

j. Widen TN:

This measure would widen the TN to allow for safer and easier turning for large container vessels. This would reduce congestion, and allow vessels with economies of scale to berth. This measure when combined with the Widener, and the Widen SAC measures will more efficiently achieve the study objectives. Without the combined measures, there could still be a transportation cost savings however there may still be increased congestion and increased transit hazards. This measure meets the study objectives when combined with other measures.

k. Deepen TN:

Widening and deepening the TN to match the SAC depth when combined with the Deepen SAC measure would allow for more efficent turning of large container vessels. This measure would reduce congestion and allow vessels with economies of scale to berth. This measure should be combined with the Widener measure, and the Widen or Deepen SAC measures to more efficiently achieve the study objectives. This measure meets the study objectives when combined with other measures.

Figure 27: Looking North past the DCC along the SAC

l. DCC TB:

This measure would create a turning basin for smaller container vessels. The turning basin may improve maneuverability and congestion by itself. This option would not improve the economies of scale. This measure would be more effective if it were combined with the DCC measure (measure m), **Figure 27**. This measure meets objectives 1 and 3 however it does not provide sufficient NED benefits and was eliminated from further study.

m. Widen and Deepen DCC:

This measure would deepen and widen the DCC. This measure must be combined with the DCC TB measure to meet any of the three objectives. This expansion would redirect smaller container vessels to this area. This would improve berth availability and decrease congestion in other parts of the Port. Maneuverability may be improved through less congestion. Transportation cost savings from economies of scales are not directly impacted. However, other berths could now be available for larger vessels if combined with other measures and this would improve transportation cost savings, **Figure 28**. This measure meets objectives 1 and 3 however it does not provide transportation cost savings from economies of scale benefits. There are also substantial environmental concerns with this measure.

n. Extend North Jetty:

Extension of the north jetty could reduce the impact of the currents on transiting vessels , reduce northwest waves in the channel, and limit adverse conditions to deeper water where vessels have more maneuvering room. However, strong cross-currents in the Outer Entrance Channel result primarily from the proximity of the Gulf Stream/Florida Current. Migration of the current toward shore and the shedding of shoreward moving eddy currents occur at variable times and locations throughout the entire length of the OEC. There is no feasible structural alternative that can inhibit or deflect these currents, which can impact vessels over the full (1 mile +) length of the OEC. In the nearshore, extension of the jetties might have a localized impact on longshore currents, but will not affect the cross-currents that result due to the Gulf Stream/Florida Current. Longshore currents are not a significant impedance to vessel maneuverability, so a jetty extension is not a solution to the problem of vessel maneuverability. This measure does not meet the study objectives.

Figure 28: Entrance to Dania Cutoff Canal

Several of the non-structural measures could be combined with the structural measures to provide for more efficient navigation, however none of the non-structural measures when combined, reduced the scope of the structural improvements necessary to achieve a complete and fully functional project, per the study objectives.

4.7 INITIAL SCREENING

A wide variety of measures were considered and evaluated on their ability to meet the study objectives, as is presented in **Table 18**. Measures that met the study objectives were then evaluated based on technical, economic, and environmental criteria. Each measure was assessed and a determination made whether it should be retained in the formulation of alternative plans. Measures were then combined to form alternatives.

Table 18: Management Measure Evaluation Matrix

	Decrease costs associated with vessel delays from congestion, channel passing restrictions, and berth deficiencies? Objective 1	Decrease transportation costs through increasing economies of scale for cargo vessels? Objective 2	Increase channelmaneuverability at Port Everglades? Objective 3	Does this measure meet at least one objective? (if No = eliminated from formulation)
Non-Structural Measures				
1. No Action	No	No	No	**No**
2. Additional Tugs	No	No	No	**No**
3. Clear Berthed Vessels	No	No	No	**No**
4. Bypass Port	Yes	No	No	Yes
5. Off-loading Cargo	No	No	No	**No**
6. Light-loading Vessels	No	No	Yes	Yes
7. Lightering	No	No	Yes	Yes
8. Off-shore Petroleum	No	No	No	**No**
9. Rail	No	No	No	**No**
Structural Measures				
a. Widen OEC	Yes, when combined	Yes, when combined	Yes	Yes
b. Deepen OEC,IEC	Yes, when combined	Yes, when combined	Yes	Yes
c. Widen MTB	Yes	Yes, when combined	Yes	Yes
d. Deepen MTB	Yes, when combined	Yes, when combined	Yes, when combined	Yes, when combined
e. Deepen NTB	No	No	No	**No**
f. Deepen STB	Yes	No	Yes	Yes
g. Widener	Yes	Yes	Yes	Yes
h. Widen SAC	Yes, when combined	Yes, when combined	Yes, when combined	Yes, when combined
i. Deepen SAC	Yes, when combined	Yes, when combined	Yes, when combined	Yes, when combined
j. Widen TN	Yes, when combined	Yes, when combined	Yes, when combined	Yes, when combined
k. Deepen TN	Yes, when combined	Yes	Yes	Yes
l. Dania TB	Yes	No	Yes	Yes
m. Widen and Deepen Dania	Yes	No	Yes	Yes
n. Extend N. Jetty	No	No	No	**No**

4.8 DEVELOPING ALTERNATIVE PLANS

When meausures are combined to form the study alternatives; they must meet the following four criteria from the P&G.

Completeness: The extent to which the plan provides and accounts for all necessary investments or actions to ensure realization of the planning objectives
Effectiveness: The extent to which the plan contributes to achieving the planning objectives
Efficiency: The extent to which the plan is the most cost effective means of achieving the objectives
Acceptability: The extent to which the plan is acceptable in terms of applicable laws, regulations, and public policies.

4.8.1 Measures Used to Formulate Non-Structural Alternatives

As is discussed in **Section 3,** if there is no action to modify the facilities at Port Everglades, the most probable future conditions consist of the Port continuing operations under the current conditions. The OEC channel will continue to be affected by strong shore-parallel currents that combine to make entrance transit difficult for the Port Pilots. Maneuverability and passing operations will be restricted. Depths of channels and basins throughout the Port will restrict fully loaded vessel usage. Inefficient distribution of vessel types and sizes will continue to exist throughout the Port.

The no-action alternative is considered throughout the planning process. Structural and non-structural alternatives are compared to the no-action alternative. Non-structural alternatives were formulated to achieve study objectives without violating study constraints. However, non-structural alternatives do not always address the potential opportunities for future traffic, efficiency, and utilization as noted above. Specific examples include improving transit from the OEC through to Southport, developing the DCC to accommodate mid-size vessels, providing additional berthing and turning capabilities in the TN, and accommodation of larger generation cruise vessels. These improvements cannot be achieved with non-structural measures. Mid-size vessels (approximately 500 feet in length overall (LOA), draft >20 feet) cannot transit into the DCC which can only accommodate smaller vessels (200 feet LOA vessels with a draft <10 feet) without structural improvements. These improvements are not being implemented therefore the DCC was eliminated from further study. Similarly, cruise vessels cannot utilize facilities without sufficient basin depth, and accommodation of additional berthing and/or turning capabilities within the TN cannot occur without structural improvements. Four of the non-structural measures (1, 4, 6, 7) as outlined in Table 18 were carried forward and evaluated. Other non-structural measures were eliminated due to not meeting any of the study objectives.

Measure NS-1: No-Action

There are no benefits under this plan and the no action alternative. Under the no-action alternative vessels would continue to be constrained by the existing channel depth and width. **The no-action alternative is not recommended however, the no-action alternative must be carried through the analysis for comparison purposes.**

Measure NS-4: Bypass Port

Importing commodities to another port and then trucking to original destinations increases total transportation costs, **Measure NS-4 was eliminated**.

Measure NS-6: Light-loading Vessels

Light-loading vessels does allow for larger vessels to transit Port Everglades, light loading when combined with widening measures was carried forward, **Measure NS-6 Light-Loading Vessels was carried forward for consideration when combined with other structural measures**.

Measure NS-7: Lightering Vessels

Lightering increases total transportation costs due to a second cargo handling and use of an additional vessel, **Measure NS-7 was eliminated**.

4.8.2 Measures Used to Formulate Structural Alternatives

Twelve structural measures were carried through initial screening; these measures are used to form the structural alternatives. The following structural measures were retained during the intermediate plan formulation process for the reasons outlined below.

Measure S-a: Widen OEC

Currents in the OEC are a hazard to the existing and future fleet. The flared widening of the OEC allows pilots to safely line up in the channel while transiting through the reefs. The widening also allows for more room when vessels are crabbing. **S-a is carried forward**.

Measure S-b: Deepen OEC, IEC

The design vessel (S-Class) needs additional depth in both the OEC and IEC. Vessels must speed up to navigate the currents and eddies around the OEC; this causes the vessels to squat and require a deeper underkeel clearance. Underkeel clearance requirements for each of the Port Everglades project components are discussed in detail in Engineering **Appendix A Section 3.4.11**. **S-b is carried forward**.

Measure S-c: Widen MTB

Widening the MTB increases efficiency and maneuverability of the vessels in the turning basin and allows smaller vessels to transit past turning vessels. **S-c is carried forward**.

Measure S-d: Deepen MTB

Additional depth is needed for liquid bulk vessels to get to berths 7-15 and to bring the design vessel to berth 31/32. Of note: The Northern Turning Basin (NTB) portion was eliminated as it is only used for cruise operations and has sufficient depth. **S-d is carried forward but must be combined with additional measures**.

Measure S-f: Deepen STB

This deepening allows for a fully loaded design vessel to turn here. Only a partial cut is needed for maneuverability. **The STB was originally carried forward in combination with the MTB however it was later eliminated due to lack of benefits.**

Measure S-g: Widener

A safer, wider turning radius in this area reduces congestion by allowing smaller vessels to transit past larger vessels. **S-g is carried forward.**

Measure S-h: Widen SAC
A widened SAC allows the S-Class container design vessel to transit past berthing cruise ships and berth at 30, 31, and 32. The widening is designed to minimize environmental impacts. **S-h is carried forward.**

Measure S-i: Deepen SAC
Deepening is needed for the design vessel to transit the SAC. **S-i is carried forward.**

Measure S-j: Widen TN
Widening the TN allows the design vessel to berth in the TN and turn in the TN to berth at 31/32. **S-j is carried forward.** *This was combined with S-k to become a sponsor measure "S_TN" and is included in the existing condition to match to sponsor's Port Master Plan.

Measure S-k: Deepen TN
Deepening the TN allows the design vessel to berth in the TN and turn in the TN to berth at 31/32. **S-k is carried forward.*** This was combined with S-j to become a sponsor measure "S_TN" and is included in the existing condition to match to sponsor's Port Master Plan. Both measures S-j and S-k were added later as the non-federal sponsor moved forward with plans to deepen the Turning Notch, which is currently underway.

Measure S-l: DCC TB
This TB is needed to accommodate the panamax class vessel "Bellatrix" to berth in the DCC. **S-l was originally carried forward but later eliminated as the DCC was eliminated from further study due to lack of benefits.**

Measure S-m: Widen and Deepen DCC
This is needed to accommodate the panamax class vessel "Bellatrix" to berth in the DCC. Deepening in the DCC does not offer benefits to larger vessels; panamax vessels can already transit the harbor. Therefore there is no added national economic benefit to deepen this area. **S-m was originally carried forward but later eliminated as the DCC was eliminated from further study due to lack of benefits.**

4.9 EVALUATION OF INTERMEDIATE PLANS

The final measures are combined to form intermediate plans, and ultimately the NED Plan. The plan that reasonably maximizes net benefits while being consistent with protecting the nation's environment is the NED plan. If two cost-effective plans produce no significantly different levels of net benefits; the less costly plan is to be the NED plan. Environmental impacts were avoided or minimized to the extent practicable. Where unavoidable impacts occurred, mitigation is proposed. The **EIS** addresses in greater detail study objectives from **Table 15**.

4.9.1 Non-Structural Plan Screening

No-Action Plan: The no-action plan is not recommended as there are no NED benefits with this plan however structural and non-structural plans are compared to the no-action plan.

4.9.2 Structural Plan Screening

Structural measures were refined to determine recommendations in each segment of the channel. The Outer Entrance Channel, Inner Entrance Channel, Main Turning Basin, Southport Access Channel, and the Turning Notch were evaluated further to determine the optimal footprint for navigation improvements as follows.

Outer Entrance Channel (OEC) and Inner Entrance Channel (IEC) (measures S-a and S-b)

Under conditions of strong, variable currents, the 500 foot OEC presents a hazard to both the existing and future design fleet. Presently, Pilots are required to line up with the channel before the outer marker and bring vessels in at high speed to maintain a straight course. Rapid deceleration of the vessel is then required for safe negotiation of the entrance jetties. As determined by ship simulation; to alleviate the need for potentially dangerous maneuvering for the existing and future design fleet, the OEC requires lengthening as well as widening of the seaward end of the channel. By extending and expanding the outer end of the existing channel and then tapering evenly over a distance back to the original design width, a "flare" is created. The flared entrance allows the vessel room to maneuver in the presence of strong currents while still maintaining safe speeds when lining up to the entrance channel.

Prior to determining the final dimensions and alignment as described above and to further minimize impacts to the third reef, several alignments for the OEC were considered. The proposed configurations included two “dogleg” turns at the seaward end of the channel and two alignments that would make use of natural gaps in the outermost reef tract. The latter would require vessels to transit between the second and third reefs until reaching the existing entrance channel location. Navigation concerns were raised due to the sharp turns, adjacent reefs, and strong cross-currents. Navigation and environmental concerns were raised, associated with impacting the adjacent reef tracts during transit and security issues were raised by the USCG, the U.S. Navy, and the Port Everglades Pilot Association. Therefore, the four alternative alignments were removed from consideration and the flare alignment was recommended. Refer to **Engineering Appendix A, Section 3.4.2.3** for additional details.

The OEC is recommended to be extended in a flare alignment, widened and deepened to allow for larger vessels to transit Port Everglades under the with-project condition. Included for recommendation is the deepening of the Inner Entrance Channel (IEC) that connects the OEC to the MTB.

Main Turning Basin (MTB) (measures S-c and S-d)

Deepening the MTB would accommodate both the turning of S-Class design vessels and to provide additional depth for the Aframax design vessel. Originally, ship simulation resulted in a preliminary design to deepened only a portion of the existing authorized footprint, based on the turning requirements of the "S Class" container vessel. However, consultation with the Port Everglades Pilots determined that while the reduced MTB footprint would technically allow for vessel turning it generated significant risks to vessel safety. Specifically the reduced footprint did not allow adequate room to slow or turn a vessel in the event of tug failure. This scenario has occurred in the past at Port Everglades and would result in significant vessel damage and possible risk to human life if it occurred with a deep draft vessel in the confines of the proposed turning area. The sharp difference in depth between the deeper proposed turning area and the surrounding 42 foot existing depth also has the potential of creating hydraulic conditions that would make vessel maneuvering difficult and unpredictable. Based on these concerns two additional alternatives were proposed, an extension of the turning area to the western existing Federal limits with a small "flare" to the south and an extension to the west with "flares" to both the south and the north.

While the expansion of the turning area and the addition of flares alleviated some concerns regarding emergency maneuvering, the potential for difficult and unpredictable vessel handling due to the depth differences in the confined turning area could not be eliminated. Of particular concern was the proximity of the depth transition (essentially a vertical rock shelf) to the oil tanker slips at the west end of the MTB. A small course deviation, resulting in impact with the shelf could result in serious environmental consequences. Therefore, in coordination with the Port Everglades Pilots, deepening of the MTB is recommended for the existing MTB footprint, additional details are in **Engineering Appendix A Section 3.4 and Engineering Sub-Appendix A**.

Southport Access Channel (SAC) (measures S-h and S-i)

Six initial designs were developed for the SAC to address transit of the S-Class Post-Panamax vessels from the MTB to berths 30 – 32. Initial screening and ship simulation of the six component designs resulted in elimination of all but one design. Eliminations were also made due to significant environmental impacts including the removal of land in the John U. Lloyd State Park (designs 2 – 4) and excessive impacts to Port infrastructure and adjacent cargo/passenger facilities (alternative components 5 and 6). South of the knuckle bend, in the general area of berths 26-29, the channel would be shifted to alleviate restrictions due to non-Federal berths. The cost of this shift is included in the berthing area dredging costs which are 100% non-federal. Details of these six component designs can be found in the **Engineering Appendix A, Section 3.4.8**.

The SAC is recommended for widening and deepening to allow for larger vessels to transit Port Everglades under the with-project condition.

Turning Notch (TN) (measures S-j and S-k)

Originally, expansion of the TN was investigated as two separate alternatives, a "Turning Only" alternative that included only those modifications necessary to turn the S-Class

vessel (widening along the east and west SAC) and a "Turning and Berthing" alternative that included a 400-foot expansion of the TN to the west plus the additional widening along the SAC. However, during the course of the study, the sponsor made the decision to proceed with expansion of the existing TN to a 2,400-foot dimension. The Port's expansion of the TN (to a depth of 42 feet MLLW) is currently under design and is included in the future without-project condition. Widening the SAC to the north and east of the TN, to accommodate vessel turning, as well as deepening the expanded 400 foot portion of the TN will remain components for further plan formulation analysis.

The TN is recommended for deepening with minor widening to allow for larger vessels to transit and turn in the SAC under the with-project condition.

Widener (WIDE) (measure S-g)

A widener is required in the area of the USCG current facility. This widener is required for larger vessels to transit Port Everglades from the Inner Entrance Channel to the Southport Access Channel. The study team has extensively coordinated with the USCG staff located at the Fort Lauderdale Station and USCG District 7 and they continue to remain involved. Extensive effort has been made to coordinate with the U.S. Navy through additional meetings and correspondence. U.S. Navy staff from Naval SurfaceWarfare and NAVFAC Engineering Division have participated. Specifically, design of the Widener has been coordinated with the U.S. Navy. Coordination with the USCG and U.S. Navy will continue during the design phase.

The Widener is recommended for widening and deepening to allow for vessels to transit under the with-project condition.

4.10 FINAL ARRAY OF PLANS

The selection of the structural measures uses a combination of planning objectives and goals to form plans for economic analyses and final plan selection. The structural measures are grouped together in various combinations to specific plans. **Table 19** shows how the structural measures were combined into these various alternative plans and how they match with the study objectives. The plans were also matched with the benefiting fleet to determine what combination would offer the maximum benefits and thus the recommended channel segments for deepening and widening.

The structural measures were grouped into six different plans based on structural characteristics, environmental impacts, and economic channel segments.

- *Plan 1* allows for benefits from petroleum vessels
- *Plan 2* allows for benefits from larger container vessels, which incidently provides benefits from larger petroleum vessels
- *Plan 3* allows for additional berthing capacity to improve navigation at the port through relocating fleets without impacting other environmentally sensitive areas

- *Plan 4* provides for more operational efficiency in the MTB with minimized environmental impact
- *Plan 5* allows for benefits from larger container vessels, which incidently provides benefits from larger petroleum vessels and provides more efficient operations at the port, and
- *Plan 6* allows for light-loaded Post-Panamax container vessels to transit with a lesser impact on environmentally sensitive areas.

Table 19: Combining Structural Measures

	Outer Entrance Channel (OEC), Inner Entrance Channel (IEC), Main Turning Basin (MTB), South Turning Basin (STB), Widener (WIDE), Southport Access Channel (SAC), Turning Notch (TN),Sponsors Turning Notch (S_TN), Dania Cutoff Canal (DCC)
☆	*Plan 1A OEC, IEC, MTB*
☾	*Plan 1B OEC, IEC, MTB, STB*
☆	*Plan 2A OEC, IEC, MTB*
	Plan 2B OEC, IEC, MTB, WIDE, SAC
	Plan 2C OEC, IEC, MTB, WIDE, SAC, TN (berth&turn)
	Plan 2D OEC, IEC, MTB, WIDE, SAC, TN (turn only)
	Plan 2E OEC, IEC, MTB, WIDE, SAC, S_TN (berth&turn)
	Plan 3A DCC
	Plan 4A STB
☆	*Plan 5A OEC, IEC, MTB*
☾	*Plan 5B OEC, IEC, MTB, STB*
	Plan 5C OEC, IEC, MTB, WIDE, SAC, STB
	Plan 5D OEC, IEC, MTB, WIDE, SAC, STB, TN (berth&turn)
	Plan 5E OEC, IEC, MTB, WIDE, SAC, STB, TN (berth&turn), DCC
	Plan 5F OEC, IEC, MTB, WIDE, SAC, STB, TN (turn only)
	Plan 5G OEC, IEC, MTB, WIDE, SAC, STB, TN (turn only), DCC
	Plan 6A WIDE
	Plan 6B OEC, WIDE, SAC
	Plan 6C OEC, WIDE, SAC, TN (berth&turn)
	Plan 6D OEC, WIDE, SAC, TN (berth&turn), DCC
	Plan 6E OEC, WIDE, SAC, TN (turn only)
	Plan 6F OEC, WIDE, SAC, TN (turn only), DCC

☆ Note the Plans with the same combination of measures-these are considered one feasible alternative.
☾ Note same as above.

Table 20: Proposed Combinations of Measures for Structural Plans

Measures	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6
Light-loading Vessels (widening at existing 42 ft project depths)						X
Widen OEC	X	X			X	X
Deepen OEC, IEC	X	X			X	
Deepen MTB	X	X			X	
Deepen STB	X			X	X	
Widener-		X			X	X
Widen SAC		X			X	X
Deepen SAC		X			X	
Widen TN		X			X	X
Deepen TN		X			X	
DCC TB			X		X	X
Widen and Deepen DCC			X		X	X
Plan 6 has no deep draft deepening of the harbor for accommodation of Post-Panamax vessels. Plans 1-5 examine the existing and greater depths incrementally.						

Table 20 outlines the project measures combined into the six economic alternative plans (Plans 1 – 6). The six plans were then subjected to incremental justification and consisted of plan levels of incremental measures A through G. These plans represent the additional measures combined. At each level an additional measure was added. This resulted in 18 different feasible combinations of measures. For each of the plans, an incremental optimization of the depth was performed to determine at which depth the greatest net benefits from lower costs per unit good were achieved, and/or the improved port operational efficiency achieved. In addition, a harbor widening simulation and delay time savings is conducted for each of the feasible alternatives.

Figures 29 through **34** show plans with proposed measures. While each plan was developed to address the study objectives, incremental optimization of the plans resulted in some plans in the final array being identical due to the fact certain structural features address multiple objectives.

Alternative Plans 1 through 6

Plan 1: This plan addresses petroluem vessel access to slips 1, 2 and 3 located adjacent to the MTB by creating opportunities for improving vessel efficiency at greater depth. This plan is broken down into two plan levels of incremental measures A and B.

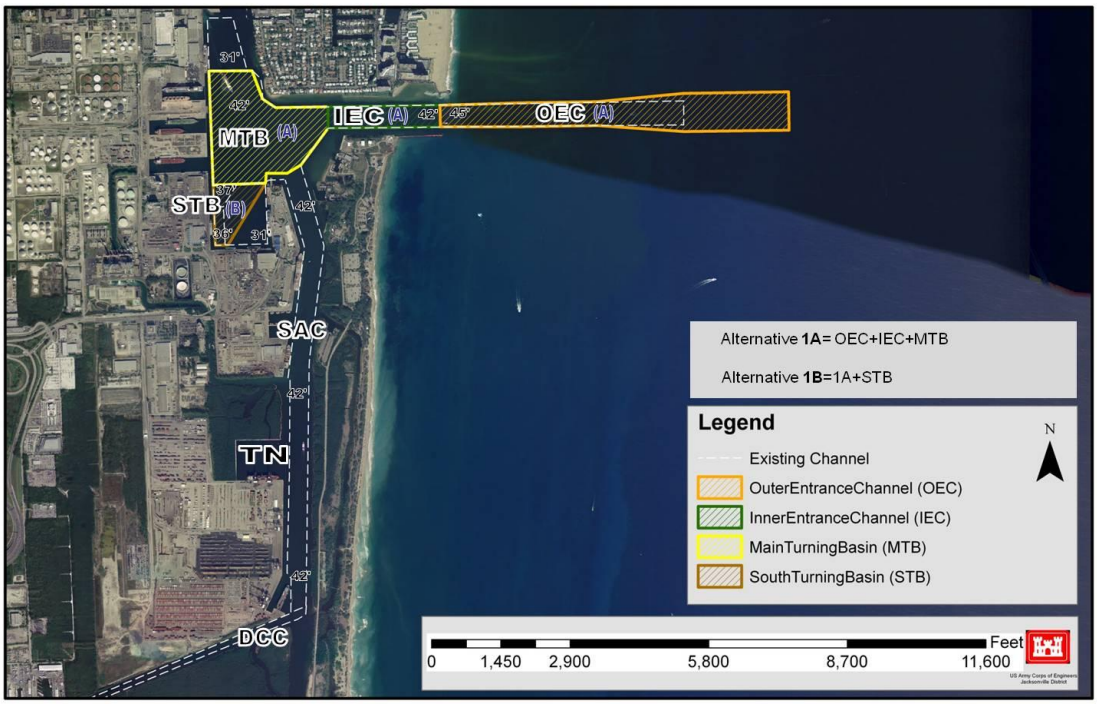

Figure 29: Alternative Plans 1A and 1B

Plan 1A: This plan would analyze depths incrementally from existing 45 ft to 57 feet in the OEC, and from existing 42 to 50 feet in the IEC and MTB to allow deeper draft tankers to safely transit through the harbor. Depth will be optimized to achieve the greatest net benefits by analyzing one foot increments. It is assumed that the Port will deepen the connecting berths to the optimized USACE project depth.

Structural Improvements:

Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths

Plan 1B: This plan expands from plan 1A to include an incremental analysis of deepening the South Turning Basin. This plan would analyze depths in the STB from 31 feet to 45 feet. This plan would improve port operating efficiency. Deeper draft vessels could use this area for additional turning room or to reduce congestion in the MTB.

Structural Improvement:

Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin

Deepen adjacent berths
Deepen the South Turning Basin

Plan 2: This plan would resolve problems and create opportunities for the petroleum vessels and the container vessels. This plan will allow deeper draft petroleum and container vessels to enter the Port while improving efficiency of navigation.

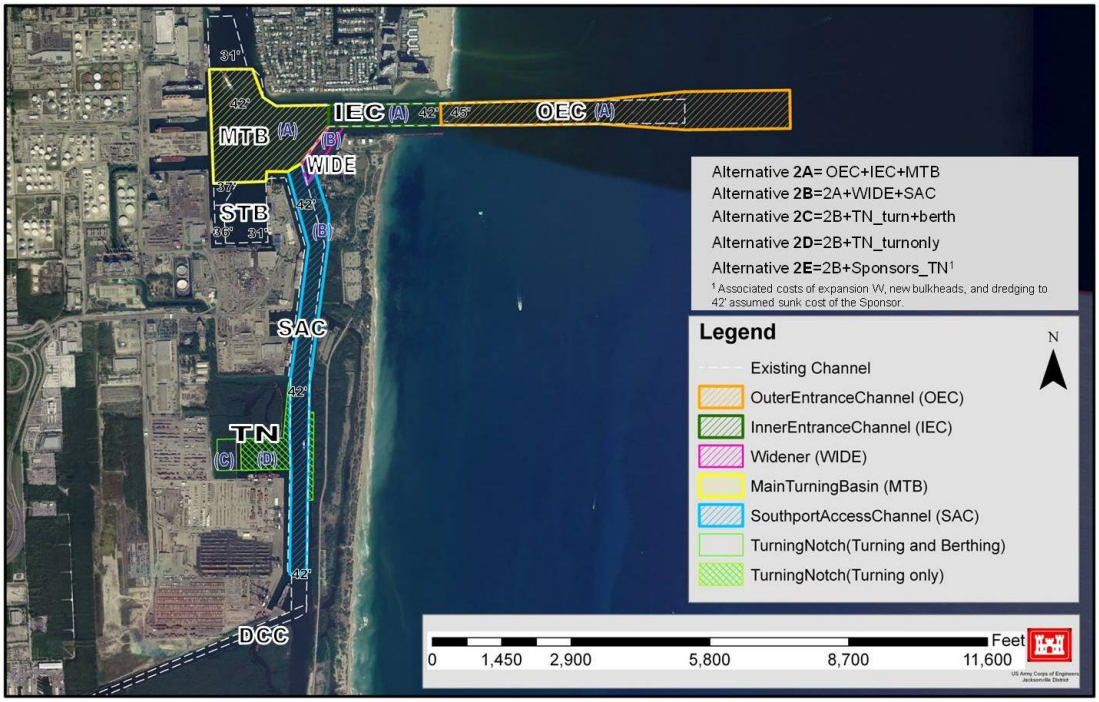

Figure 30: Alternative Plans 2A, 2B, 2C, 2D, and 2E

Plan 2A: This combination of measures is the same as Plan 1A.

Plan 2B: This plan expands on Plan 2A and would accommodate Post-Panamax container vessels that could not safely enter without the additional deepening and widening of the WIDE and SAC measures. This Plan analyzes incremental depths in the SAC and the WIDE from 42 to 50 feet.

Structural Improvement:
Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Widener measure
Widen and deepen the Southport Access Channel

Plan 2C: This plan expands on Plan 2B with the widening and deepening of the TN. Plans 2A and 2B could create inefficiency and improve maneuverability without this additional measure. Post-Panamax container vessels would be required to turn in the MTB and use only one berth without

the widening and deepening of the TN. This could cause congestion and delays. Plan 2C will analyze depths incrementally from 42 to 50 feet in the TN. The TN is important to fully realize all potential benefits for container vessels. This measure would allow Post-Panamax container vessels to berth and turn in Southport.

Structural Improvement:
Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Widener measure
Widen and deepen the Southport Access Channel
Widen and deepen the Turning Notch
Additional widening and deepening of the Southport Access Channel to allow turning

Plan 2D: This plan takes an element away from Plan 2C. Plan 2D includes only deepening of the TN, analyzing depths incrementally from 42 to 50 feet and not expanding the width of the TN.

Structural Improvement:
Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Widener measure
Widen and deepen the Southport Access Channel
Deepen the Turning Notch
Additional widening and deepening of the Southport Access Channel to allow turning

Plan 2E: This component was added as a result of the Sponsor's intent to expand the TN as a future without-project condition. Therefore this plan examines deepening the 400 foot widened portion of the TN and the existing TN footprint from a future without project depth of 42 feet, in addition to the widening increments in the SAC. Depths will be analyzed incrementally from 42 to 50 feet. Plan 2E includes deepening the TN footprint (including the expanded portion that is currently under design).

Structural Improvement:
Widen and deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Widener measure

Widen and deepen the Southport Access Channel
Sponsor widens and deepens a 400 ft portion of the Turning Notch
Deepen existing and sponsor expanded portion of the TN
Additional widening and deepening of the Southport Access Channel to allow turning

Plan 3: This plan would improve port operational efficiency and create additional berthing areas.

Plan 3A: Plan 3A would optimize the DCC depth at the point where benefits from efficiency are the greatest. Depths analyzed will be in one foot increments ranging from 11 to 34 feet. This plan does not reduce the cost per unit good, but it relocates some of the existing fleet to increase berth space and port efficiency overall. The DCC was later eliminated from further study as the benefits are not significant, as is discussed in Section 5.4.

Structural Change:

Widen and Deepen the Dania Cut-off Canal
Create through Widening and Deepening the Dania Cut-off Turning Basin
Create Berths

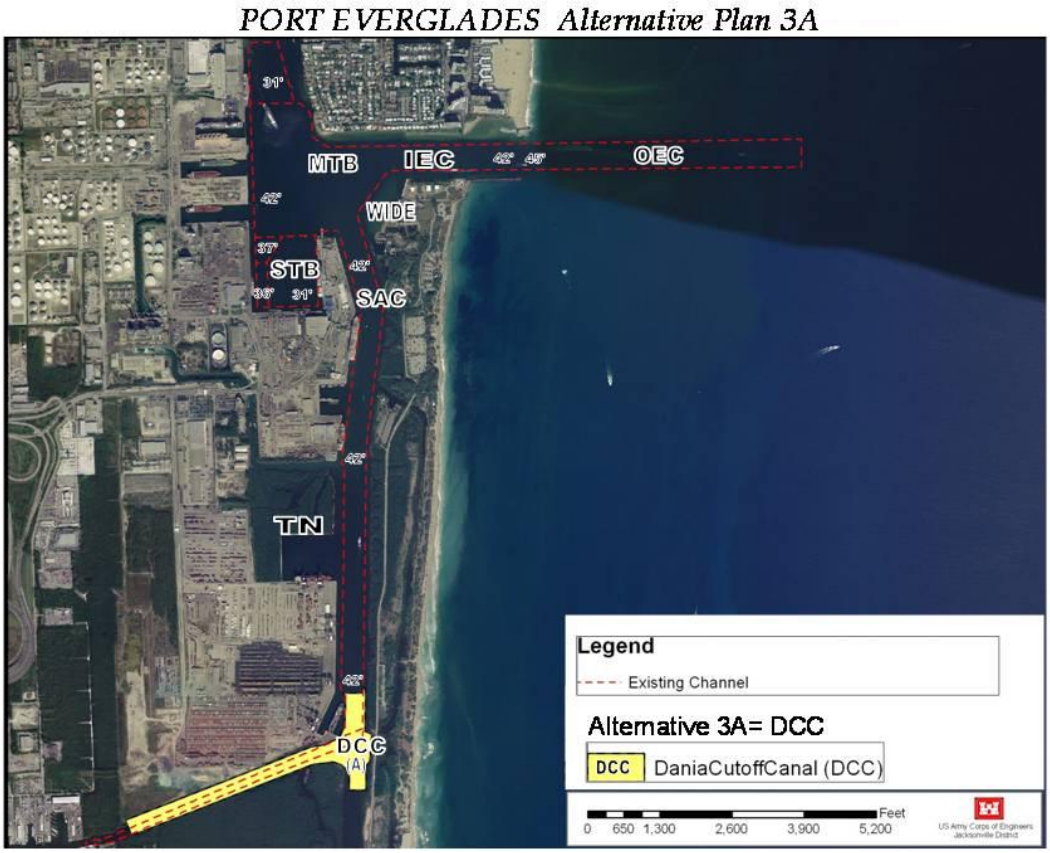

Figure 31: Alternative Plan 3A

Plan 4: This plan would improve port operational efficiency and create additional berthing areas.

Plan 4A: This plan includes deepening the STB, and would analyze incremental depths from 31 feet to the 45 feet. Deeper draft vessels could use this area for additional turning room to reduce congestion in the MTB.

Structural Improvement:

Deepen the South Turning Basin

Deepen adjacent berths

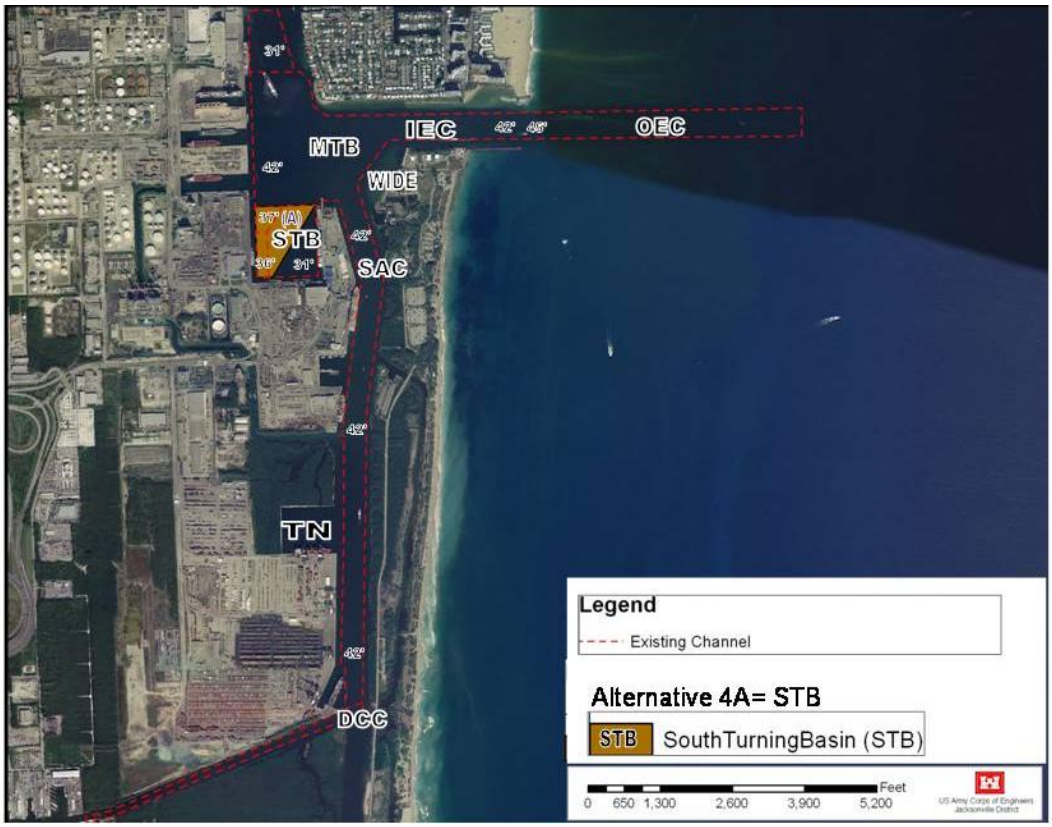

Figure 32: Alternative Plan 4A

Plan 5: This plan would resolve problems and create opportunities by allowing deeper draft petroleum and container vessels to enter the Port while improving navigation efficiency. The main differencees between the array of alternatives in Plan 5 and Plan 2 is the incorporation of the STB and the DCC into Plan 5's array.

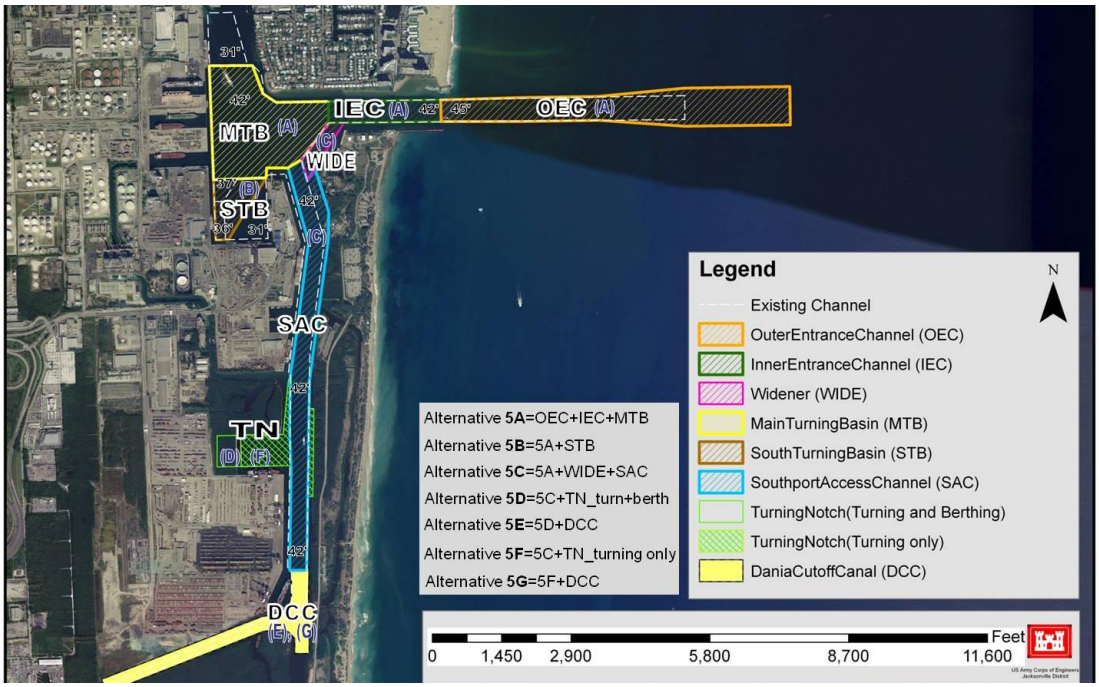

Figure 33: Alternative Plans 5A, 5B, 5C, 5D, 5E, 5F, and 5G

Plan 5A: This contains the same combination of measures as Plan 1A and 2A.

Plan 5B: This contains the same measures as Plan 1B.

Plan 5C: This plan expands on Plan 5B and would accommodate Post-Panamax container vessels that could not transit the Port under the without-project condition. This plan will allow deeper draft container vessels to transit thus decreasing the unit cost per good. Depths from 42 feet to 50 feet were analyzed at one-foot increments in the SAC and the WIDE. Post-Panamax container vessels would be required to turn in the MTB and use only one berth without plan 5C which could cause congestion and delays.

Structural Improvements:

Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Deepen the South Turning Basin
Widener measure
Widen and Deepen the Southport Access Channel

Plan 5D: This plan expands on Plan 5C and involves the widening and deepening of the TN. Incremental depth analysis was conducted in the TN from 42 to 50 feet. This plan is important to fully realize all potential benefits for container vessels. Post-Panamax containers vessels and others transiting

the SAC would transit more efficiently. This component would allow Post-Panamax container vessels to berth and turn in Southport which could not be done without this change.

Structural Improvements:

Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Deepen the South Turning Basin
Widener measure
Widen and Deepen the Southport Access Channel
Widen and Deepen the Turning Notch
Additional Widening and Deepening of the Southport Access Channel to allow turning

Plan 5E: This plan expands on Plan 5D and would optimize the DCC depth at the point where benefits from efficiency are the greatest. Depths analyzed are in one foot increments from 11 to 34 feet. This plan does not reduce the cost per unit good, but it relocates some of the existing fleet to increase berth space and port efficiency overall. The DCC was later eliminated from further study as the benefits are not significant, as discussed in Section 5.4.

Structural Improvements:

Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Deepen the South Turning Basin
Widener measure
Widen and Deepen the Southport Access Channel
Widen and Deepen the Turning Notch
Additional Widening and Deepening of the Southport Access Channel to allow turning
Widen and Deepen the Dania Cut-off Canal
Create through Widening and Deepening the Dania Cut-off Turning Basin
Create and deepen Berths

Plan 5F: Plan 5F involves deepening the TN, and therefore is an added increment from 5C. Incremental depth analysis was conducted in the TN from 42 to 50 feet. This plan is important to fully realize all potential benefits for container vessels. Post-Panamax containers vessels and others transiting the SAC would transit more efficiently. This plan would allow Post-Panamax container Vessels to berth and turn in Southport which could not be done without this change.

Structural Improvement:

Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Deepen the South Turning Basin
Widener measure
Widen and Deepen the Southport Access Channel
Deepen the Turning Notch
Additional Widening and Deepening of the Southport Access Channel to allow turning

Plan 5G: This plan expands on Plan 5F. Plan 5G would optimize the DCC depth at the point where benefits from efficiency are the greatest. Depths analyzed will be in one foot increments from 11 to 34 feet. This plan does not reduce the cost per unit good, but it relocates some of the existing fleet to increase berth space and port efficiency overall. The DCC was later eliminated from further study as the benefits are not significant, as discussed in Section 5.4.

Structural Improvement:

Widen and Deepen the Outer entrance channel
Deepen the Inner Entrance Channel
Deepen the Main Turning Basin
Deepen adjacent berths
Deepen the South Turning Basin
Widener measure
Widen and Deepen the Southport Access Channel
Deepen the Turning Notch
Additional Widening and Deepening of the Southport Access Channel to allow turning
Widen and Deepen the Dania Cut-off Canal

Plan 6: This plan would require Post-Panamax container vessels to enter the Port light-loaded and use the existing depth at Port Everglades. This plan would reduce the environmental impacts compared to other plans as it avoids impacts to offshore reefs by avoiding additional deepening in the OEC.

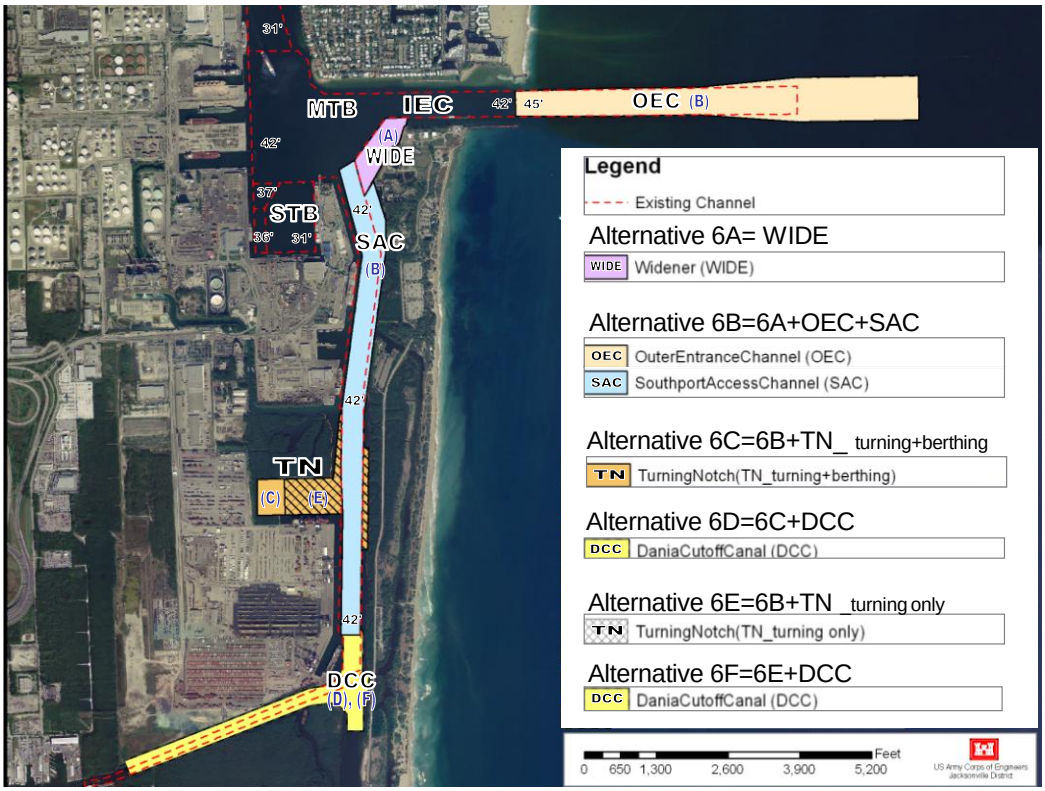

Figure 34: Alternative Plans 6A, 6B, 6C, 6D, 6E and 6F

Plan 6A: This plan would improve the maneuverability and efficiency of the existing fleet and does not involve deepening beyond the existing 42 foot channel depth.

Structural Improvement:
Widen the Widener measure

Plan 6B: This plan is the next added increment to Plan 6A and involves the widening of the OEC and the SAC. This plan would accommodate Post-Panamax container vessels drafting less than or equal to 39 feet (to allow for 3 feet of underkeel clearance) that could not transit without this change. This plan will allow the project's container design vessel to transit potentially light loaded, which would decrease the unit cost per good.

Structural Improvement:
Widen the Widener measure
Widen the Outer Entrance Channel
Widen the Southport Access Channel

Plan 6C: This plan is important to fully realize all potential benefits for light-loaded Post-Panamax container vessels and expands on Plan 6B to include the widening of the TN. Benefits are predicated on delay time savings, and depths are assumed current existing conditions for the OEC, SAC, and the TN.

Vessels will benefit from the more efficient passage and safer passing distances, thus improving transit times. This component would allow light-loaded Post-Panamax container vessels to berth and turn in Southport which could not be done without this change.

Structural Improvement:
Widen the Widener measure
Widen the Outer Entrance Channel
Widen the Southport Access Channel
Widen the Turning Notch
Additional Widening of the Southport Access Channel to allow turning

Plan 6D: This plan expands upon Plan 6C and would optimize the DCC depth at the point where benefits from efficiency are the greatest. Depths analyzed will be analyzed in one foot increments from 11 to 34 feet. This plan does not reduce the cost per unit good, but it relocates some of the existing fleet to increase berth space and port efficiency. The DCC was later eliminated from further study as the benefits are not significant, as discussed in Section 5.4.

Structural Improvement:
Widen the Widener measure
Widen the Outer Entrance Channel
Widen the Southport Access Channel
Widen the Turning Notch
Additional Widening of the Southport Access Channel to allow turning
Widen and Deepen the Dania Cut-off Canal
Create the Dania Cut-off Turning Basin
Create Berths

Plan 6E: This plan expands upon Plan 6B and would accommodate Post-Panamax container vessels drafting less than or equal to 39 feet that could not transit without this change. This plan will allow the container design vessel to transit potentially light loaded, which would decrease the unit cost per good. This measure would allow light loaded Post-Panamax container vessels to berth and turn in Southport.

Structural Improvement:
Widen the Widener measure
Widen the Outer Entrance Channel
Widen the Southport Access Channel
Additional widening and deepening of the Southport Access Channel to allow turning in the TN

Plan 6F: This plan expands upon Plan 6D and would accommodate Post-Panamax container vessels drafting less than or equal to 39 feet that could not transit without this change. This plan would optimize the DCC depth at the point where benefits from efficiency are the greatest. Depths analyzed are in one foot increments from 11 to 34 feet. This plan does not reduce the cost per unit good, but it relocates some of the existing fleet to increase berth space and port efficiency. The DCC was later eliminated from further study as the benefits are not significant, as discussed in Section 5.4.

Structural Improvement:

Widen the Widener measure
Widen the Outer Entrance Channel
Widen the Southport Access Channel
Additional widening and deepening of the Southport Access Channel to allow turning in the TN
Widen and Deepen the Dania Cut-off Canal
Create the Dania Cut-off Turning Basin
Create Berths

Plan 1 focused on solutions for petroleum vessel constraints. *Plan 2* focused on container ship constraints (which incidentally solves the petroleum vessel constraints). *Plan 3* focused on increasing the number of berths and improving port operations by relocating fleets without impacting environmentally sensitive areas. *Plan 4* focused on improving operational efficiency in the Main Turning Basin while minimizing environmental impacts. *Plan 5* focused on solutions for all of the Port constraints and creating opportunities for efficiencies. *Plan 6* focused on accommodating light-loaded Post-Panamax container vessels and reduced impacts on environmentally sensitive areas.

5.0 EVALUATION OF ALTERNATIVE PLANS

National Economic Development (NED) benefits were assessed 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 USACE analyses and policy guidance.

The benefits estimated for the separable elements of each alternative were compared to their cost to determine their economic justification. The plan that reasonably maximizes net benefits (benefits less costs) is the National Economic Development (NED) Plan. If there are two cost-effective plans that produce no significantly different levels of net benefits; the less costly plan is to be the NED plan.

The two primary benefiting vessel types of the self-propelled deep-draft fleet are Aframax tankers and Post-Panamax container vessels. The tanker fleet benefits mainly from greater channel depths, whereas the container fleet benefits from both greater depth and improvements to access to Southport via the Southport Access Channel (SAC). In addition, cruise vessels will benefit from reduced congestion and wait times at the "knuckle" (berths 24-27). Vessels will also experience reduced congestion within the harbor due to fewer overall vessel calls under the with-project condition.

The benefits that were considered in the economic analysis were transportation cost savings benefits that result from (1) the vessels being able to carry more cargo, which applies to deepening benefits, and (2) delay reduction or time savings benefits due to increased vessel maneuverability and removal of transit time restrictions which applies to widening benefits.

5.1 VESSEL UTILIZATION SAVINGS (DEEPENING BENEFITS)

Deepening benefits affect the containership fleet and petroleum tanker fleet. Large Panamax vessels and future Post-Panamax vessels transiting the Trans-Atlantic and North-South global trade routes are the key benefitting containership classes. Foreign-flagged petroleum tankers will transition to larger Aframax tankers. Refer to the **Economic Appendix B** for further detailed analysis. Older, smaller Sub-Panamax vessels that serve the regional Caribbean basin trade are not expected to expand sufficiently in size to require channel deepening. The benefits for container vessels are computed on three size categories: Panamax 2 (4800 TEU average capacity), Post-Panamax Generation 1 (6500 TEU average capacity), and Post-Panamax Generation 2 (8000 TEU average capacity).[4] Panamax 2 and Post-Panamax Generation 1 vessels currently transit the harbor under restricted conditions.

Under with-project conditions, it is predicted that the vessels which can benefit from

[4] Post-Panamax Generation 2 vessels can range from 8,000 to 10,000 TEUs. This Post-Panamax Generation 2 vessel is a representation from this range.

channel deepening will carry more cargo and/or make fewer vessels trips. In the initial screening-level economic assessment, Panamax 2 and Post-Panamax 1 vessels were assumed to transfer an average of 8,000 tons/call (based on averaged 800 TEUs transferred and 10 tons/TEU). Post-Panamax-2 vessels are estimated to transfer 10,000 tons/call. To date, the largest container vessel to call on the harbor is of the Post-Panamax Generation I vessel class. Deepening will allow for a greater share of Post-Panamax vessels as these vessels become more prominent in the world fleet. By the base year, 2023, approximately 26% of container vessel calls at Port Everglades will be Post-Panamax vessels. By 2030, that percentage is anticipated to increase to 31% and continues to increase throughout the 50-year period of analysis with containerized cargo. With each foot of increased depth at Port Everglades, the costs per containership increase as more cargo is moved per call. However, the gross cargo volume increases at a greater rate than the increased voyage related costs, resulting in a lower cost per TEU transported and fewer ships required to deliver the same total volume of cargo to the Port which is the primary source of the deepening benefits.

5.2 VESSEL DELAY REDUCTION BENEFITS (WIDENING BENEFITS)

The proposed improvement alternatives are necessary to accommodate the expected future fleet at Port Everglades. Cruise ships do not benefit from channel deepening, they do benefit from the widening components. The proposed alternatives will reduce delays resulting from berthing capacity constraints and traffic restrictions and reduce transportation costs (note: cruise ships and Navy vessels have priority berthing and pilotage because of tight schedules, as such, they do not experience as significant delays as cargo ships). Commercial cargo vessels, regardless of size, experience vessel delays, and therefore could benefit from widening of channels and turning basins or similar improvements that result in improved maneuverability and reduced transit times.

5.3 INCREMENTAL ANALYSIS

Navigation benefits are computed in the form of transportation cost savings due to reduced congestion and more efficient use of vessels through deepening. In the initial screening level economic assessment, transportation costs for the without and with project conditions were estimated in one-foot increments to compute the NED benefits associated with the project deepening. The cost savings, the difference between the without and with project costs, represent the benefits of the deepened channel. Cost efficiencies accrue as vessels are able to increase loading and reduce transits. The estimated NED Average Annual Equivalent (AAEQ) benefits and project costs are compared to determine if the improvements are economically justified and to identify the widening footprint and deepening components at which NED net benefits are reasonably maximized. Refer to Section 3.9.2 of the **Engineering Appendix A** for more detailed discussion on the incremental costs.

Initial screening-level incremental benefits were calculated showing by one-foot increments the effective benefit of a deeper and/or wider channel. The combination of deepening and widening in some plans results in a higher benefit than deepening only plans. **Table 21** outlines the discussion of benefits for all the various plans and the corresponding measures of those plans.

Table 21: Plan Alternatives and Discussion of Benefits

Alternatives	Measures	Benefits Discussion
1A, 2A, 5A	OEC, IEC, MTB	No container deepening benefits without SAC measure. Deepening benefits for Tanker access to MTB berths.
1B, 5B	*OEC, IEC, MTB, STB*	*No benefits from added increment of STB. Deepening benefits for Tanker access to MTB berths*
2B	OEC, IEC, MTB, Widener, SAC	Source of Deepening Benefits from Container for widening and access to Southport and Deepening benefits for Tanker access to MTB berths.
2C	OEC, IEC, MTB, Widener, SAC, TN (Turn& Berth)	Source of Deepening Benefits from Container for widening and berthing in the TN and access to Southport. Deepening benefits for Tanker access to MTB berths. This plan has been overcome by events as the port is currently under design to expand the TN, Plan 2E includes the expanded footprint.
2D	OEC, IEC, MTB, Widener, SAC, TN (Turn Only)	Source of Deepening Benefits from Container for widening and turning in the TN and access to Southport. Deepening benefits for Tanker access to MTB berths.
2E	OEC, IEC, MTB, Widener, SAC, S_TN	Source of Deepening Benefits from Container for widening and berthing in the TN and access to Southport. Deepening benefits for Tanker access to MTB berths. This is the only plan under Plan 2 that includes deepening the entire TN footprint (including the portion under design to be deepened by the non-federal sponsor).
3A	*DCC*	*Not benefiting projected fleet.*
4A	*STB*	*Minimal widening benefits from STB.*
5C	OEC, IEC, MTB, STB, Widener, SAC	Source of Deepening Benefits from Container for widening and access to Southport and Deepening benefits for Tanker access to MTB berths. *No benefits from added increment of STB.*
5D	OEC, IEC, MTB, STB, Widener, SAC, TN (Turn& Berth)	Source of Deepening Benefits from Container for widening and berthing in the TN and access to Southport. Deepening benefits for Tanker access to MTB berths. *No benefits from added increment of STB.*
5E	OEC, IEC, MTB, STB, Widener, SAC, TN (Turn& Berth), DCC	Source of Deepening Benefits from Container for widening and berthing in the TN and access to Southport. Deepening benefits for Tanker access to MTB berths. *No benefits from added increment of STB. DCC not benefiting projected fleet*
5F	OEC, IEC, MTB, STB, Widener, SAC, TN (Turn Only)	Source of Deepening Benefits from Container for widening and turning in the TN and access to Southport. Deepening benefits for Tanker access to MTB berths. *No benefits from added increment of STB.*
5G	OEC, IEC, MTB, STB, Widener, SAC, TN (Turn Only), DCC	Source of Deepening Benefits from Container for widening and turning in the TN and access to Southport. Deepening benefits for Tanker access to MTB berths. *No benefits from added increment of STB. DCC not benefiting projected fleet.*
6A	Widener	Source of Widening Benefits from container Vessels for efficient transit into the SAC via the WIDE component.
6B	Widener, OEC,SAC	Source of Widening Benefits from container Vessels for efficient transit into the OEC and down the SAC and WIDE components.
6C	Widener, OEC, SAC, TN (Turn&Berth)	Source of Widening Benefits from container Vessels for efficient transit into the OEC and down the SAC and WIDE components. Turning and berthing benefits from TN expansion.
6D	Widener, OEC, SAC, TN (Turn & Berth), DCC	Source of Widening Benefits from container Vessels for efficient transit into the OEC and down the SAC and WIDE components. Turning and berthing benefits from TN expansion.*DCC not benefiting projected fleet, no additional benefits.*
6E	Widener, OEC, SAC, TN (Turn Only)	Source of Widening Benefits from container Vessels for efficient transit into the OEC and down the SAC and WIDE components. Turning only benefits from TN.
6F	Widener, SAC, TN (Turn Only), DCC	Source of Widening Benefits from container Vessels for efficient transit into the OEC and down the SAC and WIDE components. Turning only benefits from TN. *DCC not benefiting projected fleet, no additional benefits*

5.4 COMPARISON OF ALTERNATIVE PLANS

The widening benefits were combined with the deepening benefits for final plan selection. Improvements (deepen) to the South Turning Basin (STB) would have negligible impacts on transportation costs and as a result alternatives 1B, 4A, 5B, 5C, 5D, 5E, 5F, and 5G would at best have very low net benefits Because the STB is used for cruise vessels which are not depth restricted under the existing conditions. Improvements (deepening and or widening) to the Dania Cuttoff Canal (DCC) have also have negligible impacts on total transportation costs, because the extension of improvements to the DCC would not benefit the fleets projected to call at the proposed new facilities along the DCC, and thus the DCC improvements would simply serve to create new berth capacity for the Port and alleviate some congestion at existing facilities currently used by smaller vessels. Vessels using the DCC are not depth restricted under the exsiting conditions. As a result, Alternatives 3A, 5E, 5G, 6D and 6F would have negligible net benefits and were eliminated.

No significant benefits are derived from alternative 1A, 2A, and 5A because the benefits are predicated on the ability of the containership to transit to Southport, and these plans do not provide the means for that however these alternatives 1A, 2A, and 5A gain benefits from the added tanker access for the benefiting Aframax Vessels, however it is not enough to outweigh the construction costs, and thus the net benefits for these alternatives are negligible. Alternatives 6A, 6B, 6C, and 6E were eliminated as the benefits were not greater than the costs.

Plan 2 provides the most benefits, allowing for larger container and tanker vessels to transit Port Everglades. Plan 2A and 2B were eliminated as they did not include the Turning Notch component. The Turning Notch is necessary for larger post-panamax vessels to transit in the SAC. Ship simulation determined the optimal channel footprint (widening). Plans 2C, 2D, and 2E were compared for optimization. The only difference between these plans was the configuration of the Turning Notch. The alternative that provides the most benefits with the least cost is 2E. Alternative 2E includes deepening with minimal widening of the Turning Notch (including the expanded footprint that will be constructed by the non-federal sponsor) to allow for post-panamax vessels to transit the Southport Access Channel.

The Final plan that is carried forward for determination of the Recommended Plan is to deepening and widen from the Outer Entrance Channel through the Southport Access Channel, including the Turning Notch. This plan, 2E, is an optimization of Plan 2 and provides the most benefits. Harborsym was used to compute the benefits for determining the recommended alternative depth (from 42 to 50 feet) as is discussed in the next section.

5.5 FINAL ARRAY OF ALTERNATIVES – HARBORSYM ANALYSIS

The USACE HarborSym model was used to compute transportation cost savings. HarborSym records and accumulates the total time and cost of vessel transits through the harbor and at sea. Since many variations of events can occur over a total voyage, many iterations of the simulation were run to obtain the average values for time in the harbor, time waiting, and total operating costs of vessels in the harbor and at sea.

Inputs to the model include vessel types, Port structures, commodity types and tonnages, vessel transit rules, and vessel routes (outside of the Port). Once the model was fully set up and calibrated, the with-project and without-project conditions were simulated by loading each project condition with its corresponding fleet of vessel calls and commodity transfers.

The primary output of the model used to determine transportation cost savings (NED benefits) is total transportation costs for each alternative by year. The results were interpolated over the period of analysis and across project depths and then annualized and adjusted to present value (**Table 22**).

Table 22: Cost and Benefits of Alternative Depths

Depth	AAEQ Costs*	AAEQ Benefits	AAEQ Net Benefits	BCR
46ft	$15,000,000	$45,100,000	$30,100,000	3.00
47ft	**$15,900,000**	**$46,900,000**	**$31,000,000**	**2.90**
48ft	**$16,860,000**	**$48,240,000**	**$31,400,000**	**2.90**
49ft	$17,800,000	$48,300,000	$30,500,000	2.70
*Costs include IDC and O&M.				

The National Economic Development (NED) Plan is determined by comparing benefits, based on HarborSym model outputs, to project costs. NED benefits are based on differences in total transportation costs between with the future with-project condition and the future without-project condition. Average annual benefits were compared to average annual costs to determine average annual net benefits. The NED Plan is the plan that reasonably maximizes average annual net benefits. The plan that most reasonably maximizes net benefits is 47 feet. USACE policy guidance ER 1105-2-100 Exhibit G-1 3.c directs that "where two cost-effective plans produce no significantly different levels of net benefits, the less costly plan is to be the NED plan."

The NED plan has been identified to be 47 feet. There is not a significant difference between the 47-foot and 48-foot plans, as the change is only 1.3% in AAEQ net benefits. The non-federal sponsor requested a locally preferred plan (LPP) of 48 feet which was approved by the ASA(CW) on October 16, 2014. There are positive net benefits at this depth. The Recommended Plan is the LPP of 48 feet. In addition to deepening, widening in several channel segments is also recommended. **Figure 35** outlines the Recommended Plan area. **Table 23** shows the total average annual equivalent (AAEQ) benefits for a 47-

foot and 48-foot channel to be estimated at $46.9 million and $48.2 million, respectively. The NED and LPP are shown below at the existing FY15 interest rate of 3.375% and the 7% interest rate. The non-federal sponsor would be responsible for 100% of the incremental costs in addition to their cost shared portion of the 47-foot plan.

Table 23: Total AAEQ Costs and Benefits of the NED and LPP

Depth	Plan	AAEQ Costs	*AAEQ IDC*	AAEQ Benefits	AAEQ Net Benefits	BCR 3.375%	BCR 7%
47ft	NED	$ 15,900,000	*$ 1,200,000*	$46,900,000	$ 31,000,000	2.9	1.5
48ft	LPP	$ 16,860,000	*$ 1,400,000*	$48,240,000	$ 31,400,000	2.9	1.5

Notes: FY15 Price Levels at 3.375%

5.6 DEVIATION FROM THE NED PLAN: REASONS FOR THE LPP

The purpose of the economic analysis for the Port Everglades Feasibility Study is to measure the change in the cost of cargo movement for channel deepening and widening alternatives ranging from 42 feet (widening only) to 50 feet (deepening and widening). The analysis accounts for the fact that larger vessels sail at a range of operational drafts. Past a certain point, each deeper operational draft is associated with a diminishing probability of occurrence. Channel depth alternatives necessary to accommodate deeper vessel sailing drafts come at an increasing cost. The National Economic Development (NED) Plan is that alternative that reasonably maximizes transportation cost savings (benefits) for the lowest cost. From the national perspective, the 47-foot alternative provides the greatest net benefit; it can accommodate the full transition of vessels for the lowest investment cost. Channel depths greater than 47 feet show that benefits continue to increase, but at a slower rate than the alternative costs.

The economic community has discussed in detail the Port Everglades study plan selection and which alternative best meets the criteria to "reasonably maximize" net benefits. The net benefit curve flattens out between 46 feet and 50 feet. The difference in net benefits between 47 and 48 feet is 1.3%. The benefit curve remains flat through depths of 49 and 50 feet indicating that efficiencies are maximized at a 47-foot channel depth where the net benefits are most reasonably maximized and the costs are lower. Approximately 60% of the economic benefits are attributable to petroleum products, 36% are from containers, and 4% are from other savings (e.g. dry bulk and delays). The fleet is expected to have a major shift to Post Panamax Generation 1 and 2 vessels and largest allowable tankers at 44 feet of channel depth or greater, with greater vessel utilization as depths increase. The Port Everglades benefitting fleet is in the active world fleet today (versus in design or expected to be developed). Fleet deployment of larger vessels is expected to occur within the first 5 years following construction. This allows benefits to be achieved in the near term, versus the more standard 15 to 20 years from the base year.

5.6.1 LPP Environmental

The majority of environmental impacts occur with the first increments of widening and deepening. The total impact for seagrasses is at the first foot of depth, while the reef and hardbottom impacts increase at approximately 1 acre of impact per foot of depth dredged. For the NED depth of 47 feet and the LPP depth of 48 feet, the seagrass and mangrove impacts are the same (4.21 acres of seagrass and 1.2 acres of mangroves). For reef and hardbottom habitats, the direct impact acreage is inversely correlated to the below-dredge depth potential impacts: as the channel goes deeper, more of the impact moves from the potential impact below-dredge depth category to the direct impact category. For the 47-foot plan, the direct impact is 14.5 acres and 7.2 acres of potential impacts below dredge depth. At 48 feet, the direct impacts are 15.3 acres and 6.4 acres of potential impacts below dredge depth. As there is only so much reef to impact, the more direct impact to the reef the less potential impacts (i.e. for each additional foot of impact there is less remaining of the reef to impact therefore with an additional foot dredged there is a greater direct impact which leaves less to potentially impact). Upfront mitigation for both depths include the direct impacts, 10% of the below dredge depth impacts, and loss of 2% function as a result of indirect effects of turbidity and sedimentation. The incremental increase in mitigation costs going from 47 feet to 48 feet is approximately $2 million. The incremental increases in cost reflect the mitigation measures high initial fixed cost versus a small incremental cost of adding additional mitigation units.

5.6.2 LPP Engineering

The additional deepening from 47 feet to 48 feet represents an approximate 5.4% increase in cost. There is no significant change in the unit cost of construction or disposal between the 47-foot or 48-foot depth, nor is there a price break-point, between these depths. Using the current criteria for cost development and cost and schedule risk analysis, there is a high level of confidence to execute this project, and that confidence is equal under each alternative. Construction and disposal techniques for each alternative depth are the same. Material will be removed using a cutter head dredge or blasting with cutter head or clam shell removal and placed in ocean disposal. The proposed Ocean Dredged Material Disposal Site (ODMDS) is of sufficient capacity to include material from the 48-foot plan and future O&M, with no impact to long-term disposal capacity.

While vessels have been known to take advantage of tide cycles to transit at a deeper draft, minimizing channel depth requirements, this is not a viable practice at Port Everglades. The tide range at Port Everglades is approximately 2.5 feet to 2.7 feet between mean lower low water and mean high water. Given the magnitude and unpredictable nature of offshore and nearshore currents and the unusual speed (10 to 12 knots) required to maintain vessel control while transiting the entrance channel, the tidal range at Port Everglades is not sufficient to ensure adequate underkeel clearance for vessels with drafts deeper than those for which the channel dimensions are specifically designed. The pilots use the tide to allow some vessels to transit up to and no deeper than the authorized depth, depending on the vessel and channel segment. The risk of

grounding and/or vessel and environmental damage is significant should vessels deeper than the design draft attempt to enter the harbor. Thus use of tide is not a viable option to transit at a deeper depth than authorized.

5.6.3 LPP Operations and Maintenance (O&M)

Port Everglades has a history of low annual shoaling and an infrequent O&M dredging requirement. Because of the minimal shoaling in the project area, the with-project annual O&M is minimally more (~$55,500) than historical cost, and the volume of additional material does not change the frequency of O&M dredging. The increase in annual O&M is primarily due to the increase in channel footprint (widening); therefore there is no projected difference in annual O&M between the 47-foot NED and 48-foot Recommended Plan.

5.6.4 LPP Incremental Costs and Benefits

The average annual equivalent (AAEQ) incremental costs and benefits of the Locally Preferred Plan above the NED plan are displayed in **Table 24**, Costs and Benefits of Project Increments. As shown in this table, the incremental AAEQ benefits for the 48-foot channel are $1.4 million, all of which are transportation savings benefits.

Table 24 shows that the incremental AAEQ net benefits for the LPP (48-foot project depth) are $400,000 with an incremental BCR of 1.40. This is not considered a significant difference between plans, as the change is only 1.3% in AAEQ net benefits between the NED and LPP. The USACE policy guidance in ER 1105-2-100 Exhibit G-1 3.c directs that "when two cost-effective plans produce no significantly different levels of net benefits; the less costly plan is to be the NED plan." The non-federal sponsor would be responsible for 100% of the incremental costs in addition to their cost shared portion of the 47-foot plan.

Table 24: AAEQ Incremental Costs and Benefits of the Locally Preferred Plan above the NED Plan

Incremental AAEQ Cost	Incremental AAEQ Benefits	Net Incremental AAEQ Benefits	Incremental BCR
$ 960,000	$ 1,340,000	$ 400,000	1.4

Note: FY15 Price Levels at 3.375%

The LPP provides the same type of benefits, transportation cost savings, as the NED plan. The NED and LPP plan will have the same type of mitigation required; however there is an incremental increase in mitigation under the LPP commensurate with the increase in reef and hardbottom impacts due to the deeper depth. The LPP demonstrates similar in-kind outputs and equal to the outputs of the Federal plan while meeting the criteria of environmental acceptability.

5.7 SUMMARY OF ACCOUNTS

The Federal objective is to determine the project alternative with that reasonably maximizes net benefits while protecting or minimizing impacts to the environment. Both the 47-foot and 48-foot alternatives were reduced during the plan formulation process and optimized to minimize environmental impacts under the EQ account. In particular, the widening was the absolute minimum necessary for safety while avoiding impacting the mangroves as much as possible. Efforts to avoid and minimize environmental impacts will continue in the Preconstruction Engineering and Design (PED) phase. Environmental impacts are more fully described in the EIS.

The Port Everglades area economy, under the RED account, will most likely experience regional economic benefits from the implementation of this project.

The OSE account includes effects on social aspects such as community impacts. The effects of the project on people living and working in the region have been documented; their opinions are noted in the report and included in the EIS, **EIS Sub-Appendices L and M**. In addition the study evaluated environmental justice and determined that the project would have no effect and would not influence any foreseeable future actions that could adversely affect minority and low-income populations.

Table 25: Summary of Accounts

Alternative 2E	Federal Objective			
	NED	EQ	OSE	RED
No Action	X	●	X	X
46'+Widening	●	●	●	●
47'+Widening	●	●	●	●
48'+Widening	●	●	●	●
49'+Widening	●	●	●	●
50'+Widening	●	●	●	●

● - Meets objective

X - Does not meet objective

NED (National Economic Development), EQ (Environmental Quality), OSE (Other Social Effects), RED (Regional Economic Development)

5.8 RECOMMENDED PLAN

After conducting the economic analysis, Plan 2E at a depth of 47-feet was selected as the National Economic Development Plan. The sponsor requested a Locally Preferred Plan (LPP) of 48 feet and has agreed to pay 100% of the additional cost of the additional foot. The Recommended Plan is the 48-foot LPP.

The Recommended Plan consists of deepening Port Everglades to 48 feet which as shown in **Figure 35**. Through authorization of the recommended plan, the existing limits of the Federal channel will be expanded. The recommended plan includes the following features:

- deepen and widen the Outer Entrance Channel (OEC) from an existing 45-foot project depth over a 500-foot channel width to 55 feet by 800 feet and extend 2,200 feet seaward;
- deepen the Inner Entrance Channel (IEC) from 42 feet to 48 feet;
- deepen the Main Turning Basin (MTB) from 42 feet to 48 feet;
- widen the rectangular shoal region to the southeast of the MTB by about 300 feet and deepen to 48 feet (Widener);
- widen the Southport Access Channel (SAC) in the proximity of berths 23 to 26, referred to as the knuckle, by approximately 250 feet and reconfigure the USCG facility easterly on USCG property;
- shift the existing 400-foot wide SAC about 65 feet to the east (cost is included in the non-federal berthing area dredging costs and is 100% non-federal) from approximately berth 26 to the south end of berth 29 to provide a transition back to the existing Federal channel limits;
- deepen the Southport Access Channel (SAC) from about berth 23 to the south end of berth 32 from 42 feet to 48 feet;
- Environmentally Friendly Bulkheads (EFB) will be placed along portions of the SAC to maintain the existing shoreline. These are used to stabilize the shoreline as the channel is deepened and widened the natural side slopes will fall and to prevent damage to John U Lloyd and the Conservation Easement from side slopes (See Engineering Appendix A Section 4 for more information);
- deepen the Turning Notch (TN), including Sponsor expanded portion, which is currently in the design phase, from 42 feet to 48 feet with an additional 100-foot widening parallel to the channel on the eastern edge of the SAC over a length of about 1,845 feet;
- widen the western edge of the SAC for access to the TN from the existing Federal channel edge near the south end of berth 29 to a width of about 130 feet at the north edge of the TN.

To compensate for the unavoidable adverse effects of the action on various significant habitat types, USACE has proposed the following: mitigate for (a) the removal of approximately 7.41 acres of vegetated and unvegetated seagrass habitat (including that within the new channel footprint and resulting side slopes) and (b) the loss of approximately 1.16 acres of mangroves in the project footprint through use of ecosystem benefits from a previously permitted restoration project at West Lake Park (Broward County, FL), which is currently under design. Mitigation for impacts will involve use of approximately 2.4 seagrass functional units and approximately one (1) mangrove functional unit, respectively, from that project, located in a county-operated, state-owned, natural area immediately to the south of the project area. USACE has also proposed the following: mitigate for (c) the direct removal of approximately 14.62 acres of complex, high-profile, linear and spur/groove reef habitat through the creation of approximately 5

acres of artificial reef with the transplantation of 11,502 corals from the impact site to the artificial reef and the outplanting of approximately 103,000 nursery raised corals. Additional mitigation will be provided due to any detectable, incidental, direct impacts of dredging equipment and indirect impacts on hardbottom habitats due to turbidity/sedimentation. These mitigation components were determined to be economic "Best Buys" from among mitigation alternatives.

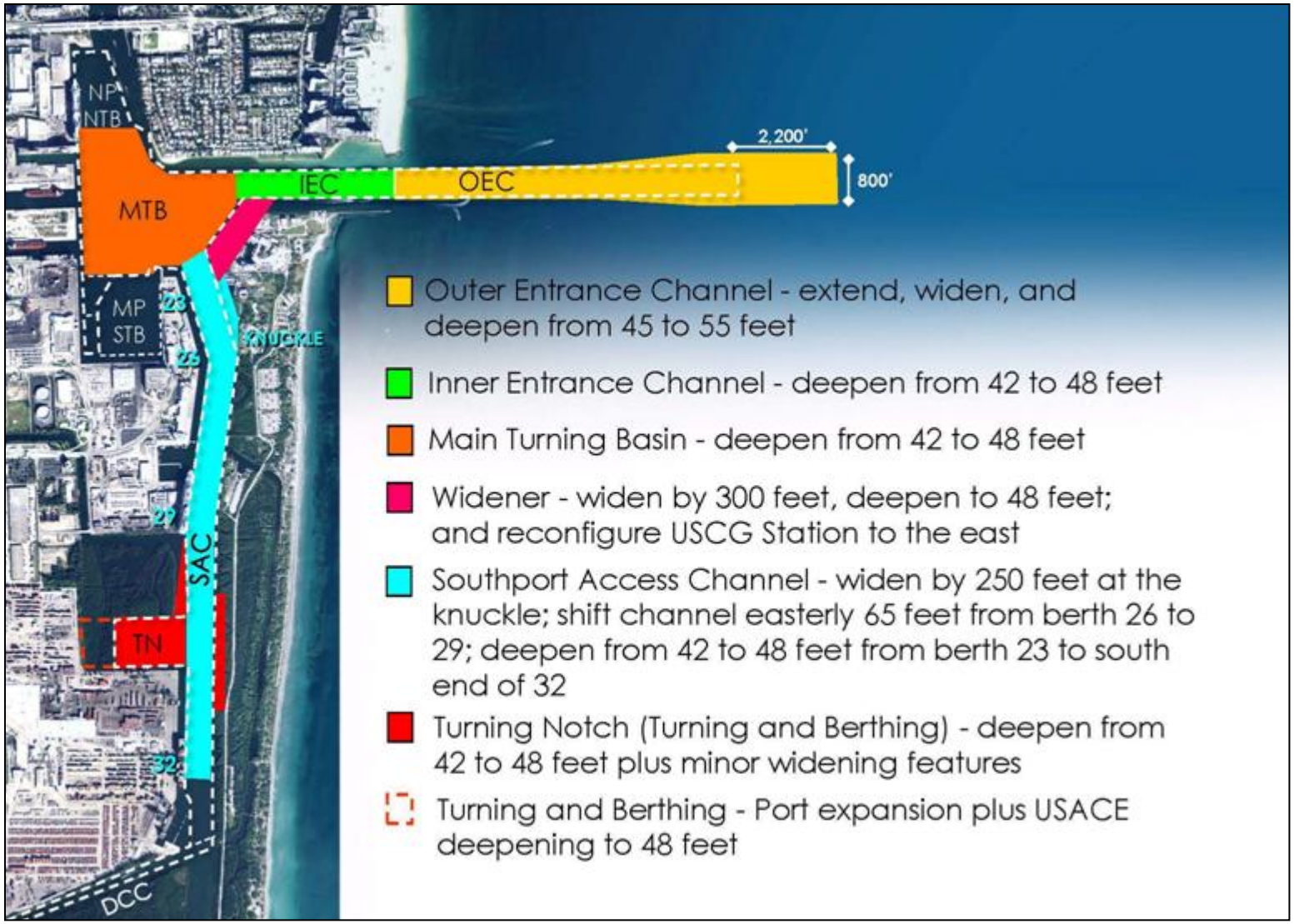

Figure 35: Recommended Plan Components

5.9 COSTS AND BENEFITS OF THE RECOMMENDED PLAN

Table 26 itemizes the estimated first costs for the Recommended Plan of 48 feet. The detailed cost estimate can be found in the **Cost Estimate Appendix F**. Total project costs, including associated costs and interest during construction, for all of the components, are included and generate a total investment cost of $374,100,000. For the full breakdown of costs and cost sharing tables see **Section 8.0**.

Table 26: 48-Foot Recommended Plan Costs and Benefits at FY15 Price Levels

Port Everglades	RECOMMENDED PLAN
Federal Cost	**$189,900,000**
Non-federal Costs	**$184,200,000**
Total Cost Allocation	**$374,100,000**
Project First Cost	**$322,700,000**
Total AAEQ Costs	**$16,900,000**
AAEQ Benefits	**$48,200,000**
B/C Ratio	**2.90**

6.0 THE RECOMMENDED PLAN

Tables 27 and **28** summarize Federal and non-federal components, respectively.

Table 27: Federal Elements of the Recommended Plan

Reach	Project Depth[1] (ft MLLW)	Channel Width (ft)	Channel Length (ft)	Additional Federal Elements[2]
Outer Entrance Channel	55	Varies 800max to 400min	Extends 2,200 lf offshore	0.5H:1V (reef/rock) 3H:1V side slope (sand)
Inner Entrance Channel	48	400	Same as Existing	0.5H:1V (reef/rock) 3H:1V side slope (sand)
Main Turning Basin	48	See Fig 38	Same as Existing	0.5H:1V (reef/rock) 3H:1V side slope (sand)
Widener	48	See Fig 38	See Fig 38	0.5H:1V (reef/rock) 3H:1V side slope (sand)
Southport Access Channel	48	See Fig 38	9,385	0.5H:1V (reef/rock) 2H:1V side slope (sand), Environmentally Friendly Bulkheads
Turning Notch	42 to 48	145	1,315 (E-W)	0.5H:1V (reef/rock) 2H:1V side slope (sand)
USCG Basin Reconfiguration[3]	N/A	200	350	Reconfigure basin and adjacent buildings
Mitigation	N/A	N/A	N/A	Seagrass, Mangrove and Reef

[1] An additional depth of 1 foot required and 1 foot allowable will be included in dredging contract

[2] Mitigation for certain project elements will be further discussed in the Recommended Plan Design section

[3] Reconfiguration based on Ship Simulation Study and CGWAVE results

Table 28: Non-federal Elements of the Recommended Plan

Project Component	Impacted Bulkhead (by Berth)	Bulkhead Age		Required Action
		< 40 yrs	> 40 yrs	
OEC	---			---
IEC	---			
MTB	7 - 10		X	Extend depth of pre-project bulkhead
STB	16 - 19		X	Extend depth of pre-project bulkhead
Widener	---			No existing bulkheads impacted
SAC	31 - 32	X		Construct toewall to stabilize bulkhead
TN	30	X		Construct toewall to stabilize bulkhead

6.1 CONSTRUCTION PHASING

Construction Phasing is based on USACE estimates for dredging durations and element costs, and provides the plan for contract phases per fiscal year. The number of contracts required to complete this project is a function of the funding stream, the contractors proposal, construction methodologies, equipment availability, construction window compliance among others. These factors may require multiple contracts.

Table 29: Construction Phasing

Location	Depth	Quantity[1] (cy)	Site	Start Year	Contract No.
ODMDS Selection	---	----	---	Year 1	1
Plans & Specifications	---	----	---	Year 2	1
Outer Entrance Channel	55	1,057,062	ODMDS	Year 3	1
Inner Entrance Channel	48	307,693	ODMDS	Year 4	1
Widener	48	996,245	ODMDS	Year 5	1
Main Turning Basin	48	700,734	ODMDS	Year 5	1
Southport Access Channel	48	1,571,500	ODMDS	Year 6	1
Turning Notch	48	608,528	ODMDS	Year 8	1

[1] Quantities include maintenance material, required and allowable overdepth, and project related berthing areas

The precise number of contracts required will be determined during the Preconstruction Engineering and Design (PED) phase that follows this feasiblity phase. **Table 29** is based on a conservative estimate for funding of the project, on a phased basis.

6.2 USACE CAMPAIGN PLAN

USACE Vision – A great engineering force of highly disciplined people working with USACE partners through disciplined thought and action to deliver innovative and sustainable solutions to the Nation's engineering challenges.

USACE Mission – Provide public engineering services in peace and war to strengthen National security, energize the economy, and reduce risks from disasters.

Commander's Intent – The USACE will be one disciplined team, in thought, word, and action. We will meet USACE commitments, with and through USACE partners, by saying what we will do and doing what we will say. The USACE will, through execution of this Campaign Plan, become a GREAT organization as evidenced by the following in all mission areas; Delivering superior performance, Setting the standard for the profession, Making a positive impact on the Nation and other nations, Being built to last by having a strong "bench" of educated, trained, competent, experienced, and certified professionals.

The Recommended Plan for this project is consistent with these themes. The project team took the latest policy and planning guidance and worked with professionals familiar with the local coastal system to design a project that will work in tandem with adjacent projects to help provide safe, effective, and efficient navigation. Extensive reviews were performed to ensure quality and consistency. The team worked with stakeholders on the state and Federal level as well as local stakeholders.

7.0 RECOMMENDED PLAN DESIGN

Construction methodology for the project will be determined by the contractor selected by the USACE. However, certain assumptions for planning and estimating purposes were made regarding various proposed construction techniques that may be used.

Outer Entrance Channel (OEC)
A 3H:1V angle of repose is expected over time for the side slope. The OEC will have to be extended 2,200 feet offshore to remove two areas that are shallower than the new project depth. The flare located at this region of the channel is required to allow for safer maneuvering of large vessels when a strong cross shore current is experienced. The project depth in the OEC is increased from 45-feet to 55-feet to accommodate ship wave movement and squat associated with the larger design vessel. Additional information on the engineering calculations leading to this depth can be found in **Appendix A, Engineering Appendix – Sub Appendix C**.

Inner Entrance Channel (IEC)
A 3H:1V angle of repose is expected over time for the side slope. Construction of the IEC will include deepening to 48 feet MLLW.

Widener/Main Turning Basin (WIDE and MTB)
The Widener work will facilitate turning and transit between the MTB and the SAC. Based on available data, USACE Geotechnical staff have indicated that it is unlikely blasting will be required for dredging in this area.

Turning Notch (TN)
Construction of the TN (including the expanded portion that will be constructed by the non-federal sponsor and is currently under design) will include deepening to 48-feet MLLW with minor widening along the SAC by approximately 100 feet. Deepening the berthing area (berth 30) on the south side of the TN to 48 feet is included as a non-federal feature.

Southport Access Channel (SAC)
The widened channel is designed to allow the S-Class Post-Panamax vessel to transit the channel with Cruise Vessels at Berths 24-27. USACE Geotechnical staff concluded, based on available data, it is probable that blasting will not be required for dredging in this area. Additional core borings will be done during the design phase for confirmation. The sideslope along John U. Lloyd SRA is expected to be 2H:1V. The channel will be dredged to 48-feet MLLW with one-foot required overdepth and one-foot allowable overdepth. To minimize environmental impacts careful consideration was given to the design of this feature including use of Environmentally Friendly Bulkheads along the eastern shore. This type of bulkhead allows sufficient water to pass through to continue flushing of mangroves and allow juvenile fish access to the mangroves.

U.S. Coast Guard (USCG) Basin
The USCG basin will have to be reconfigured to allow for safe transit of the larger

vessels based on ship simulation study results. Consultations have occurred with the USCG throughout the planning process. The numeric model CGWAVE was analyzed and results verify that the most current design provided acceptable operational wave conditions within the new basin. **Engineering Appendix A** has more documentation on this model analysis. The USCG is in agreement with the plan to reconfigure a majority of their facilities. Coordination amongst the agencies can be found in the **Pertinent Correspondence Appendix**. The USCG facility reconfiguration design can be found as an attachment to the **Engineering Appendix**.

Real Estate Requirements

The deepening of the outer entrance channel, inner entrance channel, middle turning basin, and the turning notch as well as widening of the outer entrance channel, turning notch, and the Southport Access Channel (knuckle) are within the navigable waters of the United States and are available to the United States by navigation servitude. The existing and expanded ODMDS are also available to the United States by navigation servitude.

The land required for the widener at the north end of the Southport Access Channel is federally owned and operated by the U.S. Coast Guard. The U.S. Coast Guard owns a total of 7.8 acres and operates a multi-mission (search, rescue, and drug interdiction) facility on the property. Approximately one acre of uplands will be removed and turned into submerged lands to support the widening of the Southport Access Channel. Use of the U.S. Coast Guard property is necessary to allow deep draft vessels the ability to turn safely. The uplands being submerged will remain Federally-owned and be used for U.S. Coast Guard vessels.

The reconfiguration also requires several U.S. Coast Guard structures, facilities, and utilities to be shifted to the east onto adjacent Federally-owned property. The cost for this reconfiguration is included in the cost-shared project construction costs as a general navigation feature and not as a real estate cost. The U.S. Coast Guard has been involved in the planning of this project and a final plan is still being developed. A permit for use of real property by other federal agencies will be executed between the U.S. Coast Guard and the Department of the Army for construction purposes.

The primary disposal site is an existing disposal site, designated by the U.S. Environmental Protection Agency as an ODMDS. The U.S. Environmental Protection Agency has completed the draft Environmental Assessment on the expansion and has received public comments. The formal designation process including rule making and publication in the Federal Register of the expanded ODMDS is expected to be complete in 2015. No further real estate is needed for the ODMDS. The expansion of this site is required for current operation and maintenance of the channel and no additional costs are included from the ODMDS expansion for this project.

The submerged lands required for relocating excavated hardbottoms to a five acre artificial reef site and transplanting disturbed coral communities are within the navigable waters of the United States and are available by navigation servitude.

In lieu of a real estate fee acquisition for seagrass and mangrove mitigation, mitigation credits are being purchased from Broward County. Broward County is generating mitigation credits to offset impacts of Broward County projects at areas within West Lake Park. Broward County applied for and received permission to construct seagrass and mangrove features through South Florida Water Management District Environmental Resource Permit No. 06-04016-P and Department of the Army Regulatory Permit No. SAJ-2002-0072, as amended. The permits authorize Broward County to complete mitigation activities to offset impacts to tidal, saltwater, and wetland communities and accrue ecological functional value credits for the work within West Lake Park. The area is only available for Broward County projects, specifically port and airport expansion projects. Accrued credits will be purchased by the Federal government and applied to this project prior to construction. An agreement between the United States and Broward County will be executed to guarantee seagrass and mangrove mitigation in perpetuity.

ODMDS Contingency

Should EPA not designate a disposal site with capacity for proposed material from the Port Everglades Harbor deepening under Section 102 of the Marine, Protection, Research, and Sanctuaries Act (MPRSA), Section 103(b) of MPRSA authorizes USACE, with USEPA concurrence, to select a site for one time disposal of dredged material in ocean waters when the use of a site designated by USEPA is not feasible. This one-time use would be a permit for the entire construction event. After this use, USACE and EPA have the option to permit it beyond that time frame under Section 103. All maintenance material will be placed in the existing ODMDS site, which has more than enough capacity. The cost involved with this contingency plan would be approximately $100,000 (only labor funds for designation).

7.1 OPERATIONS AND MAINTENANCE CONSIDERATIONS

The Federal channels and basins will be maintained by the USACE, in accordance with WRRDA 2014; O&M is 100% Federal with a project depth under 50 feet.[5] ER 1105-2-100, Appendix E, par E-8.b.(2) states "Where an entrance channel is deeper than interior channels because of the more adverse navigation conditions of the entrance channel, cost sharing is the same as the deepest reach of the more protected interior channels." As such, the Outer Entrance Channel which includes additional underkeel clearance is cost shared at the same rate (100% Federal) for O&M as the 48-foot depth. Port facilities such as berthing areas and port bulkheads will be maintained by the non-federal sponsor. Mitigation constructed as a result of this project will be monitored post-construction by the non-federal sponsor.

The increase in maintenance costs over the existing O&M was determined using FY 15 costs and a 3.375% interest rate over the 50-year period of analysis. The annual O&M costs is expected to increase by approximately $55,500. This increase in cost is based on

[5] **WRRDA 2014 Section 2102(b) OPERATION AND MAINTENANCE.--Section 101(b)(1) of the Water Resources Development Act of 1986 (33 U.S. C. 2211(b)(1)) is amended by striking "45 feet" and inserting "50 feet".**

the increase in material needing to be removed from the channel. The existing project needs approximately 217,000 cubic yards removed every 8 years while the proposed project will need approximately 274,400 cubic yards removed. As the increase in annual O&M is primarily due to the increase in channel footprint (widening); there is no discernible difference in annual O&M between the 47-foot NED and 48-foot Recommended Plan.

7.2 Environmental Requirements and Commitments

Environmental commitments of the project include: (1) the blasting protection protocols to protect marine mammals and sea turtles from blasting activities (2) Use of the standard manatee protection protocols during construction, (3) pre- (baseline), during and post-construction monitoring of coral and hardbottom habitats adjacent to the channel; (4) relocation of hard corals from the 3rd reef entrance channel extension to adjacent habitats.

Seagrass and mangrove mitigation is planned for construction at West Lake Park and hardbottom mitigation is currently planned as artificial reef creation offshore within sand borrow sites used for Broward County beach renourishments. See the EIS for more information.

7.2.1 Seagrass and Mangrove Mitigation

The County has a mitigation project at West Lake Park that is a joint effort to address mitigation needs for the Port expansion project and expansion by the Airport. The entire improvements that extend beyond the Port expansion requirements are intended to address ecosystem-level improvements through a comprehensive plan for the entire West Lake Park area and the region, **EIS Sub-Appendix E**.

"West Lake Park is the best place in Broward to take a canoe or kayak trip with many trails and hours of paddling. At sunset, paddle out to the horseshoe wading bird rookery for a fly in or take the park's tour boat. The chance to see Roseate Spoonbills flying overhead alone makes West Lake Park a place worth visiting." (South Florida Audubon Society website)

Figure 36: West Lake Park from Florida Audubon Society

The permits for the entire enhancement plan were originally issued by the South Florida Water Management District in April 2004, by the Broward County Environmental Protection Department in August 2004, and the USACE Regulatory Division in March 2006 and have since been extended. The enhancement plan is therefore authorized for use in mitigating impacts under the regulatory jurisdiction of those agencies.

Mangrove habitats provide many important ecological functions, including providing refugia for juvenile stages of managed fish species, and have been identified as significant resources for seven Federally protected species, and four Federally protected subspecies. Based on Uniform Mitigation Assessment Methodology (UMAM) calculations, the USACE will require use of approximately one (1) functional unit to compensate for the 1.16 acres of mangroves that will be impacted by the navigation improvements at Port Everglades.

Seagrass occurrence within the Port Everglades inlet and channel consists of mixed Submerged Aquatic Vegetation (SAV) with *Halophila decipiens* and *Halodule wrightii*, mixed SAV with *H. decipiens* and *Halophila johnsonii*, monospecific beds of *H. johnsonii*, and *H. decipiens*. *Halophila johnsonii* is a threatened species under the Endangered Species Act (ESA). Mitigation for impacts will involve use of 2.4 seagrass functional units from that project, located in a county-operated, state-owned, natural area immediately to the south of the project area.

One of the principal actions for creating seagrass and mangrove habitat is the removal of exotic vegetation and grading of existing disposal material islands to the appropriate depth. These new habitats will be located along the Intracoastal Waterway. In the event that natural recruitment has not occurred within 12 to 18 months following excavation, methods to plant seagrass donor material will be initiated. It is anticipated that restoration within West Lake Park will occur as a result of enhanced flushing and circulation patterns along the southeastern region of the lagoon. Water quality, clarity, and substrate conditions more suitable for seagrass propogation are expected as a result of the proposed mitigation features.

The project will cost share in purchasing mitigation for the project. The mitigation will be bought from the county, and the county assumes responsibility for providing mitigation. More detailed information can be found in the **Mitigation Plan, Sub-Appendix D of the EIS**.

7.2.2 Hazardous, Toxic and Radioactive Waste (HTRW)

A site assessment for Hazardous Toxic and Radioactive Waste (HTRW) sources was conducted of the area of Port Everglades. The HTRW assessment is required by ER 1165-2-132 and consisted of aerial photo reviews and database reviews of the area. The areas considered for Port deepening do not include any upland disposal sites located adjacent to or near Port Everglades. The evaluation revealed that the Port navigation improvement project is in the vicinity of industrial facilities, ad hoc warehouse or storage

areas, and petroleum storage facilities, and none of these areas are to be directly impacted by the proposed deepening and widening of the Federal channel. The report also provides documentation of small spills which are not unusual for a busy port area. Likely through dilution, actual cleanup remedial actions, and tidal currents all the residual effects have been weathered and eliminated. The material proposed for dredging will be evaluated for its suitability in ocean disposal in the ODMDS constituting the final test for contamination in the material. This testing is known as Section 103 testing and is conducted during the USACE Preconstruction Engineering and Design (PED) phase. The testing may include sediment chemistry as well as bioassays.

Routine testing has been done for placement of material at the ODMDS as the Port routinely collects and examines benthic sediment samples for chemical constituents prior to conducting maintenance dredging. Sediments sampled within the OEC, IEC, NTB, MTB, and STB were tested and were found suitable for ocean disposal. Sample analyses conducted in the project area indicated that acceptable levels (set by FDEP) for heavy metals were not exceeded. In addition to those sampling events, heavy metal sampling was conducted within the boundaries of the Port's widener project. Again, analyses from these samples did not indicate adverse sediment quality. Operations and Maintenance Dredging (O&M) was completed in FY 2013 for the SAC, MTB, TN, OEC, IEC and the Port's berthing areas. That material also underwent testing under Section 103 of MPRSA and as with previous dredging events at Port Everglades, the material was tested and did not exceed required thresholds and was placed in the ODMDS.

7.2.3 Mitigation Plans (Artificial Reef Sites)

Recommendations to be implemented include the following: mitigate for (c) the direct removal of approximately 14.62 acres of complex, high-profile, linear and spur/groove reef habitat through the creation of approximately creation of 5 acres of artificial reef with the transplantation of 11,502 corals from the impact site to the artificial reef and the outplanting of approximately 103,000 nursery raised corals. The Habitat Equivalency Analysis ("HEA") method was used to calculate mitigation requirements in acres for reef and hardbottom impacts associated with the navigation improvements. Several HEAs were conducted as a result of various habitat types, recovery times, and relief/profiles in the affected areas (for more information refer to **Appendix E of the EIS**).

Mitigation for reef impacts will be done through creation of reef habitat at designated sites north of the Port (**Figure 37**). Currently, reef structures are planned to be created using rock excavated primarily from the OEC, IEC, and MTB areas, or the contractor could choose to purchase native rock instead of using material from the channel. This will be examined and analyzed during the Request for Proposal (RFP) process prior to contract award, where the contractor would present a technical evaluation of how to construct the project and then the USACE, in consultation with the resource agencies, will evaluate the sufficiency of the proposals. The configuration of the artificial reef materials will resemble, in profile and functionality, to the maximum extent practicable those habitats impacted by construction of the project.

The proposed creation of artificial reefs will be designed and placed to mimic the impacted natural habitat of the middle and outer reefs. Two types of mitigation reefs will be constructed: High Relief, High Complexity (HRHC) reefs (exceeding three feet of vertical relief) and Low Relief, Low Complexity (LRLC) reefs (approximately three feet of relief). Monitoring during and post construction of the reef mitigation site(s) will include both physical and biological monitoring. Results of all mitigation reef monitoring efforts will be summarized in annual reports and distributed to all agencies and interested parties. Additional information can be found in the **EIS**.

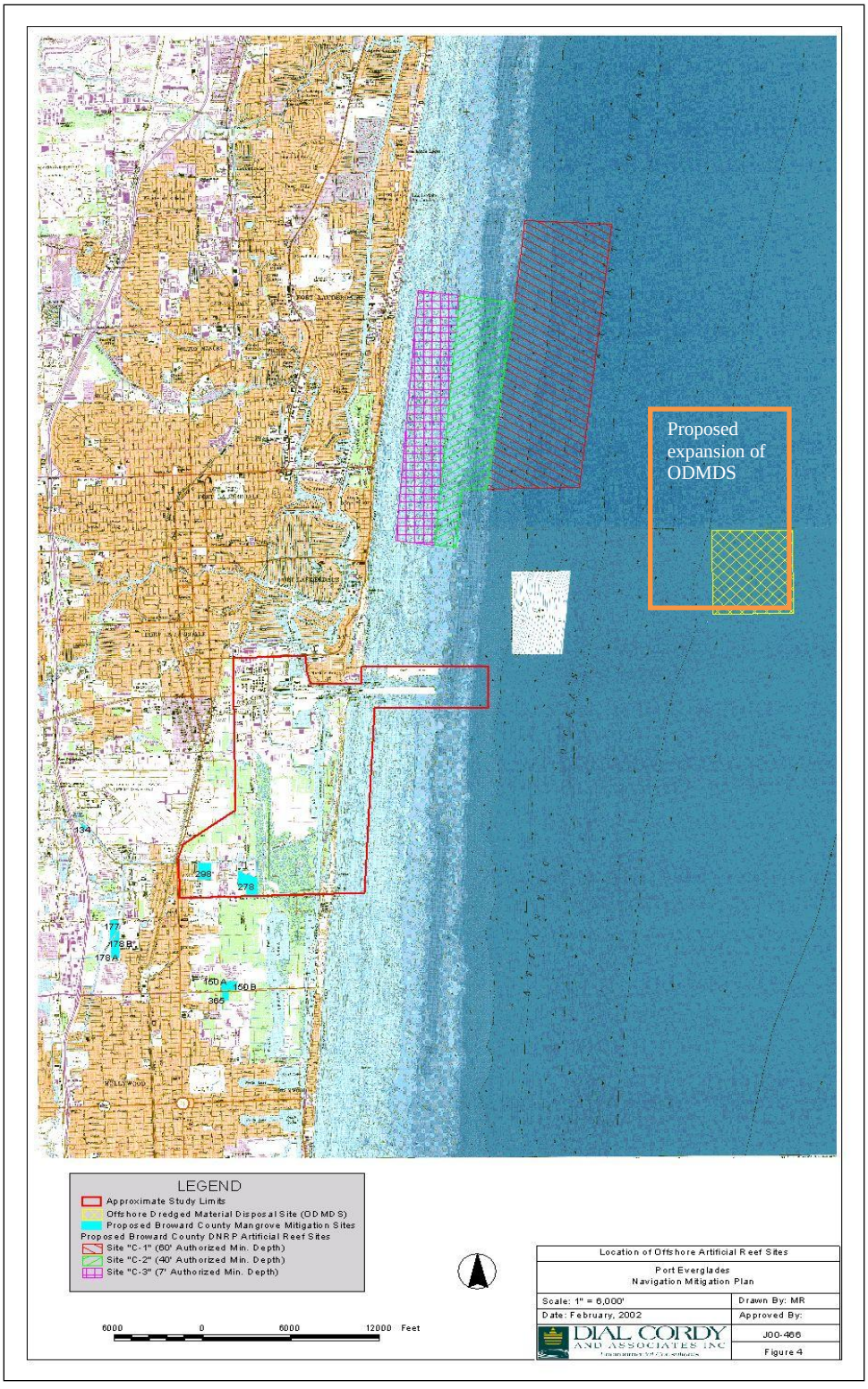

Figure 37: Reef Mitigation Sites

7.2.4 Relative Sea Level Rise Design Considerations

Relative Sea Level Rise (RSLR) refers to local elevation of the sea with respect to land, including the lowering or rising of land through geologic processes such as subsidence and glacial rebound. It is anticipated that sea level will rise within the next 100 years. To incorporate the direct and indirect physical effects of projected future sea-level change on design, construction, operation, and maintenance of coastal projects, the U.S. Army Corps of Engineers (USACE) has provided guidance in the form of ER 1110-2-8162.

ER 1110-2-8162 provides both a methodology and a procedure for determining a range of sea level rise estimates based on the local historic sea level rise rate, the construction (base) year of the project, and the design life of the project. Three estimates are required by the guidance, a baseline estimate representing the minimum expected sea level change, an intermediate estimate, and a high estimate representing the maximum expected sea level change. Following procedures outlined in USACE 2013 "Incorporating Sea-Level Change in Civil Works Programs," ER 1110-2-8162, the baseline, intermediate, and high sea level rise values were estimated over the life of the project. Based on historical sea level measurements taken from NOS gage 8723170 at Miami Beach, Florida, the historic sea level rise rate was determined to be 2.39 mm/year (0.0078 ft/year) (http://tidesandcurrents.noaa.gov/sltrends/index.shtml); the period of analysis is 50 years. Analysis shows that for three levels of projected future sea level rise over the period of analysis; baseline, intermediate, and high, sea level rise values at the end of the 50-year period of analysis are projected to be 0.39 feet, 0.84 feet, and 2.25 feet, respectively. In general, regional sea level rise (baseline, intermediate, and high) will not affect the functioning of the project alternatives or the overall maneuverability of the vessels. While there is expected to be a small increase in tide range and storm surge penetration for all three scenarios, the structural aspects of the project will be either unaffected or can be easily adapted to accommodate the change.

The primary impact of RSLR on this project may be its potential impact on mitigation measures proposed for mangroves and seagrasses at West Lake Park under the high SLR scenario. The mangroves are inside a protected lagoon, with limited water flow and currents. The USACE expects that with a gradual rise in sea level for all three rates, mangrove trees will continue to capture sediments in the mitigation areas, creating land with their prop-root structures and continue to thrive. Seagrasses are found in the IWW and Port Everglades vicinity in water depths up to 12 feet in depth. The proposed seagrass mitigation has a target elevation of -3ft MLLW. With an additional 2.25 feet of water on them, this would make the bed depth approximately 5.25 feet MLLW, within the current range of seagrass distribution of the Port. As a result, it is expected that the seagrass beds will continue to exist, although photosynthetic efficiency may decrease with increasing depth. The offshore reef mitigation is planned in water depths in excess of 40 feet. An additional 2.25 feet of water (using the maximum predicted rise in sea level as a worst case scenario) should have no effect on reef resources at Port Everglades, as the habitats being mitigated for are also found in waters deeper than 40 feet. Expanded discussion on RSLR can be found in the **Engineering Appendix**, Section 1.1.1 and the **EIS** Section 4.26.3.

8.0 RECOMMENDED PLAN IMPLEMENTATION

8.1 INSTITUTIONAL REQUIREMENTS

All construction material and future maintenance material is planned to be placed in the Port Everglades Ocean Dredged Material Disposal Site (ODMDS), which is undergoing approval for expansion by EPA scheduled for completion in 2015. Berthing area material, subject to Section 103 testing, may be placed offshore or in an upland site such as for use as landfill cap, consistent with previous Port practices. An additional depth of 1 foot required and 1 foot allowable will be included in the dredging contract. The Outer Entrance Channel (OEC) has additional depth requirements for squat and underkeel clearance, 7 feet beyond the required and allowable overdepth.

8.2 VIEWS OF THE NON-FEDERAL SPONSOR

Broward County, the non-federal sponsor, supports the Recommended Plan and fully understands the commitments they must satisfy in order to participate in the project.

8.3 ECONOMIC SUMMARY

Transportion cost savings are the estimated benefits of the project. The detailed economic analysis can be found in the **Economics Appendix B**. Costs and benefits were evaluated at the current FY15 3.375% rate.

Interest during construction takes place at a uniform rate of expenditure starting at the beginning of construction. The Recommended Plan AAEQ benefits are $48,240,000 and AAEQ Costs are $16,860,000, which provide AAEQ Net Benefits of $31,400,000. The benefit to cost ratio is 2.90.

Total costs, including associated costs and interest during construction for all of these components, are included and generate a total investment cost of $374,100,000.

8.4 COST APPORTIONMENT

The Water Resources Development Act of 1986 (Public Law 99-662) as amended, specifies cost apportionment by project purpose for deep draft navigation projects. Federal participation in navigation projects is limited to sharing costs for design and construction of general navigation features (GNF) consisting of breakwaters and jetties, entrance and primary access channels, widened channels, turning basins, anchorage areas, locks, dredged material disposal areas with retaining dikes, and mitigation. Non-federal interests are responsible for and bear all costs for acquistion of necessary lands, easements, rights-of-way and relocations, terminal facilities, as well as dredging berthing areas and interior access channels to those berthing areas.

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

For a commercial navigation project with project depths greater than 20 feet but not in excess of 45 feet, the non-federal share for the construction is 25 percent and for a commercial navigation project with project depths greater than 45 feet, the non-federal share for the construction is 50 percent. Lands, Easements, Rights-of-Way, and Relocations (LERRs) are 100 percent non-Federal costs. Operation and maintenance (O&M) of the general navigation features up to 50 feet in depth with a 100 percent commercial vessel navigation project are a 100 percent Federal responsibility. O&M in excess of 50 feet is cost-shared 50 percent by the non-Federal sponsor. In determining the cost-sharing, the 48-foot depth represents the project depth. Costs for associated wave allowance, squat, allowable and required overdepth are shared at the same rate as the project depth. Preparation of design documentation reports and plans and specifications during the preconstruction, engineering and design phase will be cost shared in accordance with the cost sharing required for project construction. **Table 30** summarizes the cost sharing percentages.

Table 30: General 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% 46'and deeper	10% from 0' to 20' 25% from 20' to 45' 50% >45'
GNF's costs for this project include: mobilization, all dredging costs, all disposal area construction costs, demolition costs for items not on Port property, USCG reconfiguration costs, and mitigation.		
Associated Costs [2]	0%	100%
Associated costs for this project are: dredging of Port berthing areas; Port infrastructure construction including bulkheads, toe walls, etc; lands, easements, and rights of way, and acquisition of disposal sites; all utility relocations except those associated with the USCG facility; costs for features requested by Port in excess of TSP.		
Navigation Aids	100%	0%
Operation and Maintenance		
GNF	100% except cost share 50% costs for maint. > 50 feet	0% except cost share 50% for maint. > 50 feet
Port berths, Port , Infrastruc.	0%	100%
USCG Facilities	100%	0%
Mitigation	0%	100%

[1] The non-Federal Sponsor shall pay an additional 10% of the costs of GNF over a period of 30 years, at an interest rate determined pursuant to section 106 or WRDA 86. The value of LERR shall be credited toward the additional 10% payment.

[2] There are no utility relocations associated with this project.

Cost sharing for the Recommended Plan (48 feet) is as follows: 75/25 at and below 45 feet, 50/50 from 45 feet to 47 feet (the NED plan), and 100% non-federal for 47 feet to 48 feet.

Table 31: Cost Sharing Table NED Plan Summary (October 1, 2014 price levels and FY2015 discount rate)

(October 1, 2014 Price Levels and FY15 discount rate) Cost Summary NED Plan (Deepen to 47 feet)			
	Total Cost	**Federal Share**	**Non-federal Share**
	20-45 ft.	**75%**	**25%**
General Navigation Features	**46-47 ft.**	**50%**	**50%**
Mobilization	**$3,100,000**	**$2,100,000**	**$1,000,000**
Dredging and Disposal	**$132,900,000**	**$93,000,000**	**$39,900,000**
Environmentally Friendly Bulkhead[6]	**$61,000,000**	**$45,800,000**	**$15,200,000**
Associated General Items[1]	**$4,500,000**	**$3,200,000**	**$1,300,000**
Environmental Mitigation	**$50,900,000**	**$37,100,000**	**$13,800,000**
Mitigation (Mangrove, Seagrass, Art Reef w/Corals)	*$34,600,000*	*$25,400,000*	*$9,200,000*
Monitoring	*$900,000*	*$700,000*	*$200,000*
Coral Propagation	*$15,400,000*	*$11,000,000*	*$4,400,000*
Pre-Construction, Engineering, and Design	**$5,600,000**	**$3,900,000**	**$1,700,000**
Construction Management (S&I)	**$8,400,000**	**$5,900,000**	**$2,500,000**
USCG Reconfiguration	**$38,900,000**	**$29,200,000**	**$9,700,000**
NED Subtotal Construction of GNF	**$305,300,000**	**$220,200,000**	**$85,100,000**
Lands and Damages[2]	-	-	-
NED Total Project First Costs	**$305,300,000**	**$220,200,000**	**$85,100,000**
Non-federal Construction Costs (Local Service Facilities)	**$37,800,000**	**$0**	**$37,800,000**
Non-federal Berthing Area Costs	**$12,700,000**	**$0**	**$12,700,000**
Aids to Navigation[3]	**$200,000**	**$200,000**	**$0**
10% GNF Non-Federal[4]	**$0**	**($30,500,000)**	**$30,500,000**
Total NED Cost Allocation[5]	**$356,000,000**	**$189,900,000**	**$166,100,000**
1. Includes Turbidity Monitoring and Dedicated Marine Animal Observer			
2. Real Estate Costs: There are no LERR for this project, there is $12,000 under PED for minimal administrative costs.			
3. Navigation Aids - 100% Federal			
4. The Non-Federal Sponsor shall pay an additional 10% of the costs of GNF of the NED plan, pursuant to Section 101 of WRDA 86. The value of LERR shall be credited toward the additional 10% payment. The value of lands provided for mitigation including the sponsor's incidental cost of acquisition are not creditable against this 10% since that value is cost shared as a GNF.			
5. In addition to these costs the AAEQ increases in O&M costs are approximately $55,500. Future O&M costs are due to the channel widening and are 100% Federal.			
6. These bulkheads are required to stabilize the shoreline as the channel is deepened and widened the natural side slopes will fall. To prevent damage to John U Lloyd and the Conservation Easement from slide slopes, these bulkheads will be placed along portions of the SAC to maintain the existing shoreline.			

The NED plan is cost shared 75/25 up to 45 feet and 50/50 greater than 45 feet as is shown in **Table 31** and the Recommended Plan (48-foot LPP) has an estimated additional cost of $18 million. The additional cost would be a 100% non-federal cost as is outlined in **Table 32**.

Table 32: Cost Sharing Table Recommended Plan/LPP Summary (October 1, 2014 price levels and FY2015 discount rate)

(October 1, 2014 Price Levels and FY15 discount rate) Cost Summary Recommended Plan/Locally Preferred Plan (Deepen to 48 feet)			
	Total Cost	Federal Share	Non-federal Share
	20-45 ft.	75%	25%
	46-47 ft.	50%	50%
General Navigation Features	48 ft.	0%	100%
Mobilization	$3,100,000	$2,100,000	$1,000,000
Dredging and Disposal	$147,800,000	$93,000,000	$54,800,000
Environmentally Friendly Bulkhead[6]	$61,000,000	$45,800,000	$15,200,000
Associated General Items[1]	$5,100,000	$3,200,000	$1,900,000
Environmental Mitigation	$52,800,000	$37,100,000	$15,700,000
Mitigation (Mangrove, Seagrass, Art Reef w/Corals)	*$35,600,000*	*$25,400,000*	*$10,200,000*
Monitoring	*$900,000*	*$700,000*	*$200,000*
Coral Propagation	*$16,300,000*	*$11,000,000*	*$5,300,000*
Pre-Construction, Engineering, and Design	$5,600,000	$3,900,000	$1,700,000
Construction Management (S&I)	$8,400,000	$5,900,000	$2,500,000
USCG Reconfiguration	$38,900,000	$29,200,000	$9,700,000
Subtotal Construction of GNF	$322,700,000	$220,200,000	$102,500,000
Lands and Damages[2]	-	-	-
Total Project First Costs	$322,700,000	$220,200,000	$102,500,000
Non-federal Construction Costs (Local Service Facilities)	$37,800,000	$0	$37,800,000
Non-federal Berthing Area Costs	$13,400,000	$0	$13,400,000
Aids to Navigation[3]	$200,000	$200,000	$0
10% GNF Non-Federal[4]	$0	($30,500,000)	$30,500,000
Total Cost Allocation[5]	$374,100,000	$189,900,000	$184,200,000
1. Includes Turbidity Monitoring and Dedicated Marine Animal Observer			
2. Real Estate Costs: There are no LERR for this project, there is $12,000 under PED for minimal administrative costs.			
3. Navigation Aids - 100% Federal			
4. The Non-Federal Sponsor shall pay an additional 10% of the costs of GNF of the NED plan, pursuant to Section 101 of WRDA 86. The value of LERR shall be credited toward the additional 10% payment. The value of lands provided for mitigation including the sponsor's incidental cost of acquisition are not creditable against this 10% since that value is cost shared as a GNF.			
5. In addition to these costs the AAEQ increases in O&M costs are approximately $55,500. Future O&M costs are due to the channel widening and are 100% Federal. There is no increase in O&M costs from 47 to 48 feet.			
6. These bulkheads are required to stabilize the shoreline as the channel is deepened and widened the natural side slopes will fall. To prevent damage to John U Lloyd and the Conservation Easement from slide slopes, these bulkheads will be placed along portions of the SAC to maintain the existing shoreline.			

8.5 FEDERAL RESPONSIBILITIES

Federal funding is subject to budgetary constraints inherent in the formation of the national civil works budget for a given fiscal year. The USACE will perform the necessary planning, engineering and design needed for the Federal project prior to construction. The USACE will obtain water quality certification and coastal zone management consistency determination for all construction pursued (including associated Port berthing area dredging, toe wall/bulkhead construction and Port infrastructure construction), and abide by the terms and conditions of the Biological Opinion.

8.6 NON-FEDERAL RESPONSIBILITIES

Non-federal construction costs for local service facilities are approximately $37.8 million. These include berthing area costs (Toe Wall, Cathodic Protection, Marine Hardware, etc.) in the Main Turning Basin (Berths 7 and 8), Turning Notch (Berth 30) and the Southport Access Channel (Berths 31 and 32). The cost for non-federal berthing area mechanical dredging in the Main Turning Basin, Southport Access Channel and Turning Notch are approximately $13.4 million. The total estimated non-federal costs for local service facilities and berthing area dredging total $51.2 million. These are 100% non-federal costs.

The non-federal sponsor, after the project has been authorized for construction, enters into a Project Partnership Agreement (PPA) with the United States Government.

8.7 ENVIRONMENTAL CONSIDERATIONS

The National Environmental Policy Act (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. Section 6 of the **EIS** details compliance with applicable environmental laws. 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, the inshore areas of the Intracoastal waterway and the reefs and hardbottom habitats have been considered in the formulation process.

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 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.

To compensate for the unavoidable adverse effects of the action on various significant habitat types, USACE has proposed the following: mitigate for (a) the removal of approximately 7.41 acres of vegetated and unvegetated seagrass habitat (including that within the new channel footprint and resulting side slopes) and (b) the loss of approximately 1.16 acres of mangroves in the project footprint through use of ecosystem benefits from a previously permitted Broward County restoration project at West Lake Park (Broward County, FL), which is currently under design. Mitigation for impacts will involve use of approximately 2.4 seagrass functional units and approximately one (1) mangrove functional unit, respectively, from that project, located in a county-operated, state-owned, natural area immediately to the south of the project area. USACE has also

proposed the following: mitigate for (c) the direct removal of approximately 14.62 acres of complex, high-profile, linear and spur/groove reef habitat through the creation of approximately 5 acres of artificial reef with the transplantation of 11,502 corals from the impact site to the artificial reef and the outplanting of approximately 103,000 nursery raised corals. Additional mitigation will be provided due to any detectable, incidental, direct impacts of dredging equipment and indirect impacts on hardbottom habitats due to turbidity/sedimentation. These mitigation components were determined to be economic "Best Buys" from among mitigation alternatives.

8.8 OTHER RELATED LAWS

As previously mentioned, the proposed action affects seagrass, mangrove 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** to comply with the CWA. USACE will seek state approval. The state permitting process is used to obtain a coastal zone consistency determination and WQC.

The U.S. Fish and Wildlife Service (USFWS) has provided several recommendations in the Coordination Act Report (CAR).

The USACE has determined that the project "may affect, but is not likely to adversely affect" the Federally endangered species including the 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, and threatened Johnson's seagrass and Acroporid corals, and has determined that the project is not likely to adversely modify designated critical habitat. NMFS provided a Biological Opinion on March 7, 2014 with a Clarification Letter on May 1, 2014.

In addition, the USACE 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 USACE has also determined that designated critical habitat for the West Indian manatee, Johnson's seagrass, and Acroporid corals will not be adversely modified by the proposed action. The USACE 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. Consultation with the USFWS, including a biological assessment, was completed and is addressed in the **EIS**. The previously mentioned whale and dolphin species are also protected by the Marine Mammal Protection Act of 1972 (MMPA). Refer to Section 6 of the **EIS** for the complete listing and discussion of all other related laws addressed in this study.

8.9 FLOODPLAIN MANAGEMENT

Executive Order 11988 requires the Federal Government to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains as well as direct or indirect support of development in those areas where there is a practical alternative. The existing Port facilities at Port Everglades are already in the 100-year floodplain (National Flood Insurance Program). 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.

8.10 COASTAL ZONE MANAGEMENT CONSISTENCY

The Coastal Zone Management (CZM) Act of 1972, as amended (PL92-583) requires Federal activities to be consistent to the maximum extent practicable with federally approved enforceable policies of a state's coastal management plan.The state will review the permit application and project plans and specifications in order to make a final consistency determination prior to project construction. See **Sub-Appendix C of the EIS.**

8.11 COASTAL BARRIER RESOURCES ACT

The proposed new Federal investment decision for the Port Everglades navigation project does not include any recommendations that would result in any new Federal expenditures or financial assistance prohibited by the Coastal Barrier Resources Act (Public Law 97-348); nor were funds obligated in past years for this project for purposes prohibited by this Act.

8.12 SUMMARY OF COORDINATION, PUBLIC VIEWS AND COMMENTS

The Feasiblity Phase of the study began in 2001 and included a NEPA public scoping meeting on March 28, 2001. Prior to this meeting the Notice of Intent to prepare an **EIS** appeared in the Federal Register, Volume 66, No. 57, on March 23, 2001. As outlined in the EIS, numerous meetings with the resource agencies were held. As is detailed in the **EIS Section 1.6 Table 1**, during the feasibility phase there were 40 agency and/or public meetings held between 2001 and 2014.

8.13 PUBLIC REVIEW

A 45-day comment period for the Draft EIS opened with publication of a Notice of Availability of the EIS in the Federal Register on June 28, 2013. Two public meetings were held during the above mentioned comment period. Following publication of the Draft EIS, 578 comments were received from among 254 parties (including regulatory

and resource agencies) during the public notice period. Issues for which multiple comments were received involved such issues as longshore sediment transport, impacts to reefs and protected coral species, and quantity of available seagrass mitigation at West Lake Park. Many of the comments received were in favor of the project. Areas of anticipated controversy include adequacy of mitigation for impacts to reefs and control of water quality and sedimentation during project construction. A summary of the public comments is included in the EIS Sub-Appendix L which includes copies of the comments received on the DEIS and the responses to comments.

8.14 ENVIRONMENTAL JUSTICE

The purpose of the proposed action is to provide increased maneuverability, efficiency, and lower costs for navigation while protecting the environment. Existing Port facilities are not easily accessible to some larger vessels, which 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 exclude the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies. Meaningful Involvement means that; 1) people have an opportunity to participate in decisions about activities that may affect their environment and/or health; 2) the public's contribution can influence the regulatory agency's decision; 3) their concerns will be considered in the decision making process; and 4) the decision makers seek out and facilitate the involvement of those potentially affected. The proposed project would benefit shipping and the general economy including minority and low income populations.

While there are no identified minority or low income populations that are in the study area or would be affected by the project, the stakeholder involvement approach has been wide reaching and provide a variety of opportunities for all affected communities to comment on the project.

9.0 RECOMMENDATIONS

I concur with the findings presented in this report. The Recommended Plan developed is technically sound, economically justified, and socially and environmentally acceptable.

The work proposed is not within existing authority. I recommend that the plan selected herein for the 48-foot locally preferred deepening alternative be authorized by Congress for implementation. Mitigation is required for seagrasses, mangroves, and reef and hardbottoms affected by the deepening. Mitigation of 2.4 seagrass functional units and one (1) mangrove functional unit will be provided in a county-operated, state-owned, natural area immediately to the south of the project area. Approximately 5 acres of artificial reef will be constructed with the transplantation of 11,502 corals from the impact site to the artificial reef and outplanting of approximately 103,000 nursery raised corals. Additional mitigation will be provided due to any detectable, incidental, direct impacts of dredging equipment and indirect impacts on hardbottom habitats due to turbidity/sedimentation. These mitigation components were determined to be economic "Best Buys" from among mitigation alternatives. Aids to navigation will be provided at 100% Federal cost. Absent sufficient Coast Guard funding, or adequate justification for the navigation aids, non-Federal interests may be required to provide them.[6]

For the purpose of calculating the Section 902 limit, the total estimated project first cost of the project is $322,700,000, October 1, 2014 price level, including an estimated Federal share of $220,000,000 and an estimated non-federal share of $102,500,000. The total estimated project cost includes only GNF costs plus LERR value. The Federal share includes only the Government's percentage share of GNF costs. The estimated non-federal share includes only the non-federal initial percentage share of GNF costs (i.e. not the extra 10% payment amount) plus LERR value. The cost for local service facilities and non-federal berthing areas is approximately $51,200,000 million dollars. These costs are 100% non-federal and are not included in the first total cost of the Recommended Plan.

The Recommended Plan conforms to the essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other Administration and legislative policies and guidelines on project development. If the project were to receive funds for Federal implementation, it would be implemented subject to the cost sharing, financing, and other applicable requirements for navigation projects. These requirements were established by WRDA 1986, as amended, and would be implemented with such modifications, as the Chief of Engineers deems advisable within his discretionary authority. Federal implementation is contingent upon the non-Federal sponsor agreeing to comply with applicable Federal laws and policies. Prior to implementation, the non-Federal sponsor would enter into a written PPA, to include the following non-Federal responsibilities:

[6] Planning Guidance Notebook, ER 1105-2-100, E-8 a.(2)

a. Provide, during the periods of design and construction, funds necessary to make its total contribution for commercial navigation equal to:

(1) 25 percent of the cost of design and construction of the GNFs attributable to dredging to a depth in excess of -20 feet MLLW but not in excess of -45 feet MLLW, plus

(2) 50 percent of the cost of design and construction of the GNFs attributable to dredging to a depth in excess of -45 feet MLLW but not in excess of -47 feet MLLW, plus

(3) 100 percent of the costs attributable to dredging to a depth over -47 feet MLLW;

b. Provide all lands, easement, and rights-of-way (LER), including those necessary for the borrowing of material and placement of dredged or excavated material, and perform or assure performance of all relocations, including utility relocations, all as determined by the Government to be necessary for the construction or operation and maintenance of the GNFs;

c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the GNFs, an additional amount equal to 10 percent of the total cost of construction of GNFs less the amount of credit afforded by the Government for the value of the LER and relocations, including utility relocations, provided by the non-Federal sponsor for the GNFs. If the amount of credit afforded by the Government for the value of LER, and relocations, including utility relocations, provided by the non-Federal sponsor equals or exceeds 10 percent of the total cost of construction of the GNFs, 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 LER and relocations, including utility relocations, in excess of 10 percent of the total costs of construction of the GNFs;

d. Provide, operate, and maintain, at no cost to the Government, 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 Government, including but not limited to the following:

e. In the case of project features greater than -50 feet MLLW in depth, provide 50 percent of the excess cost of operation and maintenance of the project over that cost which the Government determines would be incurred for operation and maintenance if the project had a depth of 50 feet;

f. Give the 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 project for the purpose of completing, inspecting, operating and maintaining the GNFs;

g. Provide, at a cost to the Project, prior to construction and for the authorized life of the project, mitigation necessary to offset impacts to seagrasses and mangroves, currently estimated to be 2.4 seagrass functional units and one (1) mangrove functional unit;

h. Hold and save the United States free from all damages arising from the construction or operation and maintenance 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;

i. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of the project, 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;

j. Perform, or ensure performance of, any investigations for hazardous substances that 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 USC 9601–9675, that may exist in, on, or under LER that the Federal Government determines to be necessary for the construction or operation and maintenance of the GNFs. However, for lands, easements, or rights-of-way that the Federal Government determines to be subject to the navigation servitude, only the Federal 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;

k. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under LER that the Federal Government determines to be necessary for the construction or operation and maintenance of the project;

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

m. Comply with Section 221 of PL 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the WRDA 86, Public Law99-662, as amended, (33 U.S.C. 2211(e)) which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91 646, as amended, (42 U.S.C. 4601-4655) and the Uniform Regulations contained in 49 CFR 24, in acquiring lands, easements, and rights-of-way, necessary for construction, operation and maintenance of the project including those necessary for relocations, the borrowing of material, or the placement of dredged or excavated material; 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, PL 88 352 (42 USC 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600 7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive changes the provision of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c);

p. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation that are in excess of 1 percent of the total amount authorized to be appropriated for the project; and

q. Not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal sponsor's obligations for the project costs unless the Federal agency providing the Federal portion of such funds verifies in writing that such funds are authorized to be used to carry out the project.

r. 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.

The recommendations contained herein reflect the information available at this time and current Department 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 funding. 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.

Alan M. Dodd
Colonel, U. S. Army
District Commander

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Acronyms/definition of terms

AAEQ	Average Annual Equivalent (economic term)
BCR	Benefit to Cost Ratio
CESAJ	U.S. Army Corps of Engineers – Jacksonville District
CGWAVE	Coastal Gravity WAVE computer program
COE	U.S. Army Corps of Engineers
Corps	U. S. Army Corps of Engineers
CY	Cubic Yards
CZM	Coastal Zone Management Consistency
DEP	Department of Environmental Protection
DCC	Port Everglades Dania Cutoff Canal
DMMP	Dredged Material Management Plan
DOT	Department of Transportation
DWT	Dead Weight Ton
EIS	Environmental Impact Statement
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
EQ	Environmental quality - accounts for non-monetary effects on environmental, cultural, and aesthetic resources
EFB	Environmentally Friendly Bulkhead
ESA	Endangered Species Act of 1973
FEC	Florida East Coast Railway
FCSA	Feasibility Cost Sharing Agreement
FDEP	Florida Department of Environmental Protection
FLO/FLO	Float off – Float Off
FSM	Feasibility Scoping Meeting
FTZ	Foreign Trade Zone
FWC	Florida Fish and Wildlife Conservation Commission
GNF	General Navigation Feature
HCD	Habitat Conservation Division
HTRW	Hazardous, Toxic, and Radioactive Waste
ICTF	Intermodal Container Transfer Facility
IEC	Port Everglades Inner Entrance Channel
INROADS	Proprietary computer program used to calculate volumes
IWW	Intracoastal Waterway
JCP/WQC	Joint Coastal Permit/Water Quality Certification
LERRD	Lands, easements, rights of way, relocations and disposal area
LIDAR	Light Detection and Ranging (survey technology)
LOA	Length overall (vessel)
LO/LO	Load on/Load off
LPP	Locally Preferred Plan
MCACES	Micro Computer Aided Cost Engineering System
MLLW	Mean Lower Low Water
MTB	Port Everglades Main Turning Basin
Navy	U.S. Navy

NED	National Economic Development
NMFS	U.S. National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSU	Nova Southeastern University
NTB	Port Everglades North Turning Basin
ODMDS	Ocean Dredged Material Disposal Site
OEC	Port Everglades Outer Entrance Channel
OSE	Other social effects of a project (safety, quality of life, etc)
Panamax	Vessels that can navigate the Panama Canal
PCA	Project Cooperation Agreement (between Corps and Sponsor)
PED	Pre-construction, engineering and design (design phase of a project)
P&G	Water Resources Principles and Guidelines
Pilots	Port Everglades Pilots Association
Port	Broward County Department of Port Everglades
Post-Panamax	Vessels too large to navigate the Panama Canal before the expansion
PPA	Project Partnership Agreement
RED	Regional economic development - changes in distribution of regional economic activity
R&H Act	Rivers and Harbors Act (Federal legislation)
RFP	Request For Proposal
ROD	Record of Decision - final decision on environmental document
RO/RO	Roll on/Roll off
RP	Recommended Plan
S&A	Supervision and administration of construction work
SAC	Port Everglades Southport Access Channel
SDM	Surface Docking Module
STAR	Simulation Training and Research Center - ship simulation facility
STB	Port Everglades South Turning Basin
TEU	Twenty Foot Equivalent Unit (container size)
TIN	Triangulated Irregular Network (computer 3-D surface)
TN	Port Everglades Turning Notch
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WAM	Waterways Analysis Model
WRDA	Water Resources Development Act (Federal legislation)