U.S. Army Corps of Engineers

Galveston District
Southwestern Division

Brazos Island Harbor, Texas

Channel Improvement Project

Final Integrated Feasibility Report– Environmental Assessment

July 2014

DEPARTMENT OF THE ARMY
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Brazos Island Harbor, Texas

Channel Improvement Project

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EXECUTIVE SUMMARY

STUDY DESCRIPTION

This Final Integrated Feasibility Report and Environmental Assessment (FIFR-EA) presents the results of a United States Army Corps of Engineers (USACE) study to determine whether channel improvements to the existing Brazos Island Harbor (BIH) project are feasible and in the Federal interest. The non-Federal sponsor is the Brownsville Navigation District (BND) acting as the financial representative for the Port of Brownsville (POB). The feasibility study was authorized by a resolution of the Committee on Public Works, U.S. House of Representatives dated May 5, 1966. Additionally, Section 6009 of the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005 (Public Law 109-13) – Offshore Oil and Gas Fabrication Ports provides that in determining the economic justification for navigation projects involving offshore oil and gas fabrication ports, the Secretary is directed to measure and include in the National Economic Development (NED) calculation the value of future energy exploration and production fabrication contracts and transportation cost savings that would result from larger navigation channels.

The BIH Project, also known as the Brownsville Ship Channel (BSC), is an existing deep-draft navigation project located on the lower Texas coast. The channel uses the natural Brazos-Santiago Pass to connect the Gulf with the inland portion of the BSC. The BSC is the southernmost navigation channel in the State of Texas and the western terminus of the Gulf Intracoastal Waterway system (GIWW). The GIWW is a shallow-draft navigation channel 125 feet wide and 12 feet deep that traverses the entire length of the Laguna Madre.

The project area, shown in Figure ES-1, includes the BSC channel and property directly adjacent to the channel, including the POB and upland placement areas (PAs), as well as offshore PAs and a nearshore Feeder Berm. Nearly all of the property adjacent to the land-locked portion of the channel is owned by the POB. The Port infrastructure includes railroad and highway systems allowing access to the Port facilities. The existing BSC navigation channel is 19.4 miles in length. The Entrance and Jetty Channels extend east to west for approximately 2.4 miles, from the open Gulf of Mexico, through the jetties to the Laguna Madre. The flared North and South Jetties flank Brazos Santiago Pass, which connects the Gulf with the Lower Laguna Madre. The Main Channel extends 17 miles westward from the Laguna Madre to the Turning Basin, which is located on the eastern outskirts of the city of Brownsville.

There are ten PAs available for the placement of dredged material from the BIH Project— two existing Ocean Dredged Material Disposal Sites (ODMDSs), which can be used for the Entrance Channel, seven upland PAs for containment of material from the Main Channel, and one nearshore Feeder Berm that can be used for beach-quality sediments from the Entrance and Jetty

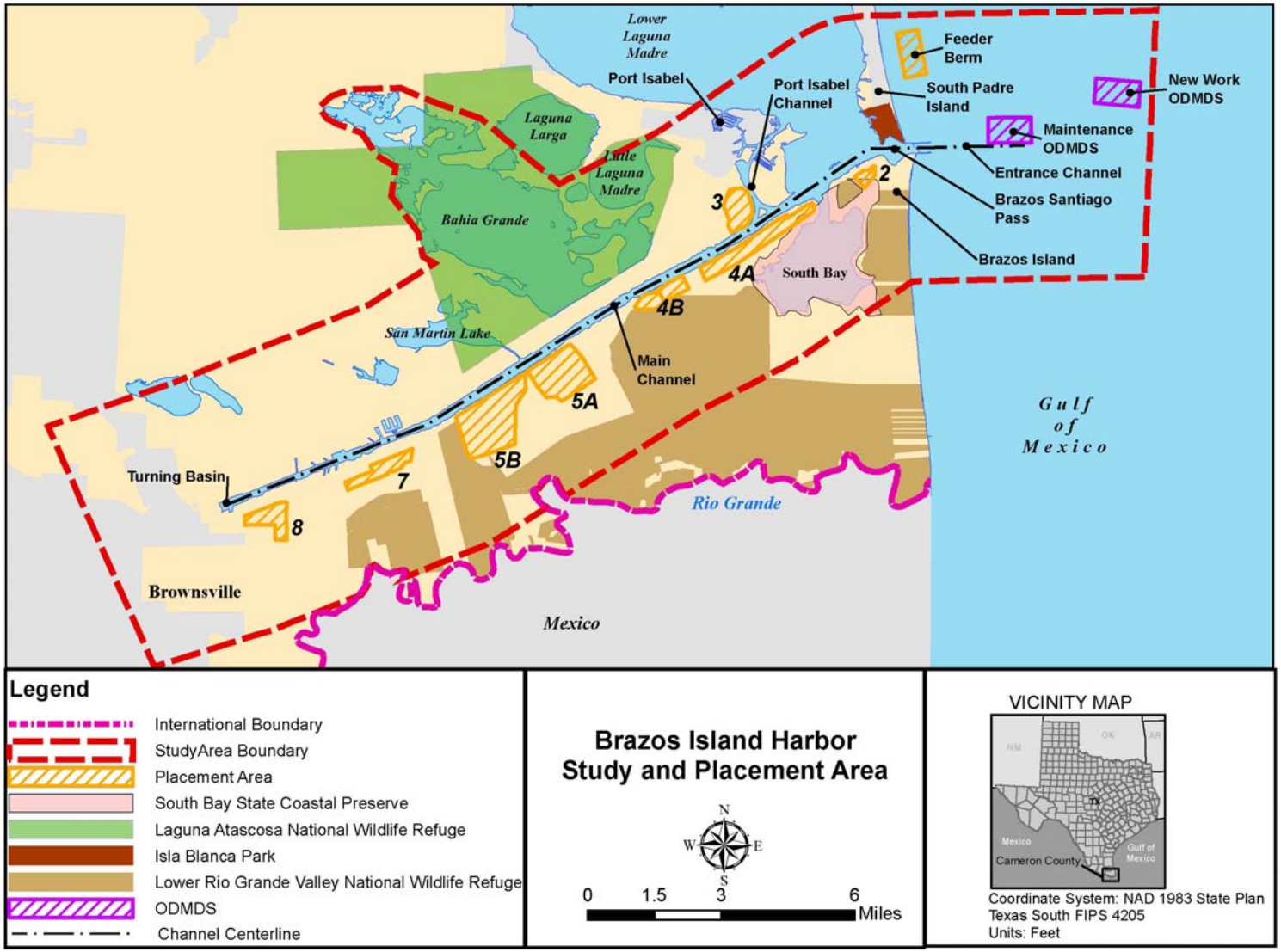

Figure ES-1. Brazos Island Harbor Study Area

Channels, and a portion of the Main Channel. The ODMDSs and Feeder Berm are all dispersive and by their nature have unlimited capacity.

PLANNING OBJECTIVE

The USACE studied navigation inefficiencies of the BIH caused by channel depth and width constraints. In addition to offshore oil rig repair and shipbreaking, Brownsville is a bulk commodity port accommodating both liquid and dry cargo handling. The POB is the only deep-draft port available to industry along the U.S.–Mexico border. Recent increases in traffic are a direct result of North American Free Trade Agreement in that a majority of the increased commodity traffic meets industrial needs in Mexico. Opportunities for the POB include increasing navigational efficiency of deep-draft vessels using the channel and increasing the ability of the channel to accommodate offshore rigs for maintenance and repair as well as the fabrication of new rigs. To develop solutions to these problems and opportunities, the following planning objective was used in formulation and evaluation of alternative plans:

- Increase navigational efficiency of cargo vessels and offshore rigs using the channel during the 50-year period of analysis.

ALTERNATIVES

Measures used to formulate alternatives included both nonstructural and structural measures, as well as a No Action Alternative. Nonstructural measures included utilization of another port, and alternative modes of commodity transport. Structural alternatives included deepening only, deepening and widening, widening only, and construction of a new turning basin to improve access to the Gulf of Mexico. Measures were evaluated to determine if they addressed the study objective with those that did not contribute to the objective being dropped from the alternative formulation.

Measures were evaluated and screened by the project delivery team through several arrays of alternatives. The No Action Alternative was included for all phases of the screening. Consistent with new SMART Planning concepts, this effort included a qualitative analysis of an Initial Array, a qualitative/quantitative analysis of an Evaluation Array, and a detailed quantitative analysis of a Final Array of alternatives. Each level consisted of more-detailed analysis when compared to the previous level.

The Final Array of alternatives consisted of a no action alternative and three action alternatives: no widening; 50-foot widening; and 100-foot widening. Four depth scales were evaluated for each action alternative: 45, 48, 50, and 52 feet mean lower low water (MLLW). Operations and maintenance (O&M) costs were developed to better estimate project costs of each proposed depth. It was determined that none of the alternatives would require additional PAs since new work construction and maintenance material could be placed in existing PAs (with necessary

containment dike raisings) or in the ODMDS. Structural alternatives evaluated during this screening appeared to address the navigation problems with the existing BIH while having minimal impact on the environment.

RECOMMENDED PLAN

The Recommended Plan was identified as Alternative F-1d, deepening of the channel to 52 feet without channel widening, which includes the least cost disposal option. The least cost dredging disposal alternative includes the beneficial use of maintenance material from the Entrance and Jetty Channels, and the first 11,000 feet of the Main Channel for placement into the nearshore Feeder Berm off South Padre Island. No environmental mitigation would be required for the Recommended Plan, as the plan would cause only negligible environmental impacts. The Recommended Plan meets the objective of this study while complying with all constraints.

It is not known if Alternative F1-d, deepening only to 52 feet, is the NED plan, which maximizes net excess benefits because the net excess benefits were still increasing with deeper channel dimensions and a deeper alternative was not included in the Final Array of alternatives. However, Alternative F1-d was the most cost effective of the Final Array of alternatives considered and the deepest channel dimension that the non-Federal sponsor would support at this time. If a plan with lesser benefits is preferred by the sponsor due to financial constraints, USACE guidance allows for a categorical exemption to be granted and this lesser plan to be selected as the Recommended Plan. Therefore, Alternative F1-d, deepening the channel to 52 feet MLLW with no widening, is considered the Recommended Plan.

RECOMMENDED PLAN COMPONENTS

Table ES-1 presents the depths of the Recommended Plan by stationing. No widening of the BIH Channel is proposed. The Entrance and Jetty Channels from Station –17+000 to 0+000 would be deepened to a depth of 54 feet MLLW. This additional 2 feet of depth is to allow for the effects of vessel pitch, roll, heave, and yaw occurring as a result of strong currents, waves, and wind. From Station 0+000 to 84+200, the channel would be deepened to a depth of 52 feet. From Station 84+200 to 86+000, the existing channel is 42 feet deep. There is no forecast change in the design drafts of vessels using this portion of the channel in the future so no deepening is proposed for this reach. The channel would be maintained at a depth of 36 feet MLLW from Station 86+000 to the end of the Turning Basin, as ships will have been light-loaded or unloaded before entering the basin.

Channel side slopes would remain the same as the existing project – 1 foot vertical over 6 feet horizontal (1V:6H) in the Entrance and Jetty Channels; 1V:3H from station 0+000 to 35+000 and 1V:2.5H from station 35+000 through 89+500 in the Main Channel. The actual dredging depth would be up to 4 feet deeper in the Entrance and Jetty Channels due to 2 feet of advance maintenance (AM) and 2 feet of allowable overdepth (AO), and up to 3 feet deeper in the Main

Table ES-1. Channel Depths of Recommended Plan

Stations		Recommended Plan Depth	Existing Channel Depth
From	To		
–17+000	–13+000	54	Beyond Existing Channel
–13+000	0+000	54	44
0+000	84+200	52	42
84+200	86+000	42	42
86+000	End of Turning Basin	36	36

Channel due to 2 feet of AM and 1 foot of AO. No improvements are proposed for the existing jetties. If the project is authorized, the 3-year construction period could begin in fiscal year (FY) 2018.

The proposed project would generate approximately 14.1 million cubic yards (MCY) of new work material from initial construction and approximately 61.7 MCY of maintenance material over the 50-year period of analysis. Maintenance dredging quantities would increase approximately 14.0 percent over the existing project. New work and maintenance material would be distributed among the existing New Work ODMDS, a nearshore Feeder Berm, and existing upland confined PAs 2, 4A, 4B, 5A, 5B, 7, and 8. The new work material would consist primarily of clay with minor amounts of sand, silty sand, and clayey sand, and maintenance material would consist of silt and clay sediments from the Main Channel and primarily sandy sediment from the Entrance/Jetty Channels and the first 11,000 feet of the Main Channel.

None of the existing ODMDSs and upland PAs would need to be expanded, and no new ODMDSs or upland PAs would be needed. Construction to raise upland PA containment dikes to heights needed to accommodate new work and maintenance quantities would be done within the footprints of the existing PAs. New work sediments would be stockpiled within the PAs and later used to raise PA dikes incrementally as needed to contain maintenance material for the 50-year period of analysis. Final elevations of the PA dikes would range from a total elevation of 17 feet North American Vertical Datum (NAVD) 88 around PA 5A to a total elevation of 38 feet around PA 7. Armoring of the exterior toe of the PA 4A (which will be used for maintenance material placement) and 4B dikes on the side facing the channel would be implemented to prevent erosion from station 22+000 to 33+800.

Maintenance material from the Entrance and Jetty Channels and the first 11,000 feet of the Main Channel would generally be placed in the nearshore Feeder Berm. Sediment removed by maintenance dredging would therefore be regularly placed back into the littoral system, available for cross-shore and longshore sediment transport to South Padre Island. If for some reason the Feeder Berm could not be used, maintenance material from the Entrance and Jetty Channels (station –17+000 to 0+000) could be placed in the Maintenance ODMDS.

ENVIRONMENTAL COMPLIANCE

USACE has prepared an environmental assessment (EA) of the Recommended Plan and alternatives that is integrated into this feasibility report. The environmental impact analyses have determined that the Recommended Plan would have only negligible environmental impacts, and therefore no mitigation is required. A Notice of Availability that describes the proposed action and the availability of the Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) was issued to interested parties, including Federal and State resource agencies on December 6, 2013. Comments on the draft EA and the District's responses have been included in Appendix D of this final report. The EA was prepared in accordance with requirements of the National Environmental Policy Act (NEPA) of 1969 and Council on Environmental Quality (CEQ) regulations.

The proposed project would result in only minor changes to the physical and hydrological characteristics of the study area. Benthic organisms would be impacted by dredging, but they would rapidly recolonize. No special aquatic sites or sensitive habitats, such as coastal dunes, wetlands, seagrass beds, black mangroves, lomas, tidal-algal flats, or oyster reef, would be impacted by the proposed project. Only minor and temporary increases in turbidity, noise, and air emissions are anticipated during construction. No impacts to historic properties are anticipated. No new impacts would be associated with placement of dredged material. Hydrodynamic modeling has determined that only negligible differences in water surface elevations, tidal velocity, and salinity would occur with construction of the proposed project and that there would be no effect on the tidal range in the Laguna Madre. Storm surge modeling has identified only minor potential impacts. The proposed project would not exacerbate the projected minor effects of relative sea-level rise in the study area.

The Recommended Plan is compliant with all applicable environmental laws and regulations. A Clean Water Act §404(b)(1) evaluation of the proposed action (Appendix G) describes the effects of the proposed discharges, and has determined that the Recommended Plan is the least environmentally damaging practicable alternative. The Texas Commission on Environmental Quality has issued water quality certification for the Recommended Plan. USACE has concluded that the Recommended Plan is fully consistent to the maximum extent practicable with the enforceable policies of the Texas Coastal Management Program (TCMP) and the Texas General Land Office has issued a consistency determination (Appendix H). Coordination with the U.S. Fish and Wildlife Service (USFWS) regarding potential endangered species impacts has been concluded, and conservation measures recommended by USFWS will be adopted to prevent potential impacts to threatened and endangered species that may occur in the study area. Consultation with the National Marine Fisheries Service (NMFS) has been concluded regarding potential adverse impacts from new work construction by hopper dredges to 4 species of threatened and endangered sea turtles (green, Kemp's ridley, loggerhead, and hawksbill). Reasonable and prudent measures (RPMs), developed in consultation with the NMFS, will be

adopted to minimize potential impacts to these species, which are not likely to jeopardize the continued existence or recovery of these sea turtle species. Based upon recent chemical analyses of water and sediment collected from within the channels, the potential for encountering hazardous material during dredging operations is considered minimal. Shoaled sediments that would be placed in the offshore Feeder Berm have been determined to be of sufficient quality for beneficial use and the US Environmental Protection Agency (EPA) has concluded that sediments are suitable for placement in the existing New Work and Maintenance ODMDSs. In compliance with requirements of the Clean Air Act and the State of Texas, the Recommended Plan has been evaluated for potential impacts to air quality, and a conformity determination would not be required because the area is in attainment with air quality standards. No impacts to historic properties have been identified.

BENEFITS AND COST OF THE RECOMMENDED PLAN

Benefits and costs were calculated with a base year of 2021 and a 50-year period of analysis using the October 2013 discount rate of 3.5 percent. Benefits were calculated using the USACE approved HarborSym Model for traditional NED benefits. In addition, separate benefit-cost ratios were calculated using the Section 6009 benefits, which are included in a separate addendum, as the detailed calculations include proprietary information and are for official use only.

Economic benefits from this navigation improvement project derive primarily from reductions in transportation costs for petroleum product tankers, dry bulk and iron and steel bulk carriers, as well as the cost reduction from not having to remove thrusters from the oil drilling rigs before entrance to the channel. Specific transportation savings would result from the use of larger vessels, more-efficient use of existing and future larger vessels, and reductions in wait time. The deepening of the BIH Channel would generate total average annual benefits of $20,539,000 with total average annual costs of $14,163,000 producing a benefit-to-cost ratio (BCR) of 1.5 at the 3.5 percent discount rate. The benefits were also calculated using Section 6009 of the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005 (Public Law 109-13) – Offshore Oil and Gas Fabrication Ports, which led to a BCR of 6.4.

The construction costs were developed by USACE – Galveston Cost Engineering using October 2013 price levels. The total project cost of all project components totals $251,952,000. The fully funded project cost of all components totals $279,817,000. Project costs and price escalation (calculated by estimating the midpoint of the proposed contracts) are combined to create the Fully Funded Cost. Costs include implementation costs and associated costs. Implementation costs include preconstruction planning and design (PED) costs, construction costs, construction contingency costs, and O&M costs. Construction costs include costs for dredging and placement area construction. No fish and wildlife or historic properties mitigation costs are anticipated. Aids to navigation (currently estimated at $108,000) will be provided by the U.S. Coast Guard

(USCG), and are a Federal cost included in the economic justification, but are not subject to project cost sharing. Construction General funding will be utilized for the Federal share of all project construction.

COST SHARING

The Recommended Plan first cost for all project components is separated into expected non-Federal and Federal cost shares and detailed in Table ES-2. These costs are accurately apportioned at different cost share rates based on the work being done at different depths. All of the channel segments proposed for deepening under the Recommended Plan are currently 42 feet deep, or 44 feet in the offshore channels. For a majority of the work where the existing channel is currently at –42-foot MLLW, the work would be cost shared 75 percent Federal/25 percent non-Federal to a depth of 45 feet MLLW and 50 percent Federal/50 percent non-Federal for the depth greater than 45 feet. The costs are separated into expected Federal and non-Federal shares and detailed in Table ES-3.

Table ES-2. Cost Apportionment
(rounded with October 2013 Price Level and 3.5% interest rate)

Cost Apportionment Navigation*	First Cost ($)	Fully Funded Cost ($)
Federal Navigation:		
BIH Channel	**116,000**	**128,811**
Lands & Damages	**8**	**9**
Total Federal GNF	**116,008**	**128,820**
non-Federal Navigation:		
BIH Channel	**88,571**	**98,487**
Land & Damages	**$3**	**3**
Total non-Federal GNF	**88,574**	**98,490**
Total GNF	**204,582**	**227,310**
Other Federal Costs		
Federal: ATON	**108**	**118**
Total Other Federal Costs	**108**	**118**
Other non-Federal Costs		
Lands	**5**	**5**
Associated Costs: Berths and Docks	**47,257**	**52,384**
Total Other non-Federal Costs	**47,262**	**52,389**
Total Project Costs	**251,952**	**279,817**

*** Costs include PED and Construction Management totals**

Table ES-3. Recommended Plan First Cost Allocation
(October 2013 price levels, $ in 1,000s)

General Navigation Features	Costs Allocated for Depth Increment from 42 to 45 feet			Costs Allocated to Depth Increment From 45 to 52 feet			Total Federal Share ($)	Total Non-Federal Share ($)	Total First Cost ($)
	Total ($)	Federal Share ($) (75% of 45-Ft Costs)	Non-Federal Share ($) (25% of 45-Ft Costs)	Total ($)	Federal Share ($) (50% of Cost - Depth Increment Greater than 45 Feet)	Non-Federal Share ($) (50% of Cost - Depth Increment Greater than 45 Feet)			
Construction Dredging and Placement Areas	50,946	38,210	12,737	118,874	59,437	59,437	97,647	72,174	169,820
Engineering and Design	-	-	-	21,719	10,860	10,860	10,860	10,860	21,719
Construction Management	3,910	2,932	977	9,122	4,561	4,561	7,493	5,538	13,032
Lands	11	8	3	-	-	-	8	3	11
Subtotal	54,867	41,150	13,717	149,715	74,858	74,858	116,008	88,574	204,582
Lands, Easements, ROW, and Relocations (LERRs)	100% Non-Federal			100% Non-Federal					
Lands	5	-	5	-	-	-	-	5	5
Subtotal	5	-	5	-	-	-	-	5	5
Total First Costs	54,872	41,150	13,722	149,715	74,858	74,858	116,008	88,579	204,587
Other Federal Costs	100% Federal			100% Federal					
Aids to Navigation - USCG Channel Markers	-	-	-	108	108	-	108	-	108
Subtotal	-	-	-	108	108	-	108	-	108
Associated Non-Federal Costs	100% Non-Federal			100% Non-Federal					
Berthing Areas & Dock Modifications		-	-	47,257	-	47,257	-	47,257	47,257
Subtotal	-	-	-	47,257	-	47,257	-	47,257	47,257
Total Project Costs	54,872	41,150	13,722	197,080	74,966	122,115	116,116	135,836	251,952

Note: Figures may not add to totals due to rounding

Non-Federal costs include non-Federal sponsor and berthing/dock owner costs. The non-Federal sponsor would be responsible for 100 percent of lands, easements, rights-of-way, and relocations (LERRs). All project construction is on lands that are currently owned by the non-Federal sponsor. No pipeline relocations, defined as "deep-draft utility relocations" pursuant to Planning Guidance Letter 44, are anticipated. Owners of berth and dock facilities that require modification in conjunction with the project would be responsible for 100 percent of those associated costs. Berth deepening and structural modifications that would be incurred are included in the project cost. The USCG is responsible for 100 percent of the cost of aids to navigation.

The maintenance of project features, such as dredging, dike raisings, and DAMP work costs, would be funded through annual appropriations of the O&M program. The actual amounts would vary on a year-to-year basis because of variability in the volume of material removed during each dredging cycle and the variability of the cycles. Costs for maintenance of the BIH would be in accordance with Section 101(b) of WRDA 1986, as modified by Section 2102(b) of the Water Resources Reform and Development Act (WRRDA) of 2014, which allocates the increment of costs for maintenance of channel depths to 50 feet as 100 percent Federal and the increment of costs for channel depths below 50 feet as 50 percent non-Federal and 50 percent Federal. Costs for dike raising for dredging of berthing areas and development of other local service facilities is 100 percent a non-Federal sponsor responsibility. Additional PA capacity for the Recommended Plan would be constructed regularly over the 50-year period of analysis in conjunction with maintenance dredging cycles. The increase in O&M costs has been calculated to be an additional $2,971,000 annually. The cost allocation for this O&M is an increase in approximately $2,674,000 in Federal cost and $297,000 in non-Federal cost annually.

PUBLIC COORDINATION

The USACE and BND developed a public involvement plan as part of the study process to ensure responsiveness to the needs and concerns of stakeholders and to ensure public involvement through an open, interactive process. A scoping meeting was held in Brownsville in January 2007 at which public input was solicited on problems and opportunities associated with channel modifications to the BSC, and potential environmental impacts. Comments and concerns expressed at this meeting were addressed in study analyses. The general public and resource agencies were given an opportunity to review the draft report, and responses to those comments are provided in Appendix D of the final report.

NON-FEDERAL SPONSOR SUPPORT

The BND fully supports the project and is willing to sponsor project construction in accordance with the items of local cooperation set forth in this report. The non-Federal sponsor has indicated financial capability to satisfy its obligations for the construction of the Recommended Plan.

AREAS OF CONTROVERSY AND UNRESOLVED ISSUES

As of the publication of this final report, there are no unresolved issues. Costs for modifications to Aids to Navigation have been estimated by USACE and included in the project cost estimate, and coordination has been initiated with the USCG to obtain an estimate from that agency. Modifications are expected to be minor, and any difference in cost is not expected to significantly affect the BCR. In order for the New Work or Maintenance ODMDS to be used, a new Site Management and Monitoring Plan (SMMP) needs to be executed in conjunction with the U.S. Environmental Protection Agency (EPA). Coordination with EPA is ongoing regarding a new format for these plans, and a new SMMP for the 52- by 250-foot deepening project will be developed in consultation with EPA during PED and prior to construction. Consultation with NMFS regarding potential impacts to threatened and endangered sea turtles has been concluded, and a final Biological Opinion (BiOp) is provided in Appendix I. RPMs recommended by NMFS have been adopted and costs for these measures are included in the cost estimate. Water quality certification and a Coastal Zone Management conformity determination have been received.

MAJOR FINDINGS AND CONCLUSIONS

The proposed actions of this report are in the national interest and include reduction in costs of navigation associated with vessel movement entering and leaving the POB, improvement of channel dimensions to accommodate current and future offshore rigs into the POB for fabrication, maintenance, and repair, and avoidance and minimization of environmental impacts to the greatest extent possible.

The proposed project meets the requirements for a categorical exemption due to the sponsor's financial constraint and is recommended as the Recommended Plan. Additional deepening beyond 52 feet was not evaluated in this study so the NED plan could not be identified. This constrained Recommended Plan consists of deepening of the channel to 52 feet as described above.

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APPENDICES

List of Acronyms

AAEQ	Average Annual Equivalent
AM	advance maintenance
AO	allowable overdepth
ATON	Aids to Navigation
BA	Biological Assessment
BCR	benefit-to-cost ratio
BiOp	Biological Opinion
BIH	Brazos Island Harbor
BMP	Best Management Practice
BND	Brownsville Navigation District
BSC	Brownsville Ship Channel
CAR	Coordination Act Report
CBRA	Coastal Barrier Resources Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO_2e	carbon dioxide equivalents
CWA	Clean Water Act
cy	cubic yards
cy/yr	cubic yards per year
DIFR-EA	Draft Integrated Feasibility Report and Environmental Assessment
DMMP	Dredged Material Management Plan
DWT	dead weight tons
EA	Environmental Assessment
EC	Engineer Circular
EFH	Essential fish habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
EOP	Environmental Operating Principles
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EQ	environmental quality
ER	Engineer Regulation
ERDC	Engineer Research and Design Center
ESA	Endangered Species Act

FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIFR-EA	Final Integrated Feasibility Report and Environmental Assessment
FM	Farm-to-Market Road
FWOP	Future Without-Project
FY	fiscal year
GHG	greenhouse gases
GIWW	Gulf Intracoastal Waterway
GLO	General Land Office
GNF	General Navigation Feature
GRBO	Gulf Regional Biological Opinion
HTRW	Hazardous, Toxic and Radioactive Waste
IDC	interest during construction
IHW	industrial and hazardous waste
JSS	Joint Storm Surge Study
LANWR	Laguna Atascosa National Wildlife Refuge
LERRs	lands, easements, rights-of-way, and relocations
LRGV	Lower Rio Grande Valley
LRGVNWR	Lower Rio Grande Valley National Wildlife Refuge
MBTA	Migratory Bird Treaty Act
MCACES	Micro Computer Aided Cost Engineering System
MCY	million cubic yards
MLLW	mean lower low water
MLT	mean low tide
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSWLF	Municipal Solid Waste Landfill Sites
NAVD	North American Vertical Datum
NED	National Economic Development
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOV	notices of violation
NO_x	nitrogen oxide
O&M	operations and maintenance
ODMDS	Ocean Dredged Material Disposal Site
ºF	degrees Fahrenheit

OSE	other social effects
P&G	Principles and Guidelines
PA	placement area
PDT	Project Delivery Team
PED	Preconstruction Engineering and Design
PGL	Planning Guidance Letter
Pilots	Brazos Santiago Pilots Association
POB	Port of Brownsville
ppt	parts per thousand
RPM	Reasonable and Prudent Measures
RCRAC	Resource Conservation and Recovery Act-Corrective Action Facilities
RCRAGR	Resource Conservation and Recovery Act-Generator Facilities
RED	Regional economic development
RHA	Rivers and Harbors Act
RRC	Texas Railroad Commission
RSLR	relative sea level rise
SAV	submerged aquatic vegetation
SH	State Highway
SHPO	State Historic Preservation Officer
SOC	Species of Concern
SOL	SOL Engineering Services, LLC
SpaceX	Space Exploration Technologies
TCEQ	Texas Commission on Environmental Quality
TCMP	Texas Coastal Management Program
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
USACE	United States Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VE	Value Engineering
WRDA	Water Resources Development Act

1 STUDY INFORMATION

1.1 INTRODUCTION

This is a Final Integrated Feasibility Report and Environmental Assessment (FIFR-EA) for channel improvements of the Brazos Island Harbor (BIH), Texas deep-draft navigation channel. The Feasibility Cost - Sharing Agreement for the feasibility study was signed on June 28, 2006, with the Brownsville Navigation District (BND) acting as the financial representative for the Port of Brownsville (POB). The study alternatives have been screened, resulting in identification of the Recommended Plan. The BND and U.S. Army Corps of Engineers (USACE) propose to modify the BIH navigation channel to improve present and future navigation efficiency associated with cargo vessels and oil drilling rig fabrication, maintenance, and repair.

1.2 STUDY AUTHORITY

1.2.1 General Authority

The Congress authorized USACE to conduct a study of BIH, Texas, to determine whether the project should be modified in any way, particularly with a view to widening and deepening the existing channels, pursuant to a resolution of the Committee on Public Works, U.S. House of Representatives dated May 5, 1966. The resolution states:

> *Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on Brazos Island Harbor, Texas, published as House Document Numbered 428, Eighty-Sixth Congress, Second Session, and prior reports, with a view to determining whether the project should be modified in any way at this time, particularly with a view to widening and deepening the existing channel.*

Additionally, in the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662) dated November 17, 1986, Section 105 established cost share requirements. Additional legislation was passed in the Fiscal Year (FY) 2003 Omnibus Appropriations Bill, stating that any work performed by the BND as part of the restoration of wetlands in Bahia Grande would be used as credit towards the mitigation requirements of the BIH deepening project.

1.2.2 Additional Study Guidelines

The Director of Civil Works issued Implementation Guidance for Section 6009 of the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005 (Public Law 109-13) – Offshore Oil and Gas Fabrication Ports in September 2012. Section 6009 provides that in determining the economic justification for

navigation projects involving offshore oil and gas fabrication ports, the Secretary is directed to measure and include in the National Economic Development (NED) calculation the value of future energy exploration and production fabrication contracts and transportation cost savings that would result from larger navigation channels.

1.3 STUDY PURPOSE AND SCOPE

The purpose of this report is to present the findings of the feasibility investigations and analyses conducted to determine if there is a Federal interest in making channel improvements to the existing BIH. The FIFR-EA describes the problems and opportunities of the existing BIH, and identifies the alternatives and analyses conducted to meet the planning objective of the study. Channel improvements are needed to reduce operating costs of deep-draft vessels using the channel to import and export both liquid and dry bulk commodities, and to reduce restrictions on the transit of large oil drilling rigs. Channel improvements would allow the transit of larger new rigs that are constructed at a facility on the channel, and reduce transit costs for rigs that enter the channel for maintenance and repair. The study evaluates a wide array of alternatives, including channel deepening and/or widening, among others, which would allow the existing deep-draft vessel fleet to load more fully and allow larger deep-draft vessels and oil drilling rigs to use the channel. The FIFR-EA also provides all of the information normally included in an Environmental Assessment and meets the requirements of the National Environmental Policy Act (NEPA). It thoroughly compares the environmental impacts of the Final Array of alternatives and fully describes the impacts of the Recommended Plan.

The study alternatives include a No Action plan and various combinations of structural and nonstructural measures. The economic and environmental impacts of each alternative, as well as other factors, were evaluated in order to identify the most economically feasible and environmentally acceptable plan. The report concludes with the identification of the plan that will be recommended for Congressional authorization. The Port Isabel side channel that connects to the BIH is not included in this feasibility study.

1.4 NON-FEDERAL SPONSOR

The USACE, Galveston District was responsible for the overall management of the study and the report preparation. As the non-Federal sponsor, the BND was actively involved throughout the study process.

1.5 STUDY AREA

The study area includes the BIH Project, also known as the Brownsville Ship Channel (BSC), an existing deep-draft navigation project located on the lower Texas coast. The channel uses the natural Brazos Santiago Pass to connect the Gulf of Mexico with the inland portion of the BSC. The POB is located at the western end of the BIH navigation channel and includes a man-made

basin located 3 miles north of the Rio Grande and the Mexican border and 5 miles east of the City of Brownsville. The BSC is the southernmost navigation channel in the State of Texas (Figure 1-1) and the western terminus of the Gulf Intracoastal Waterway (GIWW) system. The GIWW is a shallow-draft navigation channel 125 feet wide and 12 feet deep that traverses the entire length of the Laguna Madre.

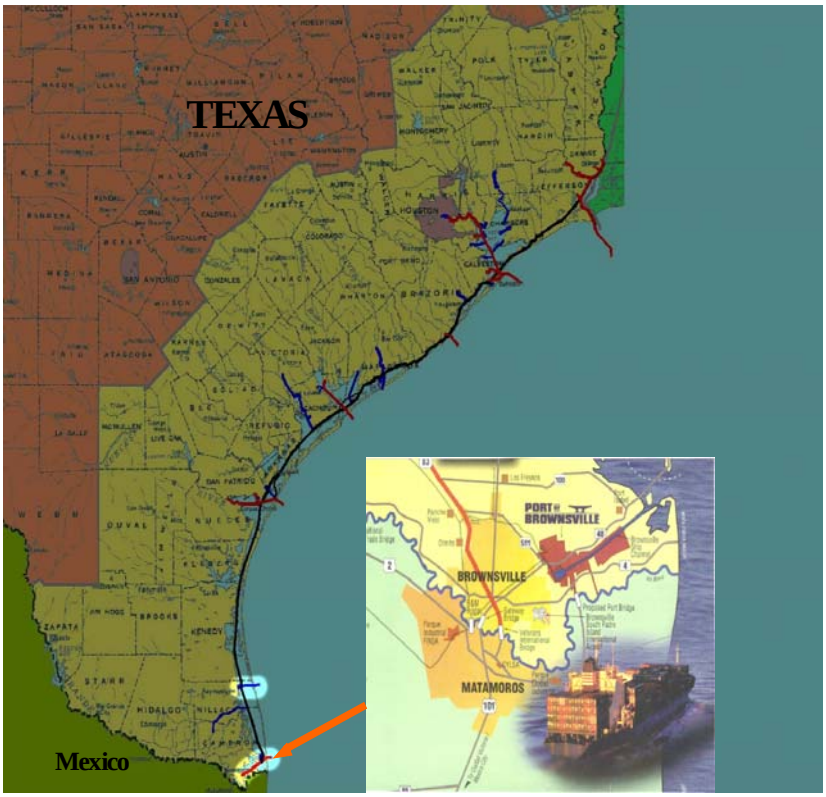

Figure 1-1. Project Location Map

The study area is located entirely within Cameron County, Texas, and encompasses the entire BIH and the surrounding region. The area is located in the Lower Rio Grande Valley (LRGV) and encompasses approximately 103,250 acres (160 square miles), extending 3 miles north, south, and west of the BIH, and continuing 5 miles offshore into the Gulf of Mexico (Figure 1-2). These 3-mile limits were established to ensure that environmental effects to areas adjacent to the Main Channel would be analyzed. In particular, they encompass the large and environmentally sensitive Bahia Grande Complex that lies north of, and is hydrologically connected to, the Main Channel, and all of the placement areas (PAs) that are located south of the Main Channel. The 5-mile offshore limit was established to encompass the existing Ocean Dredged Material Disposal Sites (ODMDSs). The study area also is extended for 10 miles along both sides of Brazos Santiago Pass for the purpose of evaluating potential shoreline impacts from deepening and extending the Entrance Channel.

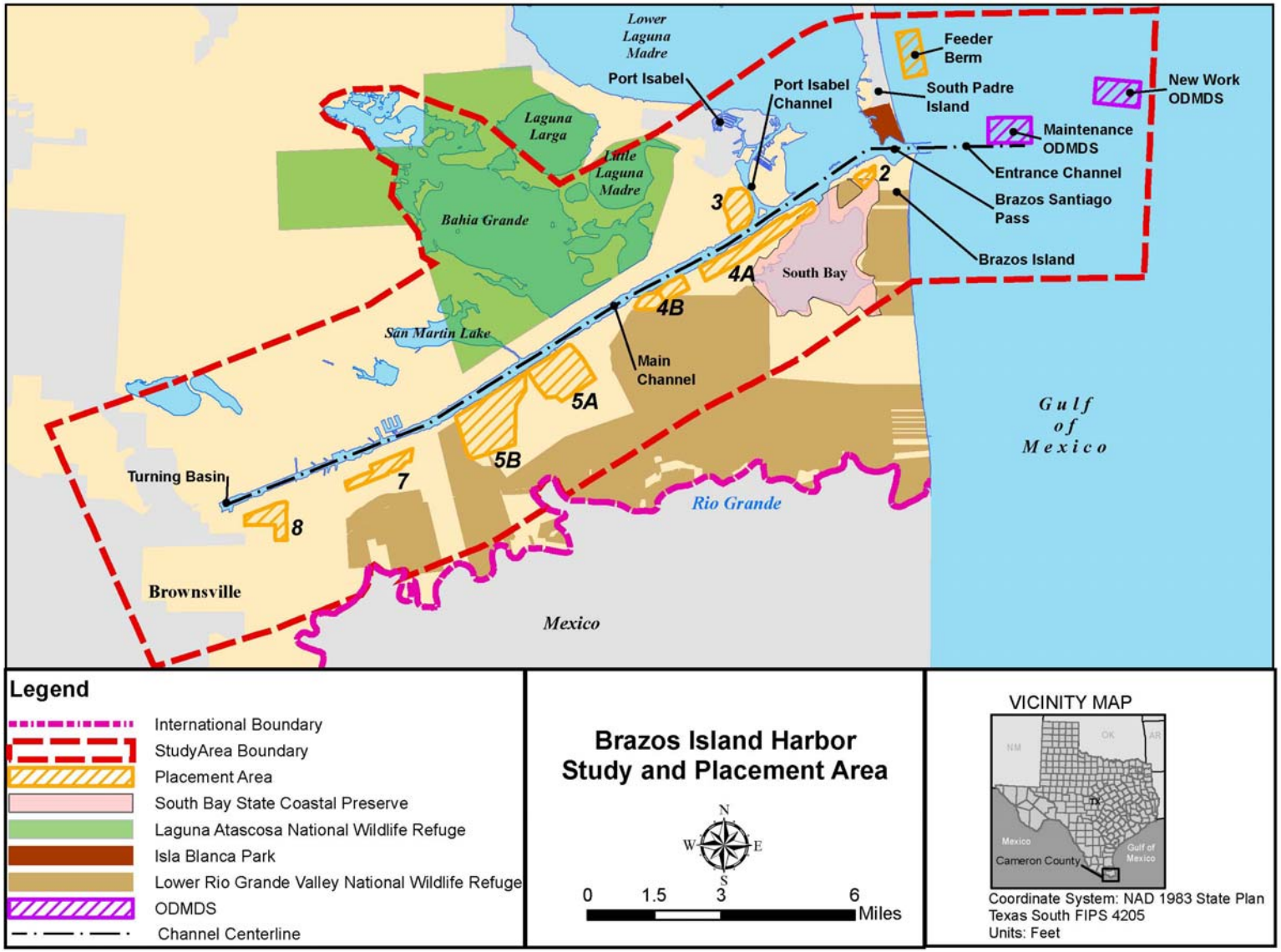

Figure 1-2. Study Area

The LRGV is one of the most biologically diverse areas in North America because biological communities from the desert, coastal, temperate, subtropical, and tropical zones converge. The diversity of ecosystems located within the study area provide habitat for an array of terrestrial and coastal flora and fauna, including a variety of threatened and endangered species, as well as providing an important stopping point for a substantial number of migratory birds. It marks the northernmost range of many tropical species found in Mexico and Central America.

Consistent with much of the Texas Gulf Coast, the study area includes barrier islands, shallow inland lagoons, and a relatively flat inland area. South Padre Island and Brazos Island, which border the Jetty Channel to the north and the south, respectively, are barrier islands. Unique to the area are extensive mud tidal flats and clay dune formations, or lomas, several of which lie adjacent to the ship channel. Emergent elevations within the study area range from sea level to a maximum of 12 feet above sea level, with an average land elevation of 1.2 feet above sea level (U.S. Geological Survey [USGS] Digital Elevation Model).

The major inland bay is the Laguna Madre. The Laguna Madre is a long, narrow, shallow, hypersaline lagoon extending from Corpus Christi Bay to the mouth of Rio Soto la Marina, Tamaulipas, Mexico. In Texas, the Laguna Madre lies between the Texas mainland and Padre Island, is approximately 120 miles long, and ranges from 4 to 6 miles wide. The lower portion of the Laguna Madre in Texas is within the study area. Brazos Santiago Pass is one of two main inlets in Texas connecting the Lower Laguna Madre to the Gulf of Mexico; the second is the Port Mansfield Channel, which is located well north of the study area. Extending into Mexico, the Laguna Madre de Tamaulipas is one of the most important bird wintering habitats on the Gulf Coast. In 2005, the Mexican government declared the Mexican portion of the Laguna Madre and the Rio Bravo's (Rio Grande) Delta a Natural Protected Area, providing legal protection to the rich natural resources of the Laguna Madre in Mexico.

In Texas, Bahia Grande is a 6,500-acre shallow bay located north of the BSC and immediately west of the Lower Laguna Madre. The construction of the BSC in the 1930s, placement of dredged material along the north side of the ship channel, and the construction of State Highway (SH) 48 isolated Bahia Grande from the Laguna Madre, effectively cutting off the natural hydrologic connection. This transformed the Bahia Grande from a wetland complex rich in biological resources to a 6,500-acre dry and barren salt/mudflat that was only periodically inundated during substantial precipitation events and occasional storm surges. The U.S. Fish and Wildlife Service (USFWS) purchased the Bahia Grande in 1998, incorporated the area into the Laguna Atascosa National Wildlife Refuge (LANWR), and initiated the largest estuary restoration project in the U.S in conjunction with several local, State, and Federal agencies. Restoration efforts are continuing in an effort to restore appropriate tidal flows and circulation into the entire Bahia Grande complex.

Army regulations and USACE Headquarters guidance on tidal datum, provided in Engineering Technical Letter 1110-2-349 Requirements and Procedures for Referencing Coastal Navigation Projects to Mean Lower Low Water Datum, dated April 1, 1993, and Engineering Manual (EM) 1110-2-1003, dated April 1, 2002, stress the necessity of converting local datum, such as mean low tide (MLT) to mean lower low water (MLLW). EM 1110-2-1003 further states that MLLW should be tied to the North American Vertical Datum (NAVD) 88. The predominant reason for conversion to MLLW is the need for consistency within the shipping and dredging industries with regard to channel depths.

Historically, USACE–Galveston used the MLT datum for its navigation channels. As noted in the regulations and guidance above, this datum was recently converted to MLLW for consistency with other USACE Districts. MLLW datum was used for all quantity calculations during plan formulation. For the BIH conversion, on average, the MLT/MLLW difference is +0.31 foot. Because this difference was so small and it would have little to no effect on dredging quantities, the study addresses MLT as equal to MLLW for conversion from historic dredging records and drawings. Therefore, –42 feet MLT is considered equal to –42 feet MLLW. The elevations of the PAs are referenced to NAVD 88.

1.6 PROJECT AREA

The project area includes the BSC and property directly adjacent to the channel, including the POB and upland PAs, as well as offshore PAs and a nearshore Feeder Berm. The POB owns all lands adjacent to the Main Channel. The port infrastructure consists of railroad and highway systems allowing access to the port facilities. The existing BIH navigation channel is 19.4 miles in length. The Entrance and Jetty Channels extend east to west for approximately 2.5 miles, from the open Gulf of Mexico, through the jetties to the Lower Laguna Madre. The flared North and South Jetties are 6,330 feet long and 5,092 feet long, respectively. They lie 1,200 feet apart, flanking Brazos Santiago Pass, which connects the Gulf of Mexico with the Lower Laguna Madre. The Main Channel begins at the Lower Laguna Madre and extends westward 14.8 miles to the Brownsville Turning Basin Extension Channel. The Turning Basin Extension transitions into the 1,200-foot diameter Turning Basin, which is the channel terminus at the POB.

There are 10 PAs available for the placement of dredged material from the BIH Project – two existing ODMDSs that can be used for the Entrance and Jetty Channels, seven upland PAs for containment of material from the Main Channel through the Turning Basin, and one nearshore Feeder Berm that can be used for beach-quality sediments from the Entrance Channel, Jetty Channel, and a portion of the Main Channel. The ODMDSs and Feeder Berm are all dispersive and by their nature have unlimited capacity.

Plans of the existing channel with stationing are included in Appendix B.

1.7 HISTORY OF THE INVESTIGATION

A reconnaissance study was undertaken to determine whether commercial navigation benefits would be produced by deepening and widening the BIH were sufficient to offset the costs and environmental consequences of any proposed improvements. The reconnaissance study concluded that channel deepening and widening appeared to be feasible and that it would be in the Federal interest to conduct more-detailed, feasibility-level studies, at a 50/50 cost shared basis with the non-Federal Sponsor, the BND. The feasibility study began in July 2006 after the signing of the Feasibility Cost Sharing Agreement. A Project Management Plan was developed to identify the investigations and analyses required to conduct the feasibility study and submit a feasibility report to Congress for authorization. A Feasibility Scoping Meeting was held in May 2008 to discuss the report submittal and Policy Compliance Review on the March 2008 submittal. Alternatives analysis and identification of the Recommended Plan have continued to present.

1.8 PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

1.8.1 Prior Studies and Reports

The following studies were reviewed as part of feasibility study investigations. These reports provide information on previous Federal and local evaluation of water resource problems in the study area.

- *Dredged Material Management Plan, Preliminary Project Assessment, Brazos Island Harbor, Texas, February 1997*. This document evaluated placement capacity for the project for 20 years. Even though the report determined that sufficient capacity exists for the next 20 years, a better assessment of the shoaling rates was recommended to accurately forecast the capacity of PAs beyond the 20-year timeframe.
- *Channel Improvements for Navigation, Project Design Memorandum, November 1990*. The memorandum summarizes the design and cost data, project evaluation, and other information as part of the Preconstruction Engineering and Design (PED) Phase of the 42-foot project. Several departures from the authorized plan were made with this report. Most significant were an enlargement of the Turning Basin to 1,200 feet in diameter and a reduction in the width of the Main Channel to 250 feet from the Entrance Channel to the Goose Island Passing Basin, and then deepening only to the Turning Basin Extension, a total channel distance of approximately 14.8 miles.
- *Reevaluation Report for the Authorized Brazos Island Harbor, Texas (42-foot Project), October 1988*. This report details completion of a reevaluation of the authorized 42-foot project. The recommended plan detailed in the report includes enlarging the inland 14.8 miles of channel to 42 feet in depth and 300 feet in width. The Entrance Channel was also to be enlarged to a depth of 44 feet and a width of 400 feet. The plan also added an additional 240 acres of confined disposal areas and

795 acres of offshore disposal area to accommodate construction and future maintenance requirements.

- *Feasibility Report on Brazos Island Harbor, Texas, Brownsville Channel Improvements for Navigation, December 1979*. This is the original authorization report for the 42-foot channel improvement project. The plan included enlarging 14.8 miles of the Brownsville Channel to 42 feet by 300 feet and enlarging 2.5 miles of the Entrance Channel to 44 feet by 400 feet.

1.8.2 Existing Water Projects

Since 1880 with the first Federal involvement in navigation improvements, the BIH has evolved from a shallow-draft navigation channel with a depth of only 10 feet to a deep-draft navigation channel with its current 42-foot depth (Figure 1-3). The Rivers and Harbors Acts (RHAs) of 1880 and 1881 provided for deepening of the natural channel through the Brazos Santiago Pass to 10 feet, widening the channel through the pass to 70 feet, and the construction of two parallel jetties at the pass. Construction of the South Jetty was started in 1882 and continued until 1884, when operations were suspended due to a lack of funds.

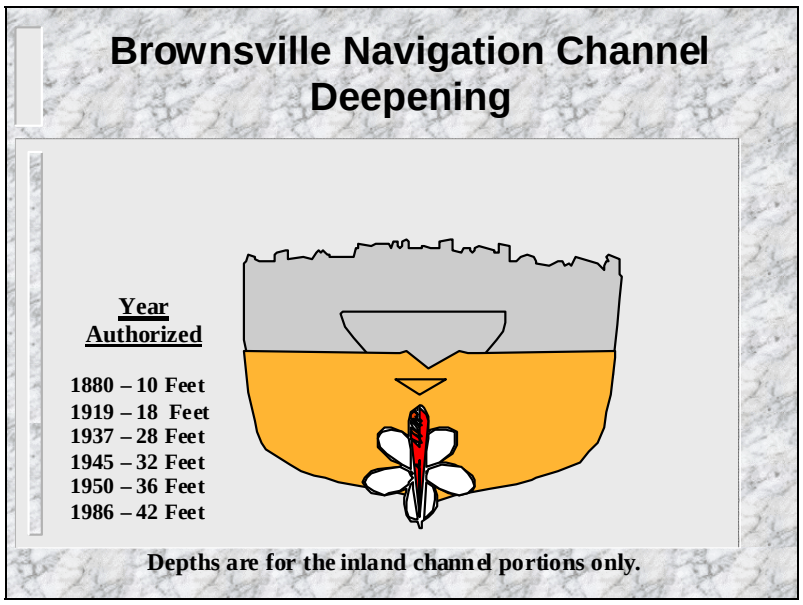

Figure 1-3. History of Channel Deepening

The RHA of 1919 provided authorization to deepen the channel to 18 feet with a 400-foot width through the pass. Under this authorization, two short stone jetties were constructed and some channel dredging was performed. As authorized in the RHA of 1930, jetties at the Brazos Santiago Pass were constructed in 1935 in conjunction with the construction of a navigation channel to Port Isabel. More channel improvements were completed in 1936 when the Main Channel to the Brownsville Turning Basin was dug through the Rio Grande deltaic plain to provide a navigation channel and turning basin for the City of Brownsville. After these channel improvements, the small fishing community of Port Isabel, located on the mainland overlooking

the Laguna Madre and Brazos Santiago Pass, began to grow and industrial facilities were constructed along the western end of the Main Channel, near the Turning Basin and the City of Brownsville.

Several improvements to the waterway were authorized by the RHA of 1960. Most of the project improvements were constructed:

- Widening 1.3 miles of the Brownsville Turning Basin Extension from 300 feet to 500 feet in 1964;
- Construction of a third basin to the Brownsville Fishing Harbor in 1968;
- Widening the upper 3-mile reach of the BIH from 200 to 300 feet in 1980; and
- Deepening a locally dredged extension of the Brownsville Turning Basin from its 32-foot depth to 36 feet in 1980.

The construction of a 1,000-foot extension to the North Jetty, which was authorized by the RHA of 1960, was deauthorized under Section 1001 of the WRDA of 1986; however, the current project dimensions were authorized under Section 201, Public Law 99-662. Some of the authorized improvements (e.g. recreational facilities, jetty walkways and comfort stations, and dust control measures) were not implemented. The authorized increase of the turning basin by 1,000 feet, also included in the RHA of 1960, was modified to a 1,200-foot width based on subsequent engineering analyses. Construction of the WRDA 1986 channel improvements was completed in 1996.

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2 EXISTING CONDITIONS

2.1 GENERAL

The BIH provides for –42-foot deep MLLW navigation on the inland portion of the channel and a 44-foot depth in the offshore Entrance and Jetty Channels (USACE, 1990). The BIH is essentially a straight waterway with no bridges or other obstructions for the entire 19.4-mile length of the waterway and is operated for single-lane, one-way traffic only. The existing waterway consists of the Entrance Channel, Jetty Channel, Main Channel, Turning Basin Extension, and Turning Basin. Table 2-1 presents the dimensions of the channel components.

Table 2-1. Dimensions of Existing Brownsville Ship Channel

Channel Reach	Constructed Depth (feet)	Constructed Bottom Width (feet)	Channel Length (miles)
Entrance Channel (Gulf of Mexico to offshore end of jetties)	44	300	1.3
Jetty Channel (Gulf of Mexico to Laguna Madre)	44	300[A]	1.1
Main Channel (Laguna Madre to Turning Basin Extension)	42	250[B]	15.1
Turning Basin Extension	Transitions from 42 to 36	Transitions from 400 to 325	1.3
Turning Basin	36	Transitions from 325 to 1,200	0.6

Notes:

A. Includes 0.2 mile by 400 feet transition to Main Channel. Remainder of Jetty Channel (0.9 mile) is 300 feet wide.

B. Includes 0.4 mile by 400 feet transition from Jetty Channel, 3.2 mile by 400 feet transition to Turning Basin and approximately 3 miles by 300 feet of Main Channel before the Turning Basin Extension. Remainder of Main Channel (11.5 miles) is 250 feet wide.

Approximately 1.1 million cubic yards (MCY) of shoaled material accumulates annually in the BIH channel, which equals 55.0 million MCY over the 50-year period of analysis (USACE, 2013a). There are nine PAs available for the placement of dredged material from the existing BIH Project—one site that can be used for the offshore section of the channel, seven upland confined sites for containment of material from the landlocked reach of the channel (PAs 2, 4A, 4B, 5A, 5B, 7, and 8), and a nearshore Feeder Berm. The two PAs for material from the offshore section of the channel are dispersive in nature and therefore have unlimited capacity. The Maintenance ODMDS is utilized for maintenance material deemed not suitable for beach or nearshore placement and is located approximately 2.5 nautical miles from shore. The nearshore Feeder Berm site is used for the close placement of beach quality sediment to augment the South Padre Island shoreline profile.

The majority of the inland portion of the channel is 250 feet wide and currently operates as a single-lane/one-way channel. The barge traffic does not interfere with deep-draft vessel movements. The rigs are generally so large that all other traffic has to be suspended while they transit the channel. Therefore, existing vessel management practices and scheduling are sufficient to maintain efficient channel operation.

2.2 PHYSICAL DESCRIPTION OF THE EXISTING PROJECT

Prior to the construction of the Federal navigation channel, the mainland adjacent to the Lower Laguna Madre was a mosaic of shallow estuarine bays and lakes, interspersed with tidal flats, islands, and clay lomas. Tidal access to the area was through the Brazos Santiago Pass, as it is today. The barrier islands, South Padre Island to the north of the Pass and Brazos Island to the south, were essentially undeveloped. The area was rich in biological resources and contained important waterfowl habitat.

2.2.1 Tides

The BIH channel is a natural tidal inlet (Brazos Santiago Pass) connecting the offshore Main and Jetty Channels to the Main Channel, a dead-end, nearly straight, man-made navigation channel. The BIH channel exchanges waters with Lower Laguna Madre, Bahia Grande, and South Bay. The Laguna Madre flows into the channel immediately west of the jetties, and this has minor impacts on the tide timing and elevations. Tides in the BIH study area range from a low ebb tide of 0.8 foot to a high flood tide of 1.4 feet. Mean range is 1.15 feet, and the diurnal range is 1.37 feet (National Oceanic and Atmospheric Administration [NOAA], 2013a).

2.2.2 Currents and Circulation

Offshore in the Gulf of Mexico, the dominant wave direction is from the southeast, producing currents flowing north and transporting sediment northward. The largest waves tend to propagate from the north-northeast and southeast, representative of strong frontal passages and tropical storms, respectively. Large waves from the north can cause significant southerly transport of sediments, though the short duration and infrequent occurrence results in less cumulative influence than the predominant northward current. Circulation in the Jetty Channel is driven by both tidal and meteorological forces. Tidal flow through the Jetty Channel flows northward into the Lower Laguna Madre, westward into the Main Channel, and a very small component southward into South Bay. The small tidal range and shallow depths of the Lower Laguna Madre and South Bay result in weak tidal circulation with these bays. Currents within the Main Channel are also very low, because it is a dead-end channel with very small freshwater inflows.

2.2.3 Relative Sea Level Rise

The range of relative sea level rise (RSLR) in the study area has been determined in compliance with the requirements of Engineer Circular (EC) 1165-2-212 (Sea-Level Change Considerations for Civil Works Programs). Low, intermediate and high projections of RSLR at the end of the 50-year period of analysis are estimated to be 0.63 foot, 1.06 feet, and 2.4 feet, respectively. Detailed discussion on RSLR is included in Section 6.3.2.

2.3 ENVIRONMENTAL AND HISTORIC RESOURCES

2.3.1 Protected/Managed Lands

All or parts of several Federal refuges and State parks and preserves are present in the study area. Federal protected lands include two national wildlife refuges managed by USFWS–LANWR and the Lower Rio Grande Valley National Wildlife Refuge (LRGVNWR) (Texas Parks and Wildlife Department [TPWD], 2003a, 2003b). State-protected lands include the Brazos Island State Scenic Park on Brazos Island and the South Bay Coastal Preserve (TPWD, 2012). Isla Blanca Park on the south end of South Padre Island, managed by Cameron County, is located in what is considered a prime surfing location.

2.3.2 Physical and Hydrological Characteristics of the Study Area

The study area is located in a unique environment—the southern end of the Texas portion of the Laguna Madre, one of perhaps six hypersaline lagoons in the world. Salinity in the Lower Laguna Madre generally ranges from 31 to 37 parts per thousand (ppt), with an average annual salinity of 33 ppt; however, salinity can vary wildly depending on rainfall and freshwater inflow, ranging from extremes of as low as 2 ppt after major tropical storms or hurricanes to as high as 120 ppt during extreme drought. Salinity in the western Gulf of Mexico ranges from 28 to 32 ppt. The waterbody is shallow, averaging approximately 4.6 feet deep, and, including the South Bay and the Bahia Grande complex, contains approximately 180,000 acres of aquatic habitat in Texas. Although no major rivers contribute fresh water to the system, some freshwater inflow is provided by the Arroyo Colorado, which flows into the Laguna Madre just north of the study area. The main outlet into the Gulf of Mexico for the southern reach of the Lower Laguna Madre is Brazos Santiago Pass (USACE, 2003).

Located in the West Gulf Coastal Plain physiographic province, the study area topography developed from sediments deposited in a mostly marine environment and later uplifted and tilted toward the Gulf (Texas Water Development Board [TWDB], 1990). Surface soils are composed of sand, silt, mud, and clay deposits of Holocene and recent ages deposited by alluvial, eolian, and marine processes (Brown et al., 1980; Page et al., 2005). In the area around Port Isabel and the barrier islands, landforms include beach ridges, tidal channels, tidal deltas, washover fans, sand and clay dunes, wind-tidal flats, and marine-plain flats. Extending inland from the marine

plain through the western edge of the study area are floodplain deposits of mud, silt, and sand. Topography in this area is almost flat to gently undulating with the greatest relief occurring near the Rio Grande. Overall, there is a gradual rise in elevation from sea level to approximately 12 feet in the vicinity of the Turning Basin. The greatest topographic relief throughout the study area is exhibited by clay dunes or lomas (reaching from near sea level to 30 feet in elevation) and PA containment dikes. Beneath the surface deposits lies the Beaumont Formation, a massive and complex alluvial deposit of clay, silt, sand, and gravel deposited during the Pleistocene. Offshore, the Beaumont Formation lies beneath a thin mantle of sand and extends as far as the continental shelf, with thicknesses ranging from 450 to 900 feet (TWDB, 1990).

The BIH study area has a humid, subtropical climate, dominated by the influence of the Gulf of Mexico (Larkin and Bomar, 1983). Average monthly temperatures in the study area range from 65 degrees Fahrenheit (ºF) in winter to 82ºF in late summer, and monthly precipitation ranges from 0.94 inch during March to 5.3 inches in September, with an average annual rainfall of 27.6 inches (National Climatic Data Center, 2012). Extreme weather events such as hurricanes, floods, and droughts are significant influences on South Texas Coastal habitats and wildlife.

Hypersaline conditions (salinity greater than 40 ppt), which occur frequently in the Lower Laguna Madre and the Bahia Grande, are caused by a combination of shallow water depths, limited freshwater inflow, a regional climate with high evaporation rates, and limited surface water exchange with the Gulf of Mexico (USACE, 1990). Tidal exchange for the Bahia Grande complex occurs solely through a 2,200-foot-long pilot channel that connects to the Main Channel (USFWS, 2003). The POB donated property for the construction of the pilot channel, and the channel was excavated in 2005. Interior channels were later opened to restore circulation among the Laguna Larga, Little Laguna Madre, and the Bahia Grande (USFWS et al., 2009). Fish and wildlife have begun to reenter and utilize the area, but restoration efforts continue in regard to restoring appropriate tidal flows, circulation and salinity regimes (Hicks et al., 2010). The tidal range is typically less than 1 foot with minimal velocities. A combination of high evaporation rates and poor circulation has resulted in salinity levels in Bahia Grande as high as 170 ppt during the summer since the opening of the pilot channel.

Precipitation accounts for a majority of freshwater input into the Main Channel as no major rivers discharge into it. The highest salinity levels usually occur in July or August or during extended periods of drought. The limited tidal exchange with the Gulf of Mexico restricts flushing of the Main Channel to occurrences of hurricane-induced storm surge and hurricane-related precipitation events. Circulation within the Main Channel is wind-dominated, resulting in weak currents that are driven by the prevailing wind direction (USACE, 2012a).

2.3.3 Biological Communities in the Study Area

Cameron County and the southern tip of Texas occur in a region where coastal, subtropical, desert, temperate, and tropical biomes converge (McMahan et al., 1984). The following describes biological communities and wildlife habitat occurring in the study area. PAs, located adjacent to the Main Channel, currently consist of large expanses of dried soils with some areas of ponded water after significant rainfall events. Vegetation within the PAs consists of scattered grasses, cactus, and shrubs. Grasses include Gulf cordgrass (*Spartina spartinae*), silver bluestem *(Bothriochloa saccharoides)*, curly mesquite *(Hilaria belangeri)* and the introduced species, guinea grass (*Urochloa maxima*). Salt cedar *(Tamarix ramosissima)*, giant sumpweed (*Cyclachaena xanthifolia*), mesquite (*Prosopis glandulosa),* and prickly pear cactus (*Opuntia engelmannii)* are typical tree and shrub species found in the PAs. The PAs are not considered high-quality wildlife habitat due to recurring disturbance and lack of established native vegetation. The sparse vegetation in the PAs consists mainly of opportunistic species that thrive on disturbed soils and do not contribute significantly as food or detritus sources or scrub habitat.

2.3.3.1 Thornscrub Forest and Brush

Thornscrub forest and brush habitat are typically characterized by thorny brush and forest, mesquite savannahs that occur on upland sites like fluvial riparian zones of resacas and the Rio Grande, and on lomas throughout the study area. Impenetrable brush with a relatively closed canopy can serve as travel corridors for the federally listed ocelot (*Leopardus pardalis*) and jaguarundi (*Herpailurus yaguarondi*). Many birds only found in the LRGV use thornscrub forest and brushland as habitat. Within the study area, thornscrub forest occurs along resacas within and near the City of Brownsville. Resacas are relict oxbow lakes of the Rio Grande scattered throughout this area that provide aquatic habitat and support riparian fringe brush (Jahrsdoerfer and Leslie, 1988). Thornscrub brush exhibits a patchy occurrence in the study area, found mainly on high depositional ridges and lomas throughout the Rio Grande Delta.

2.3.3.2 Mesquite Savannahs

Mesquite savannahs mostly occur south of the Main Channel and north of the Rio Grande (Jahrsdoerfer and Leslie, 1988). The open grassland or savannah habitats have scattered mesquite trees or yucca (*Yucca* spp.). The grassland is a good hunting area for northern aplomado falcon (*Falco femoralis*), and the yuccas serve as resting and nesting habitat.

2.3.3.3 Clay Lomas

Clay lomas are brush-covered clay dunes situated within tidal and wind-tidal flats. Since lomas are dunes situated within tidal zones, the abrupt topographic reliefs create unique habitats. Lomas can reach a height of 30 feet above surrounding flats. Texas fiddlewood (*Citharexylum berlandieri*), Texas ebony (*Ebenopsis ebano*), and other woody brush typically colonize lomas.

Base vegetation usually consists of sea ox-eye daisy (*Borrichia frutescens*) and glasswort (*Salicornia* spp.), which are common high-salt, marsh plants (Jahrsdoerfer and Leslie, 1988). Clay lomas occur within wind-tidal flats north and south of the Main Channel and are located primarily in the eastern portion of the study area. In one PA, existing containment dikes tie into one loma, essentially using it as part of the PA containment dike system.

2.3.3.4 Tidal and Algal Flats

Tidal flats provide important habitat for a variety of coastal wildlife from migratory waterfowl, shorebirds (like the federally listed piping plover [*Charadrius melodius*]), wading birds, and other estuarine-dependent species like shrimp and various finfish (White et al., 1986). Cameron County is avian rich as evidenced by the 413 species of birds recorded at nearby LANWR (USFWS, 2008) and the 403 species of birds at Santa Ana National Wildlife Refuge (USFWS, 2011). Texas contains more tidal flats than any other state (23 percent of the nation's total, approximately 14 percent of which are located around the Laguna Madre). Some portions of study area tidal flats are unique in that wind and storm events dictate inundation, as opposed to typical, astronomically driven tidal regimes. Since wind and storm events only rarely inundate flats, these areas are called wind-tidal flats. Often these areas are dry, or consist of hypersaline, warm shallow water (Tunnell and Judd, 2002).

Conditions on wind-tidal flats are not conducive to marsh vegetation, and consequently these flats are usually barren except for large areas colonized by blue-green algae mats called algal flats. Algal flats are large, flat areas occurring at sea level to less than 3.3 feet above sea level that are rarely inundated and only during extreme tidal events, storms, and floods. The unique processes that result in algal flat formations only exist in several locations worldwide, including the Persian Sea, Red Sea, and eastern Mediterranean Sea (Morton and Holmes, 2009). Within the study area, wind-tidal flats (including algal flats) mostly occur on the north end of Bahia Grande, within the San Martin Lake complex (located just west of the Bahia Grande Complex), and on the eastern portions of South Bay.

2.3.3.5 Coastal Dunes

Coastal dunes are mounds or ridges associated with barrier islands and beaches that are formed from sands that are transported and deposited by the wind and the Gulf longshore current. Coastal dunes occur in the study area on Brazos and South Padre Islands. In the study area, coastal dunes on barrier islands generally follow a pattern where primary dunes occur immediately landward of the beachfront and are usually the largest. Immediately behind the primary dunes, secondary, and back island dunes form. Although a variety of wildlife species use coastal dunes and barrier islands, coastal dune habitats are especially known to include species like the Gulf Coast kangaroo rat (*Dipodomys compactus*), keeled earless lizard (*Holbrookia propinqua*), and the spotted ground squirrel (*Spermophilus spilosoma*). Migrating peregrine

falcons also use study area coastal dunes and barrier islands as stopover habitat (Tunnell and Judd, 2002).

2.3.3.6 Bays and Deepwater Habitats

Bays and deepwater habitats are extensive in the study area and include the Main Channel, South Bay, the GIWW, the Laguna Madre, and the open Gulf of Mexico (USFWS, 2012). These bays and deepwater areas are important habitats for a variety of marine species, such as benthos, commercially and recreationally important finfish, federally endangered sea turtles, and marine mammals. The Lower Laguna Madre is one of the most productive estuaries in Texas, supporting a diversity of fish species, plankton, and benthic organisms and has great importance as a finfish and shellfish nursery area (Armstrong et al., 1987; Tunnell and Judd, 2002).

The Laguna Madre is the largest estuarine system on the Texas coast and is characterized as a hypersaline lagoon having little freshwater inflow, clear waters, and dominated by submerged aquatic vegetation (SAV) (Tunnell and Judd, 2002). In the Lower Laguna Madre, SAV covers approximately 118,000 acres of water bottom, or slightly more than 65 percent of the total water bottom. Seagrasses grow in patchy strips along the banks of navigation channels where water depths and clarity allow light penetration, including along portions of the GIWW channel. Although shoal (*Halodule wrightii*), turtle (*Thalassia testidunium*), and manatee (*Syringodium filiforme*) grasses are the primary SAV in the study area, widgeon grass (*Ruppia maritima*) may occur where salinity levels are lowest; South Bay contains small patches of star grass (*Halophila engelmannii*) (White et al., 1986).

2.3.3.7 Wetlands

Estuarine wetlands in the study area mostly consist of emergent or herbaceous vegetation, although some estuarine scrub-shrub vegetation can occur, mostly consisting of black mangrove (*Avicennia germinans*) or salt cedar. Black mangrove is a tropical shrub found in coastal wetlands in subtropical or tropical areas. Single black mangroves occur scattered throughout tidal areas of the study area; however, solid black mangrove stands occur along tidal margins (primarily channels) in the Lower Laguna Madre, South Bay, and the Bahia Grande. Stands of mangroves provide important habitat for various estuarine species and wading birds. The hypersaline conditions created by the Lower Laguna Madre, combined with the flat and low topography of the Rio Grande Delta, have resulted in estuarine wetlands that exhibit high salinity levels and foster salt-tolerant vegetation. Unlike bays in the more northern Gulf coastal areas, where smooth cordgrass (*Spartina alterniflora*) salt marshes are common along natural shorelines, smooth cordgrass marshes are very limited in the study area due to hypersalinity (TPWD, 1997; USFWS, 2012).

Freshwater wetlands occurring in the study area include palustrine emergent and scrub-shrub wetlands. These wetlands form in low areas beyond the tidal reach, interdunal depressions, and

coastal prairie depressions. Most freshwater wetlands within the study area exhibit herbaceous or emergent vegetation, although areas of scrub-shrub vegetation also occur (TPWD, 2012).

2.3.3.8 Oyster Reef

The only living oyster reefs in the study area are found in South Bay (Tunnell and Judd, 2002). The Eastern oysters (*Crassostrea virginica*) occurring there are a genetically distinct population from other oysters inhabiting the Texas coast and have adapted to the hypersaline conditions (White et al., 1986). Oysters have not been commercially harvested from the Lower Laguna Madre since 1993. However, most areas within the study area are open to shellfish harvesting except the GIWW, the Main Channel, and a small portion on the backside of South Padre Island, Vadia Ancha, the Bahia Grande, and San Martin Lake. All of South Bay is open to harvest (Texas Department of State Health Services, 2011).

2.3.4 Essential Fish Habitat

Essential fish habitat (EFH) consists of those habitats necessary for spawning, breeding, feeding, or growth to maturity of species managed by Regional Fishery Management Councils, as described in a series of Fishery Management Plans, pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. The Gulf of Mexico Fishery Management Council has identified habitats in the Lower Laguna Madre as EFH for brown, pink, and white shrimp (*Farfantepenaeus aztecus*, *Farfantepenaeus duroarum*, and *Litopenaeus setiferus*), Gulf stone crab (*Menippe adina*), several kinds of shark (Atlantic sharpnose [*Rhizoprionodon terraenovae*], blacktip [*Carcharhinus llimbatus*], bonnethead [*Sphyrna tiburo*], bull [*Carcharhinus leucas*], finetooth [*Carcharhinus isodon*], lemon [*Negaprion brevirostris*], scalloped hammerhead [*Sphyrna lewini*], spinner [*Carcharhinus brevipinna*], and silky [*Carcharhinus falciformis*]), gag (*Mycteroperca microlepis*), scamp (*Mycteroperca phenax*), cobia (*Rachycentron canadum*), dolphin (*Coryphaena hippurus*), greater and lesser amberjack (*Seriola dumerili* and *Seriola fasciata*), red snapper (*Lutjanus campechanus*), gray snapper (*Lutjanus griseus*), lane snapper (*Lutjanus synagris*), vermilion snapper (*Rhomboplites aurorubens*), red drum (*Sciaenops ocellatus)*, little tunny (*Euthynnus alletteratus)*, king mackerel (*Scomberomorus cavalla*), and Spanish mackerel (*Scomberomorus maculatus*). No Habitat Areas of Particular Concern were identified in the study area (NOAA, 2013b).

In addition to EFH, wetlands and seagrasses in the study area provide nursery and foraging habitat that support various forage species and recreationally important fishery species such as spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys* sp.), Atlantic croaker (*Micropogonias undulatus*), black drum (*Pogonias cromis*), striped mullet (*Mugil cephalus*), and blue crab (*Callinectes sapidus*). These estuarine-dependent organisms also serve as prey for other fisheries managed by the Fisheries Management Council (e.g., red drum, mackerels, snappers, and groupers) and highly migratory species, such as billfishes and sharks, managed by

the National Marine Fisheries Service (NMFS). EFH for those species that may occur in the study area and may be affected by the proposed action include the sand substrate and seagrass beds at the project site.

2.3.5 Threatened and Endangered Species

Federally listed species potentially occurring within the vicinity of the study area include the jaguarundi and ocelot, the West Indian manatee (*Trichechus manatus*), 5 whale species (blue [*Balaenoptera musculus*], finback [*Balaenoptera physalus*], humpback [*Megaptera novaengliae*], sei [*Balaenoptera borealis*], and sperm [*Physeter macrocephalus*]), 2 bird species (piping plover and northern aplomado falcon), 5 sea turtle species (green [*Chelonia mydas*], hawksbill [*Eretmochelys imbricata*], Kemp's ridley [*Lepidochelys kempii*], leatherback [*Dremochelys coriacea*], and loggerhead [*Caretta Caretta*]), and 2 plants (South Texas ambrosia [*Ambrosia cheiranthifolia*] and Texas ayenia [*Ayenia limitaris*]) (NOAA, 2012; USFWS, 2013a). The piping plover regularly occurs, and the aplomado falcon is known to occur in the study area. In addition, designated critical habitat for the piping plover is present along the eastern margin of the project area. Tidal flats are potential winter foraging habitat for the piping plover. The jaguarundi and ocelot are believed to occur and are rarely observed in the study area. Loggerhead and green sea turtles are known to feed on seagrasses in the Lower Laguna Madre, with the green sea turtle being the more abundant of the 2 species, and Kemp's ridley sea turtle nests on South Padre Island are increasing. For the remaining species, the likelihood of occurrence in the project area is low to very low, primarily due to the lack of suitable habitat in the project area or the project area being outside of the known present or historical range and distribution of these species. Candidate species for Federal listing are 3 bird species (red knot [*Caladris canutus*], red-crowned parrot [*Amazona viridigenalis*], and Sprague's pipit [*Anthus spragueii*]), the scalloped hammerhead shark, and 7 coral species (boulder star [*Montastrea annularis*] and star [*Montastrea franksi*], elliptical star [*Dichocoenia stokesii*], mountainous star [*Montastrea faveolata*], Lamarck's sheet [*Agaricia lamarcki*], pillar [*Dendrogyra cylindrus*], and rough cactus [*Mycetophyllia ferox*]). Species of Concern (SOC) consist of 5 fish species (dusky shark [*Carcharhinus obscurus*], opossum pipefish [*Microphis brachyurus lineatus*], sand tiger shark [*Odontaspis taurus*], speckled hind [*Epinephelus drummondhayi*], and warsaw grouper [*Epinephelus nigritus*]). None of the Candidate species or SOC is likely to occur in the project area.

2.3.6 Water and Air Quality

Testing indicates that State water and sediment quality standards are consistently met in the South Bay, Lower Laguna Madre and Jetty Channel portions of the study area (Texas Commission on Environmental Quality [TCEQ], 2011). In the Main Channel upstream of its confluence with the Lower Laguna Madre, low tidal exchange and low velocities at times result in low dissolved oxygen in some areas. The water quality standard for bacteria and recreational

use is not supported due to periodically elevated levels of *Enterococcus* bacteria in inland areas of the Main Channel.

The USACE has collected and archived a significant amount of water and sediment chemistry data from the BIH channel that was performed in conjunction with maintenance dredging, and new chemical, physical, and bioaccumulation assessments were conducted in 2012 (SOL Engineering Services, LLC [SOL] and Atkins, 2012, 2013). Detailed information on the chemical, physical and bioaccumulation assessments that have been conducted is available upon request. Analysis of the historical and recent testing data indicates that there is nothing in the chemical or physical analyses that would indicate a concern with the placement of these sediments in upland or offshore PAs. Toxicity bioassay results have indicated no toxic effect from BIH sediments or their elutriates.

Cameron County is currently designated as in attainment or unclassifiable with National Ambient Air Quality Standards (TCEQ, 2013a). Air quality in the study area is generally very good because there are few fixed or point emission sources that emit regulated pollutants (TCEQ, 2013b). Blowing dust can be a problem because of the prevalence of fine surface sediments in the area.

2.3.7 Noise

Land use adjacent to the BIH Main Channel is dominated by industrial development and existing PAs. As it enters from the Gulf, the BIH passes through the jetties and enters basically an industrial canal that ends at the POB Turning Basin. No noise-sensitive receptors such as residential, religious, educational, recreational, and medical facilities are located near the channel. However, several parks and recreational areas exist within the study area, including portions of the LRGVNWR, the LANWR, the South Bay Coastal Preserve, and Isla Blanca County Park.

2.3.8 Hazardous, Toxic and Radioactive Waste Concerns

The assessment of existing Hazardous, Toxic and Radioactive Waste Concerns (HTRW) conditions was conducted in general accordance with procedures described in the USACE Engineer Regulation (ER) 1165-2-132 - Water Resource Policies and Authorities Hazardous, Toxic and Radioactive Waste Guidance for Civil Works Projects (USACE, 1992). The assessment aims to identify the existence of, and potential for, HTRW contaminations on lands in the project area, or external contamination, which could impact or be impacted by the project. Historical aerial photographs were reviewed to examine the historical usage of the project area and surrounding areas. A review of reasonably accessible regulatory database findings was conducted to evaluate areas of potential environmental concern to the project area. A site reconnaissance was conducted in this assessment to verify the status and location of sites

referenced in the regulatory database search or to locate any additional unreported hazardous materials site, as identifiable from public right-of-way.

The potential environmental impacts from the dredging and/or placement of material to be dredged from the Entrance and Jetty Channels were examined. Chemical analyses of water, sediment, and elutriate samples; suspended particulate phase and solid phase bioassays; and bioaccumulation studies were conducted in August and September 2012 (SOL and Atkins, 2013). Draft results of the chemical analysis and bioassays indicated no concerns with the ocean placement of these sediments. Chemical analysis of water, sediment, and elutriate samples from the BIH Main Channel were conducted in August 2012 (SOL and Atkins, 2013). Sampling was conducted to determine whether adverse impacts would result from dredging and dredged material placement operations. The report concluded that there was nothing in the chemical analyses that would indicate a concern with placement of these sediments. Detailed information on the chemical, physical and bioaccumulation assessments that have been conducted is available upon request.

These following HTRW sites (Table 2-2) were evaluated to determine the potential for active or historical HTRW activities to impact the project area or be impacted by the project. None are located in areas to be directly affected by project construction or placement activities.

Table 2-2. Hazardous, Toxic and Radioactive Waste Sites of Interest

Site	Description
Duro Bag Manufacturing 3401 David Shor Drive Brownsville, TX 78521 (adjacent to Main Channel)	Last reported as a large-quantity generator of hazardous waste in 2009, as identified in the Resource Conservation & Recovery Act- Generator Facilities (RCRAGR06) database. This facility received four notices of violation (NOVs) between 2006 and 2009, and one informal verbal enforcement resulted in 2009. The NOVs received by this facility indicate noncompliance with Federal regulations regarding hazardous waste operations. Specific information about the NOVs was not obtained in this records review.
Brownsville Navigation District 1000 Foust Road Brownsville, TX (0.18 mile north of Main Channel)	Reported as an inactive site within the TCEQ industrial and hazardous waste (IHW) Corrective Action Program. An Affected Property Assessment Report identified contaminants on-site in 2002 as: benz-a-anthracene; benzenes, toluenes, ethylbenzenes, and xylenes; fluoranthene; fluorene; phenanthrene; pyrene; and trimethylenzene,1,2,4. No remedial actions were reported.
Allied Trading 2601 North Indiana Avenue Brownsville, TX 78526 (0.19 mile south of Main Channel)	Active Municipal Solid Waste Landfill Sites (MSWLF). Solid waste is treated and/or stored at this location.

Site	Description
Groendyke Transport Inc. SH 48 Brownsville, TX 78522 (0.27 mile northwest of Main Channel)	A specific address was not provided for this leaking petroleum storage tank site, however, GeoSearch mapped the location according to a description of the tank's former location on SH 48 and Farm-to-Market Road (FM) 511. Groundwater was impacted by the release of an unknown substance from a 3,000-gallon underground storage tank that was installed in 1956 and removed from the ground in 1989. The final concurrence of closure of this event is pending the documentation of well plugging. The leaking underground storage tank case is not closed.
Remediation Systems of Texas-Brownsville 400 Captain Don Foust Road Brownsville, TX (0.34 mile northwest of Main Channel)	This MSWLF site was reported to be closed with an estimated closure date in 1920. GeoSearch reported the facility type as a liquid transfer station.
City of Brownsville Composting Facility (approximately 3 miles northeast of Brownsville, northeast of Interstate Highway 4 and FM 511) Brownsville, TX (0.41 mile southeast of Main Channel)	Active MSWLF. Solid waste (compost) is treated and/or stored at this location.
Petro Processors Inc. on SH 48 (approximately 2.2 miles east of FM 511) Brownsville, TX 78720 (0.65 mile northwest of Main Channel)	Reported as a conditionally exempt small-quantity generator in 1990, identified through the RCRAC – Corrective Action Facilities database, and reported as a nongenerator in 2002. This petroleum refinery received six NOVs between 1986 and 2002 resulting in four enforcement actions in 1987, 1988, 1993, and 2002. Hazardous wastes at this facility were reported as ignitable waste, dissolved air flotation float, slop oil emulsion solids, heat exchanger bundle cleaning sludge, and separator sludge. An active IHW Corrective Action is identified on the TCEQ Central Registry (ID 33648). This clean up was started in 2006 and is ongoing. Various solid waste management units remain active at the time of this reporting.

2.3.9 Cultural Resources

Cultural resource surveys have been performed for much of the surrounding study area and for all of the project area, inclusive of all potential terrestrial and marine construction impact areas (Espey, Houston & Associates, Inc., 1981; Bond et al., 1990; Enright et al., 2012; Hall and Grombacher, 1974; Hoyt and Gearhart, 1992; Hoyt et al., 1991; Prewitt, 1974; Sanders, 2003; Weinstein et al., 2005). Forty-four terrestrial prehistoric and historic sites have been documented in the greater study area by numerous previous surveys. The majority of the terrestrial sites are prehistoric campsites and shell middens that date to either the Archaic or the Late Prehistoric periods. The majority of the historic sites are associated with archeological remains of the Brazos Santiago Depot, a military facility on Brazos Island during the Mexican War and later Civil War, which is the only site listed in the National Register of Historic Places in the study area. Brazos

Santiago Pass and the Laguna Madre are both considered archeologically sensitive, as historical research has identified 139 potential shipwrecks in these areas. Five marine remote-sensing surveys have covered the BIH channel from the Port Isabel Channel through the end of proposed channel improvements in the Gulf of Mexico, and these surveys found no historic properties within the project area. The BIH channel from Port Isabel to the Brownsville Turning Basin was cut through land in the 1930s; no surveys are needed for the remainder of the Main Channel since it was not constructed until the 1930s and therefore has very low potential for the presence of historically significant shipwrecks. Despite the high number of cultural resources in the study area, the cultural resource sensitivity of the project area is low as no sites or shipwrecks have been reported in the proposed project footprint.

2.3.10 Energy and Mineral Resources

Oil and natural gas make up the bulk of the region's mineral wealth (Brown et al., 1980). Within Cameron County, eight private mineral mines function to produce clays, fluorine, manganese, barium, chromium, strontium, and titanium. The Brownsville Mill (fluorine, barium, clays) and the Brazos Island mine (titanium) are located within 0.5 mile of the project area (US-Mining, 2013). These resource areas are not adjacent to the project area. Cameron County boasts approximately six oil and gas fields located within the study area. Two of these fields are located under the Laguna Madre in the Port Isabel area, while the rest are inland on either side of the channel. The biggest field is located near the Turning Basin on both sides of the channel. A review of the Texas Railroad Commission (RRC) database indicates that only one pipeline crosses the channel and none appears to cross any of the PAs (RRC, 2011). The Nustar Logistics refined petroleum products 10-inch pipeline crosses the channel in the vicinity of Station 80+000 at an approximate depth of 75 feet (USACE, 2005). Another pipeline (Port Isabel Gathering Line) is a 4.5-inch natural gas pipeline, which runs parallel to the north side of the Main Channel near the Bahia Grande and the Channel to Port Isabel.

2.3.11 Socioeconomic Considerations

Cameron County has experienced robust population growth over the last two decades, increasing by 29 percent between 1990 and 2000, and 21 percent between 2000 and 2010 (U.S. Census Bureau, 2010). The population of Cameron County has almost doubled since the 1980 census. Population growth in the vicinity of the study area has contributed substantially to the county's increase—Brownsville's population has doubled in size between 1980 and 2005, South Padre Island's permanent resident population has more than tripled, and Port Isabel's population has increased by more than 40 percent. In addition to the permanent residents, South Padre Island's population increases exponentially (averaging over 100,000) during peak tourist season, a trend that also continues to increase. The population of these 3 communities in the study area accounts for approximately 45 percent of the population of Cameron County.

The population of the Brownsville-Harlingen Metropolitan Statistical Area, located entirely within Cameron County, is currently equal to approximately 1 percent of the Texas state population. The population is forecast to increase by nearly 62 percent by 2050, or an average annual increase of 1.3 percent (Texas State Data Center, 2013). The change in population is expected to be twice that of the State of Texas (0.6 percent). Cities/towns that are expected to have the greatest growth during the period of analysis are South Padre Island (79 percent increase), Brownsville (64.4 percent increase), and Port Isabel (25.5 percent increase) (TWDB, 2011).

In 2010, the median household incomes in Cameron County ($31,264), Brownsville ($30,134), and Port Isabel ($22,969) are approximately 40 to 50 percent lower than the median household income for Texas ($49,646). In contrast, South Padre Island has a substantially higher per capita median household income ($53,175) than other parts of the study area and compared to Texas. Because South Padre Island is a coastal resort community with a small permanent resident population, high property values, and a high cost of living, the median household income of the population is higher than that for other areas in Cameron County. The Brownsville and Port Isabel poverty rates of 35.8 percent and 37.3 percent, respectively, are much higher than the 16.8 percent rate for the State of Texas as a whole (U.S. Census Bureau, 2010).

The civilian labor force in Brownsville consisted of 69,154 persons in November 2011, with an 11.3 percent unemployment rate compared to 60,951 jobs and an unemployment rate of 12.2 percent in November 2010 (Texas Workforce Commission, 2012a). The labor force in Port Isabel numbered 2,152 in 2010, compared to 2,258 in 2009 with unemployment rates of 5.8 percent and 8.1 percent, respectively. In South Padre Island, 1,020 persons were employed in 2010, compared to 1,177 in 2009 (U.S. Census Bureau, 2010).

The major employment sectors in the study area are educational and health services (25 percent), followed by government (24 percent), and trade, transportation and utilities (18 percent) (Brownsville Economic Development Council, 2010). Within Brownsville, the largest single five employers are Brownsville Independent School District, followed by The University of Texas–Brownsville, Cameron County Government, Keppel-AmFELS, and the City of Brownsville. The educational and health services sector is also the top employer in Cameron County with employment in that sector increasing by an average of 8 percent between the first quarter of 2009 and first quarter of 2011 (Texas Workforce Commission, 2012b).

2.4 ECONOMIC CONDITIONS

BIH is a bulk commodity port in which the major commodities include petroleum products, crude materials, and primary manufactured goods. There are several shipbreakers located at BIH that bring ships into the channel, dismantle the ships, and then place the materials on barges to ship out. In addition, there is one rig fabricator, Keppel-AmFELS, which builds, repairs, and

inspects offshore oil rigs that are drilling in offshore deepwater in the Gulf of Mexico. The POB estimates that the harbor dock capacity is 18.7 million tons.

The POB is the only deep-draft port available to industry along the U.S. – Mexico border. Brownsville is primarily a bulk commodity port covering both liquid and dry cargo handling. The increased traffic is a direct result of the North American Free Trade Agreement in that a majority of the increased commodity traffic is to meet industrial needs in Mexico. One-way traffic limitations do not appear to be an issue with the existing channel.

The main harbor, including the Turning Basin, its extension and approach, contains Cargo Docks 1 through 4, 7, 8, 10 through 13, and 15; Oil Docks 1, 2, 3, and 5; a bulk/grain cargo dock; a liquid cargo dock; and an express dock. Activities at the POB (Figure 2-1) include:

- Offshore rig fabrication operations;
- Ship repair and dismantling;
- Steel fabrication;
- Boat construction;
- Liquid Petroleum Gas storage/distribution;
- Bulk terminals for petroleum, chemical, and miscellaneous liquids;
- Steel products and ore minerals offloading; and
- Grain handling and storage.

Figure 2-1. Port of Brownsville

Figure 2-2 shows the location of the facilities and docks along the channel. The POB is the owner of the property along the channel and leases the land to the facility operators. Detailed economic information is included in Appendix A – Economic Appendix.

Based on historical data, the major vessel categories are tank ships, bulk carriers, scrap vessels, and barges. The existing vessel size is limited because of current channel dimensions. The maximum ship dimensions permitted by the Brazos Santiago Pilots Association (Pilots) are a maximum length of 850 feet, maximum beam of 135 feet, and maximum draft of 39 feet. On average, there are 250 deep-draft vessel calls annually, while there are more than 600 barge movements annually. Under existing conditions, the deep-draft vessels do not come into the POB fully loaded. The current bulkers and tankers range from less than 20,000 dead weight tons (DWT) to approximately 70,000 DWT in size, with the majority of the calls in the smaller size range. The largest tanker that currently comes into the channel has a beam of 120 feet, while the largest bulker has a beam of 110 feet.

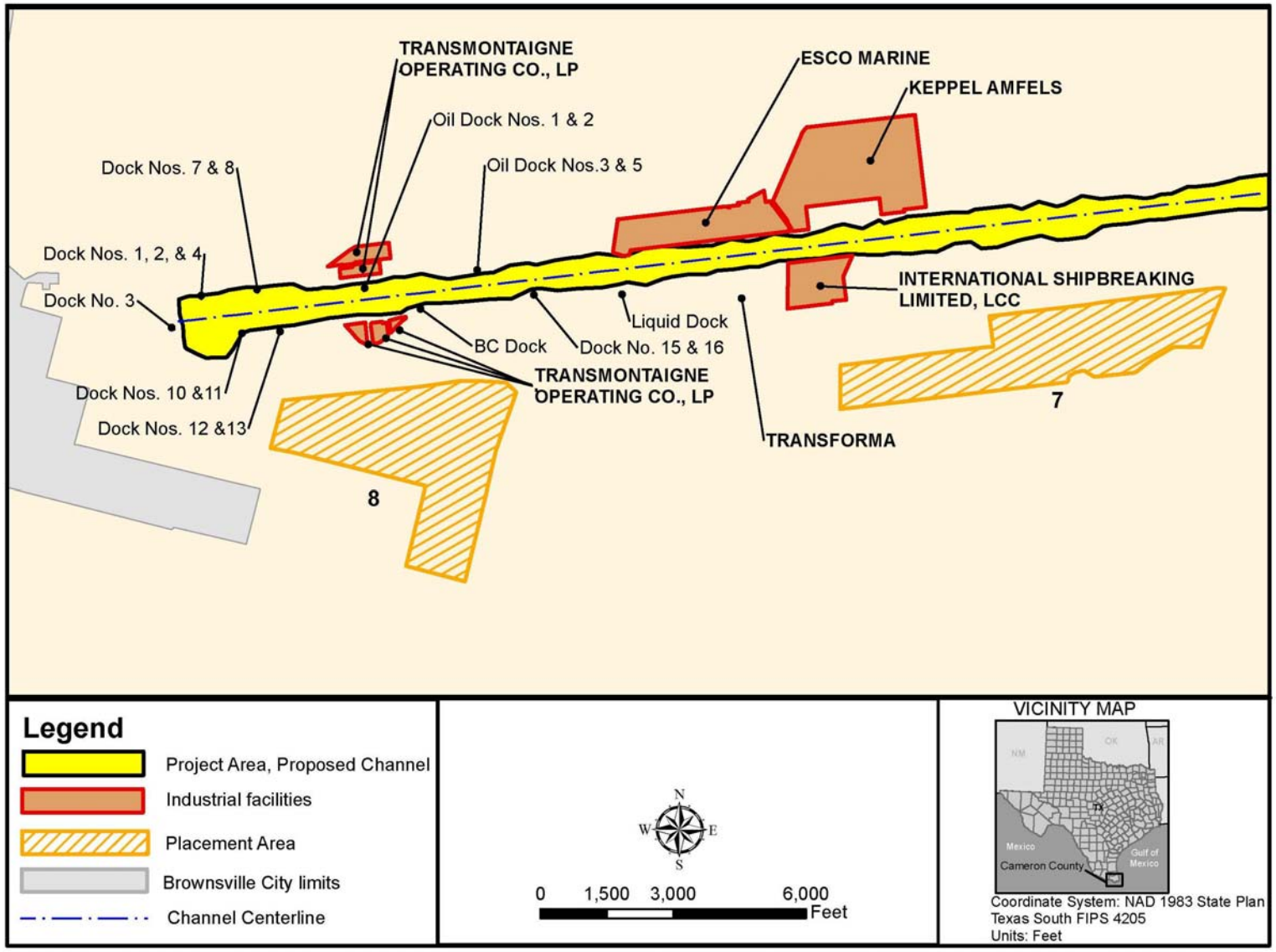

Figure 2-2. Locations of Port Facilities and Docks

Offshore oil rigs are routinely required to come into dock for inspections or they require maintenance and repair. The rigs are in dry dock for a minimum of 2 months, depending on the work required. The closest location for rigs operating in the Gulf of Mexico to have such inspections or repairs performed is the Keppel-AmFELS location at BIH. Keppel-AmFELS' work typically consists of jack-ups and semisubmersible oil rigs. However, over time, the semisubmersible rigs have been built wider and deeper, and they are reaching the limitations of the current BIH channel dimensions, which risks the operations being moved to Mexico without channel improvements.

Semi-submersible rigs use thrusters as part of their dynamic positioning while drilling offshore, but the thrusters add additional depth to the rig, constraining the rigs that can enter the channel. Some semi-submersible rigs are able to traverse the channel if the thrusters are removed at sea, which has been considered by rig owners for the work to be done at BIH. However, this costs millions of dollars and additional time, which is often a limitation for owners when deciding to bring a rig to BIH.

Analysis of the world offshore rig fleet and the current rig fleet for Brownsville indicates that only a small percentage of the world fleet could be serviced in Brownsville due to the width restrictions. Tables 2-3 and 2-4 show the world offshore rig fleet by width and the Brownsville rig fleet as compared to the world fleet, respectively.

Table 2-3. World Offshore Rig Fleet as of January 2009 (Includes New Construction)

Rig Width (feet)	Number	Percentage of World Fleet
150–165	6	2.8
189–197	3	1.4
200–236	16	7.5
246–249	4	1.9
250–277	25	11.8
280–298	24	11.3
302–325	29	13.7
327–349	29	13.7
350–399	67	31.6
400–410	7	3.3
531	1	0.5
820	1	0.5
Greater than 820	0	0.0
Total	212	100.0

Source: Fairplay/Lloyds' Register of Ships, January 2009.

Table 2-4 indicates that only 20 percent of the world fleet currently uses Brownsville while 80 percent have widths greater than 236 feet and would not be able to traverse the 250-foot channel. Additionally, Table 2-3 indicates almost 32 percent of the world fleet has widths between 350 and 399 feet and could possibly benefit from this additional width at Brownsville.

Table 2-4. Comparison of World and Brownsville Offshore Rig Fleet

Rig Width (feet)	Percentage of Brownsville Fleet				Percentage of World Fleet
	2006	2007	2008	2009	
Less than or equal to 175	63	50	33	67	12
200–236	37	50	67	33	8
Greater than 236	0	0	0	0	80
Total	100	100	100	100	100

3 FUTURE WITHOUT-PROJECT CONDITIONS

The USACE is required to consider the Future Without-Project (FWOP) alternative (called the "No Action" alternative) during the planning process and assessment of impacts to comply with USACE regulation and guidance for planning as well as NEPA. With the Future Without-Project (FWOP), it is assumed that no project would be implemented by the Federal Government or by local interests to achieve the planning objective. The FWOP forms the basis against which all other alternative plans are measured.

3.1 Economic Conditions

The non-Federal sponsor or other local interests have no plans to pursue channel improvements without Federal assistance. Therefore, the FWOP condition would retain the existing 42-foot-deep BIH by approximately 250 feet wide along the waterway. The channel would continue to be operated for one-way traffic only, as two-way traffic is not needed. The current dimensions would continue to limit the efficient movement of commodities by vessels traveling the waterway. As vessels increase in draft, the restrictive depth of the waterway would prevent vessels from entering with full loads or prevent larger vessels from even utilizing the waterway. The FWOP condition would lack social acceptance, considering the overall favorable public support of deepening and/or widening the current channel.

Population in the Cameron County study area is expected to increase by nearly 62 percent by 2050, and ethnicity is expected to remain primarily Hispanic/Latino. The study area economy would continue to be based on heavy and light manufacturing related to port activities, trade, commercial and recreational fishing, and tourism. The focus of these economic activities would continue to be the POB, the Port of Port Isabel, the Small Boat Fishing Harbor, recreation activities on the Gulf beaches and barrier island, and bird and wildlife watching in the numerous parks and preserves in the area. Publicly owned lands in the study area, such as Federal refuges, State of Texas wildlife management areas, and local parks would continue to be managed for the preservation of fish and wildlife and for public recreation. It is assumed that long-term refuge acquisition plans would continue to be implemented as funding is made available. Development along the Main Channel would continue to be constrained and controlled by POB ownership of most of the surrounding land.

Detailed economic analysis is presented in Appendix A – Economic Appendix. The current channel dimensions would also continue to limit the ability of the shipyards along the waterway to bring in the larger oil rigs that are currently operating in the Gulf of Mexico. The existing shipyard would not be able to accommodate drill ships, but would continue accommodating jack-up rigs and semi-submersible rigs. The semi-submersible rigs would need to continue to remove thrusters to enter the channel, although this has yet to be done at BIH for a variety of reasons. Based on recent economic evaluations, up to 5,000 jobs are attributed to these operations.

Without channel improvements, oil rig repair operations (and jobs) would possibly be relocated to Mexico, resulting in not only an economic impact in the South Texas region, but also the national economy.

Removing thrusters before entering the channel can be cost prohibitive because of the additional expense this adds to the vessel transportation to the channel. Among the elements included in the thruster removal costs are tractor tugs (to be transported from Corpus Christi Ship Channel), divers to remove the thrusters, a crane barge, crew, and miscellaneous support. On average it takes one day to remove or reattach one thruster and a semi-submersible rig typically has four to eight thrusters that need to be removed to enter the channel and then reattached after the work on the rig in the channel has been completed. The total cost to remove and then reattach the thrusters offshore can be upwards of $15 million.

However, while thrusters have not, to date, been removed offshore for a rig to enter the BSC, it is reasonable to assume that in the future, the without-project condition will experience rigs entering the channel with their thrusters removed for a variety of reasons. No matter where in the world a rig travels to, including BIH for modifications or inspections, if it will be dry docked, the thrusters will need to be removed. Thrusters protrude significantly and because of their height, scaffolding would likely have to be 20 feet high for work to be completed, which increases the difficulty and adds additional risk. Thus, thrusters will always be removed; it is just a matter of whether or not it will be done at the dock or in the case of BIH, outside the channel in the without-project condition. The with-project condition assumes thrusters will also be removed at BIH, but that would be done dockside in that condition.

The newest semi-submersible rigs have not reached the age in which they have required their decadal ABS inspection or modifications. As the fleet ages, though, drilling rig owners would rather have a rig operating in the Gulf of Mexico visit a local port for repair or inspection in order to reduce the transit time and cost. Even with the cost to remove and reattach the thrusters at sea before entering BIH, it is more time effective than moving the rig to a foreign country. With the assumption that it will take a week to remove the thrusters and another week to reattach the thrusters for a rig to visit BIH, this is only two weeks of downtime, but the downtime would be longer if a rig has to move to a foreign country for service.

Taking into consideration the competition to keep rigs near the Gulf of Mexico, the time and cost savings to remove the thrusters at BIH, and the upcoming need for inspections and modifications, it is reasonable to assume that thrusters will be removed at BIH in the near future, even without the channel modifications. Keppel-AmFELS has taken measures to be ready for such activities by securing a regulatory permit from USACE for a square mile of land six miles from the channel jetties where the thrusters will be able to be removed. Keppel-AmFELS has incurred the cost for this permit as commitment to remove thrusters in the without-project

condition in attempt to remain competitive in the oil drilling rig fabrication market while oil production occurs in the Gulf of Mexico.

While the volume of commodities is expected to grow in the future, lack of channel modifications to BIH would continue operating inefficiencies. The number of vessel calls would increase, but there would be continued restrictions on the draft of vessels and larger vessels would be prevented from utilizing the channel. Therefore, there would continue to be additional costs and delays for vessels, which could discourage long-range industrial growth.

3.2 Dredged Material Base Plan Description

Maintenance dredging activities would continue to be performed as they have been in the past. Dredging of the Entrance and Jetty Channels would be performed by hopper dredge, with higher shoaling sections dredged as frequently as every 18 months, and other reaches dredged on the average of 4.5 years. In recent years, all material has been placed in the least-cost nearshore Feeder Berm or directly onto South Padre Island beaches under cost-sharing agreements with the Texas General Land Office (GLO) and the City of South Padre Island. The Maintenance ODMDS site has not been used in recent years because it was preferable to use the material beneficially, if possible. The Main Channel reaches would continue to be dredged every 4 to 7 years with a hydraulic pipeline cutterhead, with material being pumped to the existing PAs that line the channel's south bank. No new PAs would be needed to accommodate quantities expected over the 50-year period of analysis. PA dikes would continue to be raised incrementally as additional capacity is needed. On occasion in the past, the BIH channel maintenance has been postponed because of budget considerations, resulting in restricting vessel drafts to those shallower than the authorized depth. However, the channel is expected to be maintained at authorized depths in the future.

3.3 Environmental and Historic Resources

Potentially adverse environmental effects of a channel modification, primarily from channel widening, would be avoided in the FWOP. Environmental effects of the existing project would continue as they do today. The largest impact is the adverse effect of hopper maintenance dredging on threatened and endangered sea turtles; no other listed species are affected by maintenance dredging or placement activities. Hopper dredging would continue to comply with the reasonable and prudent measures (RPMs) and implementing Terms and Conditions described in the Gulf Regional Biological Opinion (GRBO) for Hopper Dredging, Gulf of Mexico (NMFS, 2003 with 2005 and 2007 updates). Although the existing PAs are located in or adjacent to sensitive environmental zones, potential impacts to nearby seagrass beds, black mangrove stands, wind-tidal mud and algal flats, the Bahia Grande, the Lower Laguna Madre, and Back Bay would be avoided by the consistent use of best management practices (BMPs), which would prevent the discharge of dredged material into these areas. Similarly, the use of BMPs would

prevent impacts to all biological communities in the project vicinity, including thornscrub forest and brush, mesquite savannahs, clay lomas, coastal dunes, wetlands, and oyster reef. Minor and temporary effects to air quality and noise levels would occur during maintenance dredging episodes. The Main Channel is a dead-end channel with low tidal exchange, little freshwater inflow, and low velocities, all of which would be expected to continue to contribute to low dissolved oxygen in some areas at some times. Sediment quality would be monitored to identify contaminants in the dredged material, even though no concerns with contaminated sediments have been documented in the project area in over 30 years of monitoring.

While the study area is rich in archeological sites and numerous historic shipwrecks have been reported in the area, none are affected by on-going maintenance dredging activities. Archeological sites known to be present in the vicinity are located on clay lomas, which are avoided by construction activities, both for their cultural and habitat values. No historically significant shipwrecks have been identified along the existing channel margins or side slopes, or in the ODMDS.

3.4 Relative Sea Level Rise

The FWOP conditions must include consideration of potential changes in RSLR over the period of analysis. Rising regional sea level would result in small increases (no greater than 2.4 feet) in inundation and tidal circulation in the Laguna Madre, Bahia Grande complex, and Back Bay. Armoring may be needed to protect PAs near Brazos Santiago Pass, but overall, base land elevations along the channel are high enough that even the high range estimate would result in few changes to navigation features or industrial infrastructure.

4 PROBLEMS AND OPPORTUNITIES

4.1 PROBLEMS

The problems in the BIH study area are:

- Constraints of channel dimensions for the POB have resulted in inefficient navigational practices; and
- Limited ability for oil drilling rig fabrication, maintenance, and repair at the POB due to current channel dimensions.

4.2 OPPORTUNITIES

Opportunities in the BIH study area include the following:

- Increase navigational efficiency of vessel transportation for the channel; and
- Increase ability of the channel to accommodate offshore rigs for maintenance and repair as well as fabrication of new rigs.

Scoping, detailed in Section 9.0, identified operational constraints with the BSC as an existing problem. Other public concerns involved issues that were not within the study authority.

The POB has experienced strong overall growth from the early 1990s to present day. Total tonnage on BIH has more than tripled from 1,641,000 short tons in 1990 to 5,907,000 short tons in 2011. Foreign imports have been the primary driver for growth, including petroleum products, iron, and steel products.

In addition to traditional vessel traffic, there is a need for increased channel dimensions in order to serve offshore rigs presently operating in the U.S. Gulf Coast (USCG). Keppel-AmFELS is currently operating on the BIH for the fabrication, maintenance, and repair of rigs, and several oil companies have acquired Outer Continental Shelf blocks due to the proximity to BIH. The operational draft of the newer rigs ranges from 45 to 63 feet. Current dimensions of BIH limit the ability of shipyard repair operations to bring in larger oil rigs (Figure 4-1).

4.3 PLANNING OBJECTIVE

The following planning objective was used in formulation and evaluation of alternative plans:

- Increase navigational efficiency of cargo vessels and offshore rigs using the channel during the 50-year period of analysis.

Figure 4-1. Offshore Rig Fabrication Operations

4.4 PLANNING CONSTRAINTS

The following constraints apply to this study:

- Minimize impacts to designated critical habitat for threatened and endangered species in the study area;
- Minimize impacts to threatened and endangered species in the study area;
- Minimize impacts to cultural resources listed on or eligible for the National Register of Historic Places (defined as historic properties);
- Develop alternatives within Coastal Barrier Resources Act (CBRA) guidelines, which prohibit new Federal expenditures or financial assistance within any CBRA unit with the exception of improvements to existing navigation channels, disposal areas, and related improvements; and
- Limit channel traffic to single lane/one way only.

4.5 RELATED ENVIRONMENTAL DOCUMENTS

The proposed action is included in sections of this FIFR-EA in order to satisfy the requirements of NEPA. Other NEPA documents prepared by the USACE related to the planned action include the *Environmental Statement, Brazos Island Harbor, Texas, Brownsville Channel* (1979); *Environmental Assessment, Brazos Island Harbor Underwater Feeder Berm Construction, USACE (1988); Final Environmental Impact Statement, Brazos Island Harbor Ocean Dredged Material Disposal Site Designation, EPA (1990); and Final Environmental Impact Statement, Brazos Island Harbor 42-Foot Project, Texas, Ocean Dredged Material Disposal Site Designation, EPA (1991).*

4.6 DECISIONS TO BE MADE

This FIFR-EA will provide recommendations for reducing vessel costs to improve navigation efficiencies and improving channel dimensions to accommodate current and future offshore rigs into the POB for fabrication, maintenance, and repair during the 50-year period of analysis in the BSC. Various alternatives were evaluated and specific measures were suggested to minimize, or avoid, adverse effects to local resources.

4.7 AGENCY GOAL OR OBJECTIVE

The planning objective of the feasibility study involves the use of available information and hydrodynamic modeling to evaluate navigation improvements in BIH over the 50-year period of analysis from 2021 to 2071. The specific planning objective for the feasibility phase of the BIH channel improvement study includes identification of a plan for BIH, which most efficiently and safely maximizes net benefits for the BSC existing and future ship and rig traffic.

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5 FORMULATION AND EVALUATION OF ALTERNATIVE PLANS

5.1 PLAN FORMULATION RATIONALE

Plan formulation is the process of building alternative plans that meet the planning objective and developing alternatives within the planning constraints. Alternative plans are a set of one or more management measures functioning together to address the planning objective. A management measure is a feature that can be implemented at a specific geographic site to address the planning objective. A feature can be a structural element that requires construction or a nonstructural action.

Preliminary plans were formulated by combining management measures. Each plan was formulated in consideration of the following four criteria described in the Principles and Guidelines (P&G):

- Completeness: Extent to which the plan provides and accounts for all necessary investments or actions to ensure realization of the planning objective
- Effectiveness: Extent to which the plan contributes to achieving the planning objective
- Efficiency: Extent to which the plan is the most cost-effective means of addressing the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment
- Acceptability: Workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public, and compatibility with existing laws, regulations, and public policies

Initial study efforts involved a determination of the magnitude and extent of the problems along BIH in order to develop and evaluate an array of alternative solutions that meet the existing and long-range future needs of the non-Federal sponsor and the public. At the initiation of the feasibility phase of the project, lines of communication were opened with Federal, State, and local agencies, private groups, and the affected public. A public scoping meeting was held in Brownsville, Texas, on January 31, 2007. As mentioned earlier, the attendees were overwhelmingly in favor of the project for the economic benefits it would likely generate for the South Texas area. The public was assured that their involvement would occur throughout the planning process.

5.2 MANAGEMENT MEASURES

The main problems with the existing channel are constraints in accommodating deeper draft vessels like the post-Panamax vessels and the inability to accommodate larger offshore rigs.

Nonstructural and structural measures were developed to address the planning objective, alone or in combination with other measures. These measures were later combined to form alternatives to be evaluated in this study process. New measures identified in later phases of the Plan Formulation process were also reviewed and considered in the alternative analysis. Measures were formulated to avoid or minimize the constraints, identified in Section 4.4.

5.2.1 Nonstructural Measures

Based on the economic forecasts discussed in Section 3.1, Economic Conditions, existing vessel management practices and scheduling is sufficient to maintain efficient channel operation in the future. Therefore, no nonstructural alternatives related to vessel management were included.

The nonstructural measures considered included:

- Utilize another port; and
- Alternative modes of commodity transport.

A multiport analysis was used to assess whether or not improvements at BIH would result in a diversion of cargo traffic that would either shift to or from competing ports to or from BIH. The analysis is included in the Economic Appendix (Appendix A) and did not find any reason to assume a shift in cargo to or from BIH. If it was determined that there is an impact, the forecasted cargo traffic at BIH would be adjusted by an amount derived from the cargo movements analysis and transportation costs at competing ports; however, in this case, there was no evidence that such a shift would occur.

Further, the multiport analysis was used to determine that the nonstructural measures developed to address at least one of the planning objectives are not reasonable. Utilizing another port would require additional transportation to the subject hinterland and the use of another port and alternative modes of commodity transport would add additional cost. Therefore, the additional cost compared to the transport to BIH leads to the nonstructural measures being removed from further consideration.

5.2.2 Structural Measures

Structural measures included:

- Deepen only;
- Widen only;
- Deepen and widen channel;
- Widen only up to location of existing offshore rig fabrication operations;
- Relocate turning basin to new location closer to the channel entrance; and

- Widen using shelves to facilitate rig movements on the outer Main Channel.

The purpose of the deepening and/or widening measures of the existing 42-foot channel would be to allow existing ships to more fully utilize the channel while also allowing larger offshore rigs to come into the port for fabrication, maintenance, and repair. The deepening and/or widening measures could also be considered at different scales (various channel depths and widths). Widening specific parts of the channel includes widening using shelves on either side of the deep-draft channel to accommodate rigs that need additional widths but not at the deeper channel depth. Widening the channel only up to the existing rig facilities located near the turning basin was also considered as part of the formulation to accommodate wider rigs. Widening considered in any alternative would be limited since the channel would continue to operate for one-way traffic only in the future.

Another measure considered was construction of a new turning basin closer to the channel entrance. This measure would allow for a shorter segment of channel to be improved, allowing the vessels to travel only as far as this new turning basin. For this measure, the remainder of the channel would continue to be maintained at existing conditions and would not be able to serve any future vessels and rigs that require channel improvements. With this new turning basin measure, considerable upland development would be required after completion of channel improvements, with no benefits from the improved channel being realized by existing tenants unless their operations are relocated to this new turning basin area.

The detailed Plan Formulation analysis, including development of the alternative and screening to the Final Array, is included in Appendix L.

5.3 SUMMARY OF ALTERNATIVES ANALYSES

Measures were evaluated and screened by the team through several arrays of alternatives. Consistent with new SMART Planning concepts, this effort included a qualitative analysis of an Initial Array, and quantitative analysis of an Evaluation and Final Array of alternatives.

In the evaluation of the Initial Array, a combination of deepening and widening alternatives was evaluated qualitatively based on several factors including potential to improve navigation efficiencies, scale of possible environmental and cultural impacts, potential for significant increases in costs, both operations and maintenance (O&M) and construction, as well as possibility for public concern with the different alternatives. The alternatives were scored based on the team's assessment and a reduced combination of widening and deepening alternatives was carried forward into the Evaluation Array.

The Evaluation Array included deepening alternatives at 45, 48, and 50 feet. In this analysis, the sponsor had limited the team to considering only depths up to 50 feet because of cost limitations and the belief at that time that no vessels would utilize depths greater than that. Widening

alternatives evaluated were a full 200-foot widening and a 75-foot widening in limited areas (shelves). The 200-foot widening was driven by the possibility for large rig access in the channel. The team also evaluated creation of a new turning basin and associated facilities that would allow rigs to travel a shorter distance to their destination.

For the Evaluation Array, the team prepared qualitative assessments, again looking at the potential for improved navigation and environmental impact, as well as quantitative measures that detail costs and economic benefits. Based on the scores the team determined that all three deepening only alternatives as well as the three alternatives that combined deepening with 200-foot widening had the greatest potential for success.

From those results, the team developed a Final Array that would be evaluated quantitatively for selection of the Recommended Plan. In the quantitative results calculated for the Evaluation Array, the 50-foot deepening alternative had the greatest net excess benefits for the deepening only alternatives. Based on this result, the team added an alternative to the Final Array of deepening to 52 feet in an attempt to determine whether the 50-foot alternative was in the fact the NED Plan. Also, during the analysis performed for the Evaluation Array, changes to vessel fleet forecasts were realized that would impact the widening alternatives that would need to be evaluated. Changes were made to both expected tanker traffic and rig movements. Oil exploration is expected to switch away from rigs to drill ships, which do not require large widths but would benefit from deeper depths. Based on these considerations the 200-foot widening was dropped from consideration. However, 50- and 100-foot widening were added to ensure that sufficient analysis was conducted to determine if widening would be part of the Recommended Plan.

5.4 COMPARISON OF FINAL ARRAY OF ALTERNATIVE PLANS AND DECISION CRITERIA

Table 5-1 presents the Final Array of alternatives along with the corresponding dredged material quantities, average annual costs and benefits, net excess benefits, and benefit-to-cost ratios (BCRs) using the most current price level and interest rate at the time of calculations (October 2012 and 3.75 percent interest rate).

For the Final Array of alternatives, all of the channel depth alternatives are economically justified at either the current 250-foot or the 300-foot width alternative, but not at the 350-foot width alternative. The deepening alternatives with no widening have the greatest BCRs and net excess benefits compared to those with any widening.

In comparing the deepening only alternatives, the net excess benefits are increasing as the channel depths increase. Interpolation between these depths was used to optimize the plan and possibly identify the NED plan. Appendix A includes details of the benefit analysis and this

Table 5-1. Traditional NED Benefit Analysis for Final Array of Alternative Screening
(Cost in $1,000s, October 2012 price levels, 3.75% interest rate)

Alt. No.	Description	Dredging Quantities (cy)	First Cost	Average Annual O&M	Total Annual Costs[1]	Average Annual Benefits	BCR	Net Excess Benefits
F-1a	Deepen from 42 to 45 feet	3,736,000	89,200.0	856.3	4,932.0	9,717.2	1.97	4,785.2
F-1b	Deepen from 42 to 48 feet	8,274,000	121,340.0	1,084.2	6,670.5	14,204.6	2.13	7,534.1
F-1c	Deepen from42 to 50 feet	11,430,000	162,170.0	1,324.1	8,861.4	17,380.8	1.96	8,519.5
F-1d	Deepen from 42 to 52 feet	14,093,000	193,950.0	1,503.3	10,586.4	19,873.8	1.88	9,287.4
F-2a	Deepen from 42 to 45 feet/widen from 250 to 300 feet	7,703,000	126,090.0	2,240.2	8,067.3	10,843.1	1.34	2,775.9
F-2b	Deepen from 42 to 48 feet/widen from 250 to 300 feet	12,912,000	189,430.0	2,623.9	11,563.2	13,760.4	1.19	2,197.3
F-2c	Deepen from 42 to 50 feet/widen from 250 to 300 feet	16,503,000	230,730.0	2,853.2	13,867.0	17,939.3	1.29	4,072.2
F-2d	Deepen from 42 to 52 feet/widen from 250 to 300 feet	19,758,000	274,220.0	3,100.8	16,342.2	20,440.4	1.25	4,098.1
F-3a	Deepen from 42 to 45 feet/widen from 250 to 350 feet	14,007,000	204,970.0	4,354.3	14,063.9	8,958.2	0.64	–5,105.7
F-3b	Deepen from 42 to 48 feet/widen from 250 to 350 feet	19,315,000	271,090.0	4,889.2	17,979.5	14,140.2	0.79	–3,839.3
F-3c	Deepen from 42 to 50 feet/widen from 250 to 350 feet	22,569,000	310,880.0	5,272.9	20,342.4	16,687.0	0.82	–3,655.4
F-3d	Deepen from 42 to 52 feet/widen from 250 to 350 feet	26,728,000	365,860.0	5,606.1	23,616.5	19,896.1	0.84	–3,720.4

[1] Total Annual Costs is a sum of Average Annual Cost and Average Annual O&M. Average Annual Costs is a sum of First Cost of Construction and Interest during Construction.

interpolation for all of the final alternatives; whereas Table 5-2 presents just those interpolated depths for the no widening alternative.

Table 5-2. NED Benefit Analysis for Deepening Only Alternatives
(Cost in $1,000s, October 2012 price levels, 3.75% interest rate)

Alt. No.	Description	Average Annual Costs	Average Annual Benefits	BCR	Net Excess Benefits
	Deepen from 42 to 43 feet	3,366.6	3,239.1	1.0	–127.5
	Deepen from 42 to 44 feet	4,148.0	5,795.9	1.4	1,647.8
F-1a	Deepen from 42 to 45 feet	4,932.0	9,717.2	2.0	4,785.2
	Deepen from 42 to 46 feet	5,509.0	11,213.0	2.0	5,704.0
	Deepen from 42 to 47 feet	6,088.5	12,503.7	2.1	6,415.2
F-1b	Deepen from 42 to 48 feet	6,670.5	14,204.6	2.1	7,534.1
	Deepen from 42 to 49 feet	7,761.4	15,792.7	2.0	8,031.4
F-1c	Deepen from 42 to 50 feet	8,861.4	17,380.8	2.0	8,519.5
	Deepen from 42 to 51 feet	9,721.0	18,627.3	2.0	8,906.3
F-1d	Deepen from 42 to 52 feet	10,586.4	19,873.8	1.9	9,287.4

All alternatives in the Final Array were compared based on economic, engineering, environmental, and socioeconomic factors as presented in Table 5-3. PAs do not need to be expanded to accommodate new work material and the 50-year dredged material quantities, and no new PAs are planned. All PA containment dike lifts would be accomplished inside the footprint of the existing containment dikes, and BMPs would be utilized during construction to avoid impacts to water quality, which could affect SAVs or mangroves located near some PAs.

All structural alternatives would result in the use of hopper dredges in the Gulf of Mexico, and all therefore would have the potential to impact threatened and endangered sea turtles. RPMs, developed to avoid adverse impacts to these species, would be similar for all alternatives. None of the alternatives would result in impacts to terrestrial resources, wetlands, or tidal/algal flats. No oyster reef is located near the alternative impact areas.

The deepening only alternatives (F-1a through F-1d) would result in minor additional widening of the top of cut within the existing waterway. Benthic communities that may be present in the submerged sediment on the edge of the current channel would be destroyed, but they would rapidly recolonize. SAV beds are located near the Port Isabel Wye in the shallow waters of the Main Channel along the emergent shoreline. None of the deepening only alternatives would result in SAV impacts. Among the action alternatives, the deepening only alternatives result in the fewest environmental impacts, and there are no significant differences in impacts among them.

Table 5-3. Comparison of Final Array Alternatives

Alternative Number	No Action (F-4)	F-1a	F-1b	F-1c	F-1d (Recommended Plan)	F-2a	F-2b	F-2c	F-2d	F-3a	F-3b	F-3c	F-3d
Evaluation Criteria	**Future Without-Project (FWOP)**	**Deepen to 45 feet**	**Deepen to 48 feet**	**Deepen to 50 feet**	**Deepen to 52 feet**	**Deepen to 45 feet/ widen to 300 feet**	**Deepen to 48 feet/ widen to 300 feet**	**Deepen to 50 feet/ widen to 300 feet**	**Deepen to 52 feet/ widen to 300 feet**	**Deepen to 45 feet/widen to 350 feet**	**Deepen to 48 feet/widen to 350 feet**	**Deepen to 50 feet/ widen to 350 feet**	**Deepen to 52 feet/ widen to 350 feet**
Construction Dredging Volumes (MCY)	None	3.7	8.3	11.4	14.0	7.7	12.9	16.5	19.8	14.0	19.3	22.6	26.7
Shoaling Rates (cubic yards per year [cy/yr])	1,099,000	1,155,000	1,198,000	1,227,000	1,255,000	1,256,000	1,302,000	1,333,000	1,364,000	1,438,000	1,502,000	1,545,000	1,587,000
Channel Extension Lengths (feet)	None	2,000	3,000	3,400	4,000	2,000	3,000	3,400	4,000	2,000	3,000	3,400	4,000
Net Excess Benefits (October 2013 price level)	($127,500)	$4,785,200	$7,534,100	$8,519,500	$9,287,400	$2,775,900	$2,197,300	$4,072,200	$4,098,100	($5,105,700)	($3,839,300)	($3,655,400)	($3,720,400)
Construction Air Quality (Nitrogen oxide [NO_x] Emissions)	It is anticipated that air contaminants in the project area would increase due to continued operational constraints on the existing system and a possible increase in ship traffic resulting both from growth of existing business and from new business.	Lowest air quality impacts of all action plans, but greater than No Action; fewer impacts than Recommended Plan	Higher impacts than F-1a, but greater than No Action; fewer impacts than Recommended Plan	Slightly higher impacts than F-1b, but greater than No Action; fewer impacts than Recommended Plan	2,567 tons NO_x (total for all years of construction). Higher impacts than No Action, shallower depth alternatives, and Alternatives F-2a and F-2b; lower impacts than Alternatives F-2c and F-2d, and all F-3 Alternatives	Second lowest air quality impacts overall, but greater than No Action; fewer impacts than Recommended Plan	About the same impacts as Recommended Plan and greater than No Action; lower impacts than Alternatives F-2c and F-2d, F-3b, F-3c, and F-3d	Slightly higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternatives F-2d, F-3b, F-3c, and F-3d	Higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternatives F-3c, and F-3d	About the same impacts as Recommended Plan and greater than No Action; lower impacts than Alternatives F-2c and F-2d, F-3b, F-3c, and F-3d	Higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternatives F-2d, F-3c, and F-3d	Higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternative F-3d	Highest air quality impacts of all action plans, and greater than No Action; nearly double impacts of the Recommended Plan
Upland PAs	7 existing upland confined PAs	Same number and footprint of PAs as No Action; lower dike heights than Recommended Plan.	Same number and footprint of PAs as No Action; lower dike heights than Recommended Plan	Same number and footprint of PAs as No Action; lower dike heights than Recommended Plan	7 existing upland confined PAs; same footprint as No Action	Same number and footprint of PAs as No Action; lower dike heights than Recommended Plan	Same number and footprint of PAs as No Action; lower dike heights than Recommended Plan	Same number and footprint of PAs as No Action; higher dikes than Recommended Plan	Same number and footprint of PAs as No Action; higher dikes than Recommended Plan	Same number and footprint of PAs as No Action and same dike heights as Recommended Plan	Same number and footprint of PAs as No Action; higher dikes than Recommended Plan	Same number and footprint of PAs as No Action; higher dikes than Recommended Plan	Same number and footprint of PAs as No Action; higher dikes than Recommended Plan

Alternative Number	No Action (F-4)	F-1a	F-1b	F-1c	F-1d (Recommended Plan)	F-2a	F-2b	F-2c	F-2d	F-3a	F-3b	F-3c	F-3d
Evaluation Criteria	**Future Without-Project (FWOP)**	**Deepen to 45 feet**	**Deepen to 48 feet**	**Deepen to 50 feet**	**Deepen to 52 feet**	**Deepen to 45 feet/ widen to 300 feet**	**Deepen to 48 feet/ widen to 300 feet**	**Deepen to 50 feet/ widen to 300 feet**	**Deepen to 52 feet/ widen to 300 feet**	**Deepen to 45 feet/widen to 350 feet**	**Deepen to 48 feet/widen to 350 feet**	**Deepen to 50 feet/ widen to 350 feet**	**Deepen to 52 feet/ widen to 350 feet**
ODMDS	1 existing New Work ODMDS	Reopen existing new work ODMDS; lower mounding than Recommended Plan	Reopen existing new work ODMDS; lower mounding than Recommended Plan	Reopen existing new work ODMDS; lower mounding than Recommended Plan	Reopen existing ODMDS, dispersive with unlimited capacity; modeling indicates mounding of new work will not exceed 14.3 feet	Reopen existing new work ODMDS; lower mounding than Recommended Plan	Reopen existing new work ODMDS; lower mounding than Recommended Plan	Reopen existing new work ODMDS; slightly higher mounding than Recommended Plan	Might require resizing of existing ODMDS; mounding height would be higher than Recommended Plan	Reopen existing ODMDS, dispersive with unlimited capacity; same mounding height as Recommended Plan	Might require resizing of existing ODMDS; mounding height would be higher than Recommended Plan	Might require resizing of existing ODMDS; mounding height would be much higher than Recommended Plan	Might require resizing of existing ODMDS; mounding height would be much higher than Recommended Plan
Vegetation/SAV	Ongoing maintenance dredging would not result in impacts to vegetation or SAV	No terrestrial vegetation impacts and no impacts to SAV	No terrestrial vegetation impacts and no impacts to SAV	No terrestrial vegetation impacts and no impacts to SAV	Construction and maintenance dredging would not result in impacts to terrestrial vegetation or SAV	No terrestrial vegetation impacts and no impacts to SAV	No terrestrial vegetation impacts and no impacts to SAV	No terrestrial vegetation impacts and no impacts to SAV	No terrestrial vegetation impacts and no impacts to SAV	No terrestrial vegetation impacts and no impacts to SAV	No terrestrial vegetation impacts and no impacts to SAV	Construction would permanently impact approximately 1 acre of SAV along the edges of the Main Channel; no terrestrial vegetation impacts	Construction would permanently impact approximately 1 acre of SAV along the edges of the Main Channel; no terrestrial vegetation impacts
Terrestrial Wildlife Habitat	Ongoing maintenance dredging and placement would cause no impacts to terrestrial wildlife habitats	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	All impacts would be avoided by restricting construction activities to the existing PA footprints and existing access roads	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided	No impacts to wildlife habitats; all impacts avoided
Wetlands	Ongoing maintenance dredging and placement would not result in new impacts to wetlands.	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	All impacts would be avoided by restricting construction activities to the existing PA footprints and existing access roads	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided	No impacts to wetlands; all impacts avoided

Alternative Number	No Action (F-4)	F-1a	F-1b	F-1c	F-1d (Recommended Plan)	F-2a	F-2b	F-2c	F-2d	F-3a	F-3b	F-3c	F-3d
Evaluation Criteria	**Future Without-Project (FWOP)**	**Deepen to 45 feet**	**Deepen to 48 feet**	**Deepen to 50 feet**	**Deepen to 52 feet**	**Deepen to 45 feet/ widen to 300 feet**	**Deepen to 48 feet/ widen to 300 feet**	**Deepen to 50 feet/ widen to 300 feet**	**Deepen to 52 feet/ widen to 300 feet**	**Deepen to 45 feet/widen to 350 feet**	**Deepen to 48 feet/widen to 350 feet**	**Deepen to 50 feet/ widen to 350 feet**	**Deepen to 52 feet/ widen to 350 feet**
Aquatic Habitat	Temporary water column turbidity associated with maintenance dredging and placement would continue	Lowest aquatic habitat impacts of all action plans; impacts similar to No Action; fewer impacts than Recommended Plan	Higher impacts than F-1a, but greater than No Action; fewer impacts than Recommended Plan	Slightly higher impacts than F-1b, but greater than No Action; fewer impacts than Recommended Plan	Impacts greater than No Action; short-term, temporary impacts to benthic organisms and increased turbidity are expected, although no significant impacts would be anticipated	Impacts greater than No Action; water bottom impacts slightly greater than deepening only alternatives ; turbid conditions slightly less than all alternatives with exception of F-1a	Impacts greater than No Action; water bottom impacts slightly greater than deepening only alternatives ; turbid conditions about the same as Recommended Plan	Impacts greater than No Action; water bottom impacts slightly greater than deepening only alternatives ; turbid conditions about the same as Recommended Plan	Impacts greater than No Action; water bottom impacts slightly greater than deepening only alternatives ; turbid conditions greater than the Recommended Plan	Impacts greater than No Action; water bottom impacts and turbid conditions about the same as Recommended Plan but greater than other deepening only alternatives	Impacts greater than No Action; water bottom impacts and turbid conditions greater than deepening only and deepening plus widening to 300-foot alternatives	Impacts greater than No Action; water bottom impacts and turbid conditions greater than deepening only and deepening plus widening to 300-foot alternatives	Impacts greater than No Action; largest water bottom and turbidity impacts of all alternatives
Essential Fish Habitat (EFH)	Ongoing maintenance dredging and placement would not result in new impacts to EFH	Lowest EFH impacts of all action plans; impacts similar to No Action; fewer impacts than Recommended Plan	Higher impacts than F-1a, but greater than No Action; fewer impacts than Recommended Plan	Slightly higher impacts than F-1b, but greater than No Action; fewer impacts than Recommended Plan	Turbidity would be temporary; localized impact during dredging and placement; benthic organisms would be affected until natural recovery occurs; no significant impacts anticipated	Impacts greater than No Action; EFH impacts slightly greater than deepening only alternatives ; turbid conditions slightly less than all alternatives with exception of F-1a	Impacts greater than No Action; EFH impacts slightly greater than deepening only alternatives ; turbid conditions about the same as Recommended Plan	Impacts greater than No Action; EFH impacts slightly greater than deepening only alternatives ; turbid conditions about the same as Recommended Plan	Impacts greater than No Action; EFH impacts slightly greater than deepening only alternatives ; turbid conditions about the same as Recommended Plan	Impacts greater than No Action; EFH impacts and turbid conditions about the same as Recommended Plan but greater than other deepening only alternatives	Impacts greater than No Action; EFH impacts and turbid conditions greater than deepening only and deepening plus widening to 300-foot alternatives	Impacts greater than No Action; EFH impacts and turbid conditions greater than deepening only and deepening plus widening to 300-foot alternatives	Impacts greater than No Action; largest EFH and turbidity impacts of all alternatives
Threatened and Endangered Species	Ongoing maintenance dredging of the Entrance and Jetty Channels may adversely impact sea turtles	Lowest sea turtle impacts of all action plans, but greater than No Action; fewer impacts than Recommended Plan	Higher sea turtle impacts than F-1a, but greater than No Action; fewer impacts than Recommended Plan	Slightly higher impacts than F-1b, but greater than No Action; fewer impacts than Recommended Plan	Construction and maintenance dredging of the Entrance and Jetty Channels may adversely impact sea turtles; no other T&E species adversely affected	Second sea turtle impacts overall, but greater than No Action; fewer impacts than Recommended Plan	About the same impacts as Recommended Plan and greater than No Action; lower impacts than Alternatives F-2c and F-2d, F-3b, F-3c, and F-3d	Slightly higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternatives F-2d, F-3b, F-3c, and F-3d	Higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternatives F-3c, and F-3d	About the same impacts as Recommended Plan and greater than No Action; lower impacts than Alternatives F-2c and F-2d, F-3b, F-3c, and F-3d	Higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternatives F-2d, F-3c, and F-3d	Higher impacts than the Recommended Plan and greater than No Action; lower impacts than Alternative F-3d	Highest sea turtle impacts of all action plans, and greater than No Action

Alternative Number	No Action (F-4)	F-1a	F-1b	F-1c	F-1d (Recommended Plan)	F-2a	F-2b	F-2c	F-2d	F-3a	F-3b	F-3c	F-3d
Evaluation Criteria	**Future Without-Project (FWOP)**	**Deepen to 45 feet**	**Deepen to 48 feet**	**Deepen to 50 feet**	**Deepen to 52 feet**	**Deepen to 45 feet/ widen to 300 feet**	**Deepen to 48 feet/ widen to 300 feet**	**Deepen to 50 feet/ widen to 300 feet**	**Deepen to 52 feet/ widen to 300 feet**	**Deepen to 45 feet/widen to 350 feet**	**Deepen to 48 feet/widen to 350 feet**	**Deepen to 50 feet/ widen to 350 feet**	**Deepen to 52 feet/ widen to 350 feet**
Water and Sediment Quality	Maintenance dredging and placement activities would result in no new impacts. Testing indicates no contaminants of concern would be expected in channel sediments	Lowest temporary turbidity impacts of all action plans; no sediment contaminant concerns	Higher turbidity impacts than F-1a, but greater than No Action; no sediment contaminant concerns	Slightly higher turbidity impacts than F-1b, but greater than No Action; no sediment contaminant concerns	Construction dredging and placement activities would result in temporary increases in turbidity; testing indicates no contaminants of concern would be expected in channel sediments	Impacts greater than No Action; temporary turbidity slightly less than all alternatives with exception of F-1a; no sediment contaminant concerns	Impacts greater than No Action; turbidity conditions about the same as Recommended Plan; no sediment contaminant concerns	Impacts greater than No Action; turbidity conditions about the same as Recommended Plan; no sediment contaminant concerns	Impacts greater than No Action; turbidity conditions about the same as Recommended Plan; no sediment contaminant concerns	Impacts greater than No Action; turbidity about the same as Recommended Plan but greater than other deepening only alternatives; no sediment contaminant concerns	Impacts greater than No Action; turbidity greater than deepening only and deepening plus widening to 300-foot alternatives; no sediment contaminant concerns	Impacts greater than No Action; turbidity greater than deepening only and deepening plus widening to 300-foot alternatives; no sediment contaminant concerns	Impacts greater than No Action; largest turbidity impacts of all alternatives; no sediment contaminant concerns
Hazardous, Toxic, and Radioactive Waste (HTRW)	No change from past practices in land use and the occurrence of HTRW sites would be expected	No HTRW impacts identified	No HTRW impacts identified	No HTRW impacts identified	Construction and placement activities would not impact any known HTRW sites	No HTRW impacts identified	No HTRW impacts identified	No HTRW impacts identified	No HTRW impacts identified	No HTRW impacts identified	No HTRW impacts identified	No HTRW impacts identified	No HTRW impacts identified
Energy and Mineral Resources	Maintenance of the existing project would have no impact on pipelines and mineral resources	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	Construction and maintenance of the Recommended Plan would have no impact on pipelines and mineral resources	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts	No pipeline or mineral resource impacts
Cultural Resources	Maintenance of the existing project would have no impact on cultural resources	No cultural resource impacts	No cultural resource impacts	No cultural resource impacts	Construction and maintenance of the Recommended Plan would have no impact on cultural resources	No cultural resource impacts	No cultural resource impacts	No cultural resource impacts	No cultural resource impacts	No cultural resource impacts	No cultural resource impacts	No cultural resource impacts	No cultural resource impacts

Alternative Number	No Action (F-4)	F-1a	F-1b	F-1c	F-1d (Recommended Plan)	F-2a	F-2b	F-2c	F-2d	F-3a	F-3b	F-3c	F-3d
Evaluation Criteria	**Future Without-Project (FWOP)**	**Deepen to 45 feet**	**Deepen to 48 feet**	**Deepen to 50 feet**	**Deepen to 52 feet**	**Deepen to 45 feet/ widen to 300 feet**	**Deepen to 48 feet/ widen to 300 feet**	**Deepen to 50 feet/ widen to 300 feet**	**Deepen to 52 feet/ widen to 300 feet**	**Deepen to 45 feet/widen to 350 feet**	**Deepen to 48 feet/widen to 350 feet**	**Deepen to 50 feet/ widen to 350 feet**	**Deepen to 52 feet/ widen to 350 feet**
Socioeconomics	Socioeconomic conditions resulting from existing port activities and commerce would be expected to continue	Lowest economic benefits of all action alternatives, but greater than No Action	Slightly more economic benefits than Alternative F-1a, but less than the Recommended Plan	Slightly more economic benefits than Alternative F-1b, but less than the Recommended Plan	Economic impacts on the region would increase as a result of the channel improvements, resulting in an increase in the number of jobs	Fewer economic benefits than the Recommended Plan but greater than the No Action	Fewer economic benefits than the Recommended Plan but greater than the No Action	Fewer economic benefits than the Recommended Plan but greater than the No Action	Fewer economic benefits than the Recommended Plan but greater than the No Action	Fewer economic benefits than the Recommended Plan but greater than the No Action	Fewer economic benefits than the Recommended Plan but greater than the No Action	Fewer economic benefits than the Recommended Plan but greater than the No Action	Fewer economic benefits than the Recommended Plan but greater than the No Action
Environmental Justice (EJ)	Maintenance of existing project would not impact minority or low-income populations	No impacts to EJ segments of the population	No impacts to EJ segments of the population	No impacts to EJ segments of the population	Construction and maintenance of the Recommended Plan would not impact minority or low-income populations	No impacts to EJ segments of the population	No impacts to EJ segments of the population	No impacts to EJ segments of the population	No impacts to EJ segments of the population	No impacts to EJ segments of the population	No impacts to EJ segments of the population	No impacts to EJ segments of the population	No impacts to EJ segments of the population
Environmental and Safety Risks to Children	Maintenance of existing project would not cause environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	Construction and maintenance of the Recommended Plan would not cause environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children	No environmental or safety risks to children

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The alternatives with widths of 300 and 350 feet would extend the top-of-cut for the deepening another 25 or 50 feet toward both shores, respectively. Based upon current survey information, aerial photographs, and field inspections, the 50-foot widening alternatives for all depths (F-2a through F-2d) and the 100-foot widening alternatives for the two shallower depths (F-3a and F-3b) would not impact SAV beds, but the 350-foot width for the 50- and 52-foot deep (F-3c and F-3d) alternatives could impact approximately 1 acre of SAV beds on the north side of the channel. Mitigation costs for the impacts of Alternatives F-3c and F-3d were not estimated, as they would be minimal in comparison to project construction costs.

Each plan was formulated in consideration of the four criteria in the P&G: completeness, effectiveness, efficiency, and acceptability as presented in Table 5-4. With the exception of Alternative F-4, the No Action Alternative, each alternative in the Final Array is considered acceptable. While all of the alternatives that improve the channel would improve navigation efficiency while avoiding and minimizing environmental impacts to the greatest extent possible during the 50-year period of analysis, the plan with the greatest net excess benefits is considered the most complete, efficient, and effective plan. Therefore, Alternative F1-d, the 52-foot deep channel with no additional widening, is the plan that best meets the four P&G criteria. It is also the environmentally preferable alternative because it is the most efficient alternative in terms of minimizing damages to the biological and physical environment while providing the maximum economic benefit for the general welfare of the Nation.

5.5 PLAN SELECTION

Alternative F1-d (deepening the channel to –52 feet MLLW) is the Recommended Plan. This alternative was evaluated and determined to be economically justified, environmentally acceptable, and complete. The costs including interest during construction (IDC), NED Average Annual Equivalent (AAEQ) benefits, and BCR for the Recommended Plan are presented in Table 5-5.

5.5.1 NED Benefits

NED Benefits were calculated in HarborSym and were based on reductions in transportation costs generated for more-efficient vessel transportation and less restrictions on transit of larger oil drilling rigs. The proposed channel improvements are in response to the need for deeper access by allowing the existing fleet to load more fully and for the introduction of larger vessels, including oil drilling rigs.

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Table 5-4. Comparison of P&G Evaluation Criteria

Alternative Number	**No Action (F-4)**	**F-1a**	**F-1b**	**F-1c**	**F-1d (Recommended Plan)**	**F-2a**	**F-2b**	**F-2c**	**F-2d**	**F-3a**	**F-3b**	**F-3c**	**F-3d**
Criteria	**Future Without-Project (FWOP)**	**Deepen to 45 feet**	**Deepen to 48 feet**	**Deepen to 50 feet**	**Deepen to 52 feet**	**Deepen to 45 feet/ widen to 300 feet**	**Deepen to 48 feet/ widen to 300 feet**	**Deepen to 50 feet/ widen to 300 feet**	**Deepen to 52 feet/ widen to 300 feet**	**Deepen to 45 feet/widen to 350 feet**	**Deepen to 48 feet/widen to 350 feet**	**Deepen to 50 feet/ widen to 350 feet**	**Deepen to 52 feet/ widen to 350 feet**
Acceptability (meets all laws, regulations and guidance)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Completeness (provides and accounts for all necessary investments or other actions to ensure the realization of the planning objective)	No Action is an incomplete solution to all planning objective	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is more complete than lesser plans and has the highest net excess benefits of alternatives evaluated; but may not maximize transportation benefits are still rising and deeper plans were not evaluated.	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an more complete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives, including the Recommended Plan	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives	Plan is an incomplete solution; it provides some improvement in navigation efficiency over No Action but does not maximize transportation benefits when compared to other alternatives including the Recommended Plan
Efficiency (extent to which an alternative plan is the most cost effective means of achieving the objective)	No Action does not address the planning objective	Less costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	Less costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	Less costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	Cost-effective; achieves objective; net excess benefits may not be maximized but are greatest of alternatives evaluated; Sponsor indicated this plan is LPP	Less costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	More costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	More costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	More costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	More costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	More costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	More costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan	More costly than Recommended Plan but does not address objective as effectively; net excess benefits are not maximized and are less than the Recommended Plan
Effectiveness (extent to which the alternative plans contribute to achieve the planning objective)	Ineffective for improving navigational efficiencies	Not as effective as Recommended Plan for improving navigation efficiency	Not as effective as Recommended Plan for improving navigation efficiency	Not as effective as Recommended Plan for improving navigation efficiency	Most effective plan for improving navigation efficiency when compared to alternatives evaluated; Sponsor has indicated this plan is the LPP	Not as effective as Recommended Plan for improving navigation efficiency	Not as effective as Recommended Plan for improving navigation efficiency	Not as effective as Recommended Plan for improving navigation efficiency	Effective for improving navigation efficiency	Not as effective as Recommended Plan for improving navigation efficiency	Not as effective as Recommended Plan for improving navigation efficiency	Not as effective as Recommended Plan for improving navigation efficiency	Effective for improving navigation efficiency

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Table 5-5. Economic Summary for Plan Selection
(October 2012 price levels, 3.75% interest)

First Cost of Construction	$193,950.0
IDC	$9,824.0
Total Investment	$203,774.0
Total AAEQ Cost	$10,586.4
AAEQ Benefits	$19,873.8
Net Excess Benefits	$9,287.4
BCR	1.9

It is not known if Alternative F1-d is the NED plan that maximizes the net excess benefits because the net excess benefits were still increasing with deeper channel dimensions and a deeper alternative was not included in the Final Array of alternatives. However, Alternative F1-d was the most cost effective of the Final Array of alternatives considered and the deepest channel dimension that the non-Federal sponsor would support at this time. Therefore, Alternative F1-d, deepening the channel to 52 feet with no widening, is considered the Recommended Plan.

The Final Screening determined that Net Excess Benefits would be $9.3 million. The project would be economically justified with a BCR of 1.9.

5.5.2 Categorical Exemption

For a navigation project, if a plan with lesser benefits is preferred by the sponsor due to financial constraints, guidance allows for a categorical exemption to be granted and this lesser plan to be selected as the Recommended Plan. The USACE guidance requires that the NED plan be recommended unless there are believed to be overriding reasons favoring the selection of another alternative. Planning guidance (ER 1105-2-100) states that if the non-Federal sponsor identifies a financial constraint due to limited resources, and if net benefits are increasing as the constraint is reached, a categorical exemption may be granted and the constrained plan recommended. Categorical exemptions for plans that are lesser projects than the NED plan are cost shared on the same basis as the NED and become a federally supportable plan.

Prior to completion of the economic analysis for the study, and without model results and benefit comparisons, the non-Federal sponsor assumed 50 feet would be the optimum channel depth based on traffic and available non-Federal funding. Therefore, the depth of 50 feet was chosen by the sponsor believing it would satisfy the needs of their users and remain within their future proposed budgets. After total TSP alternative analysis was completed, the economic analysis revealed that the net excess benefits continued to increase at 52 feet with a cost significantly less than originally anticipated by the non-Federal sponsor. Rather than have a Locally Preferred Plan to remain at 50 Feet and result in fewer benefits, the non-Federal sponsor agreed that

acceptance of this deeper 52 Feet channel improvement through categorical exemptions was in the best interest of the Port and National economic development.

In this study's selection of the Recommended Plan, the sponsor has indicated a preference of the 52-foot alternative due to cost restraints. This plan is a justified plan in an array of alternatives in which it is not known if the NED benefits have been maximized. Had alternatives deeper than 52 feet been evaluated and net excess benefits decreased, it would have indicated that the 52-foot alternative was the NED plan. However, because no evaluation deeper than 52 feet was performed, the 52-foot alternative was not identified as the NED plan. This alternative still meets the policies for the high-priority outputs and has greater benefits than the smaller scale plans (see Table 5-3). Since the 52-foot plan is the sponsor's preference due to financial constraints and fits all of the criteria regarding categorical exemptions for navigation projects, this plan has been identified as the Recommended Plan. The economic analysis indicates that the NED is 52 feet deep or deeper; therefore, cost sharing would be the same as if it was the identified NED plan.

5.5.3 Least Cost Disposal Alternative

Placement options were evaluated to determine the best disposal alternative for all material, both new work and O&M. These alternatives considered possible beneficial use of dredged material, as well as traditional PAs.

5.5.3.1 Beneficial Use Opportunities

Section 2037 of WRDA 2007 amended Section 204 of WRDA 92 dealing with regional sediment management. Section 204 states that a regional sediment management plan shall be developed by the Secretary of the Army for sediment obtained through the construction, operation, or maintenance of an authorized Federal water resources project. The purposes of using sediment for the construction, repair, modification, or rehabilitation of Federal water resource projects are to reduce storm damage to property; to protect, restore, and create aquatic and ecologically related habitats, including wetlands; and to transport and place suitable sediment.

During the Feasibility study, a conceptual sediment budget was developed (HDR, 2008) and the beneficial use of the dredged material was investigated. New work construction would yield primarily clay sediments, which are suitable for dike construction or marsh restoration. New work material from the Main Channel would be stockpiled within the existing PAs and used for future incremental dike raisings. No marshes in need of clay material for restoration were identified near the project area. New work material from the Entrance and Jetty Channels would be placed at the New Work ODMDS; sediments to be dredged would be overwhelmingly clay and would not be suitable for placement at the nearshore Feeder Berm, which was designed to receive sandy sediments.

The potential for beneficial use of maintenance material from the new project was also investigated. Shoaled sediments from the majority of the Main Channel (Stations 11+000 to 89+500) are expected to be primarily clay and silt. No marsh areas that would benefit from these sediment types have been identified near the project area. Maintenance dredging of the eastern end of the Main Channel (Stations 0+000 to 11+000) and the entire Jetty and Entrance Channels are expected to be primarily sand with some silt, suitable for use in the nearshore Feeder Berm. Sandy material deposited in this nearshore berm is redeposited by cross-shore and longshore currents on the shoreline of South Padre Island, decreasing shoreline erosion. Sandy materials could also be used to nourish eroding beaches fronting the City of South Padre Island; however, beach placement is not a least-cost plan. The incremental difference between the cost of normal placement into the Feeder Berm and the cost to pump material directly onto the beach must be provided by a non-Federal sponsor. In the past, the City of South Padre Island has participated in paying the incremental cost to place the material directly onto the beach at South Padre Island. This incremental cost has been about $2 to $3 million per dredging cycle.

5.5.3.2 Screening for Least Cost Plan

Based on the possible beneficial use options identified above, several alternative placement plans were considered for the material from Station –17+000 to 11+000. This reach includes the Entrance Channel Extension, Entrance Channel, Jetty Channel, and a portion of the Main Channel. This reach is primarily sandy material that would be suitable for placement in the Feeder Berm, the current least-cost disposal plan for maintenance material. Another option for this material would be placement into the Maintenance ODMDS, which is located directly adjacent to the channel extension. However, the Maintenance ODMDS has been designated for material only from the Entrance and Jetty Channels. This designation prevents material from Station 0+000 to 11+000 (part of the Main Channel) to be placed in the Maintenance ODMDS. Placement of the material from Station 0+000 to 11+000 is limited to the Feeder Berm because of the lack of capacity in the nearby upland PAs.

Additional advance maintenance (AM) was considered to allow channel dredging cycles to be combined in order to save mobilization and demobilization costs that occur with each dredging contract. Currently 2 feet of AM is included in the channel improvement design for this reach. AM greater than the 2 feet would result in stability issues for the channel, so this option was disregarded from further consideration.

Table 5-6 presents the quantifiable costs and dredging cycles for the two remaining placement options: Placement Plan 1 (Maintenance ODMDS and Feeder Berm) and Placement Plan 2 (Feeder Berm).

Use of Placement Plan 2 rather than Placement Plan 1 provides an economically and environmentally balanced, sustainable solution for life cycle sediment management for the BIH

Project. While life-cycle maintenance dredging costs for Placement Plan 1 are essentially equivalent to Placement Plan 2, environmental benefits of Placement Plan 2 make it the optimal sediment management solution.

Table 5-6. Alternative Placement Plans

Stationing	Placement Location	Dredging Cycle (years)	Average Annual Costs
Placement Plan 1			
Sta. –17+000 to 0+000	Maintenance ODMDS	1.5	$6,246,000
Sta. 0+000 to 11+000	Feeder Berm	4.5	
Placement Plan 2			
Sta. –17+000 to 0+000	Feeder Berm	1.5	$6,387,000
Sta. 0+000 to 11+000	Feeder Berm	4.5	

Environmental benefits are achieved by regularly placing material trapped by the channel extension back into the littoral system through the use of the Feeder Berm. The material is then available for cross-shore and longshore sediment transport to South Padre Island. This improves environmental stewardship, while improving relationships with area stakeholders on South Padre Island, where shoreline erosion has averaged 18 feet per year. Placing material into the Maintenance ODMDS removes the material from the littoral system and keeps it from nourishing the shoreline.

In addition, the Feeder Berm option (Placement Plan 2) has the potential to reduce life cycle costs because sediments from the Entrance and Jetty Channels are placed farther upcurrent from the channel than the Maintenance ODMDS option (Placement Plan 1). The current Entrance Channel terminates at the southwest corner of the Maintenance ODMDS, with the majority of this ODMDS offshore of the current channel limits. For the Recommended Plan, the Entrance Channel Extension would extend the channel along the Maintenance ODMDS's southern limit. The Maintenance ODMDS site is dispersive in nature; material is generally moved away from the site by the Gulf current within a few weeks to months. While the current flows from south to north most of the time, storms and seasonal reversals sometimes result in the current moving from north to south. If maintenance materials are present at the ODMDS site when the current reverses, they could move back into the channel. The historic dredging records used to establish this study's channel shoaling rates include the current practice of Feeder Berm use for placement of all of the material from the Jetty and Entrance Channels. The Maintenance ODMDS has not been used in more than a decade. Therefore, any increase in shoaling due to the periodic reverse in current flows from north to south has not been accounted for using the recent historic records. Use of the Maintenance ODMDS with the future channel alignment could potentially increase channel shoaling and maintenance costs.

Because of uncertainties described above and the fact that these average annual costs for the two placement plans are nearly identical, these plans' costs are considered equivalent. Therefore, Placement Plan 2, the Feeder Berm option, is the preferred solution because it is the least-cost, environmentally preferable plan.

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6 RECOMMENDED PLAN

The Recommended Plan for navigation improvements for BIH has to be responsive to local needs and desires as well as the economic and environmental criteria established by Federal and State law. To do this, the plan must be able to handle current and forecasted vessel traffic safely with minimum impact on the environment. Subsequent paragraphs outline the plan design, construction, and O&M procedures.

The USACE decision making for the selection of a Recommended Plan begins at the District level and continues at the Division and Headquarters levels through subsequent reviews and approval. For congressionally authorized projects, the final agency decision maker is the Secretary of the Army through the Assistant Secretary of the Army for Civil Works.

The Recommended Plan is identified as Alternative F-1d, deepening of the channel to 52 feet without channel widening, which includes the least-cost disposal option. The least-cost dredging disposal plan includes the beneficial use of maintenance material from the Jetty and Entrance Channels and the first 11,000 feet of the Main Channel for placement into the offshore Feeder Berm (PA 1A). No environmental mitigation would be required for the Recommended Plan as it would result in only negligible environmental impacts. The Recommended Plan meets the objective of this study while avoiding all constraints previously presented in Section 4.

6.1 PLAN COMPONENTS

Table 6-1 presents the depths of the Recommended Plan by stationing. Figures 6-1 through 6-3 show the channel plan with PAs. No widening of the BIH Channel is proposed. The Entrance and Jetty Channels from Station –17+000 to 0+000 would be deepened to a depth of –54 feet MLLW. This additional 2 feet of depth is to allow for the effects of vessel pitch, roll, heave, and yaw occurring as a result of strong currents, waves, and wind. From Station 0+000 to 84+200, the channel would be deepened to a depth of 52 feet. From Station 84+200 to 86+000, the existing channel is 42 feet deep. In this reach, there are oil docks as well as the TransMontaigne Dock, which brings in petroleum products. There is no forecast change in the design drafts of vessels using the channel in the future so no deepening is proposed for this reach. There will be a transition from the 52-foot depth to the 42-foot depth in this reach. The channel would be maintained at a depth of –36 feet MLLW from Station 86+000 to the end of the Turning Basin including a transition from a depth of 42 to 36 feet, as ships would have been light-loaded or unloaded before entering the basin.

Table 6-1. Channel Depths of Recommended Plan

Stations		Recommended Plan Depth	Existing Channel Depth
From	To		
–17+000	–13+000	54	Beyond Existing Channel
–13+000	0+000	54	44
0+000	84+200	52	42
84+200	86+000	42	42
86+000	End of Turning Basin	36	36

6.1.1 New Work Construction

Under the first construction contract, a hopper dredge would be used to construct the Entrance and Jetty Channels, with a total length (after extension of the Entrance Channel) of 3.2 miles. Although the authorized depth of the offshore channels would be 54 feet, the potential dredging depth of the Entrance and Jetty Channels could actually be 58 feet, after accounting for 2 feet AM and 2 feet allowable overdepth (AO). One hopper dredge would be operated continuously for an estimated duration of 7 months to remove approximately 2.1 MCY of new work material from the Entrance and Jetty Channels. It is estimated that six subsequent contracts would be awarded for cutterhead suction dredging of the Main Channel through Station 84+200 for a total length of 15.9 miles. The remainder of the channel (the Turning Basin Extension and Turning Basin) would remain at existing depths. The authorized depth for the inland Main Channel would be –52 feet MLLW, but the potential dredging depth could actually be –55 feet MLLW, after accounting for 2 feet AM and 1 feet AO. Two or three cutterhead dredges would be working simultaneously to remove approximately 12.0 MCY of new work material over an estimated 29 months. This dredging would be performed concurrently with the hopper dredge contract for the Entrance and Jetty Channels, resulting in a total construction duration of 29 months.

6.1.2 Dredged Material Management Plan

A summary of dredged material placement is presented below with a more detailed DMMP for the Recommended Plan being included in Appendix M of this report.

6.1.2.1 New Work Placement

New work material from channel deepening would be distributed among the existing New Work ODMDS and upland confined PAs as shown in Table 6-2. All of the material from the Entrance and Jetty Channels (Station -17+000 to 0+000) would be placed at the existing New Work ODMDS (U.S. Environmental Protection Agency [EPA], 1991). This site is located in a dispersive offshore environment and has unlimited capacity. It is located approximately 4 miles from shore in 60 to 70 feet of water. The 350-acre site is large enough to contain all new work material that would be placed there during construction.

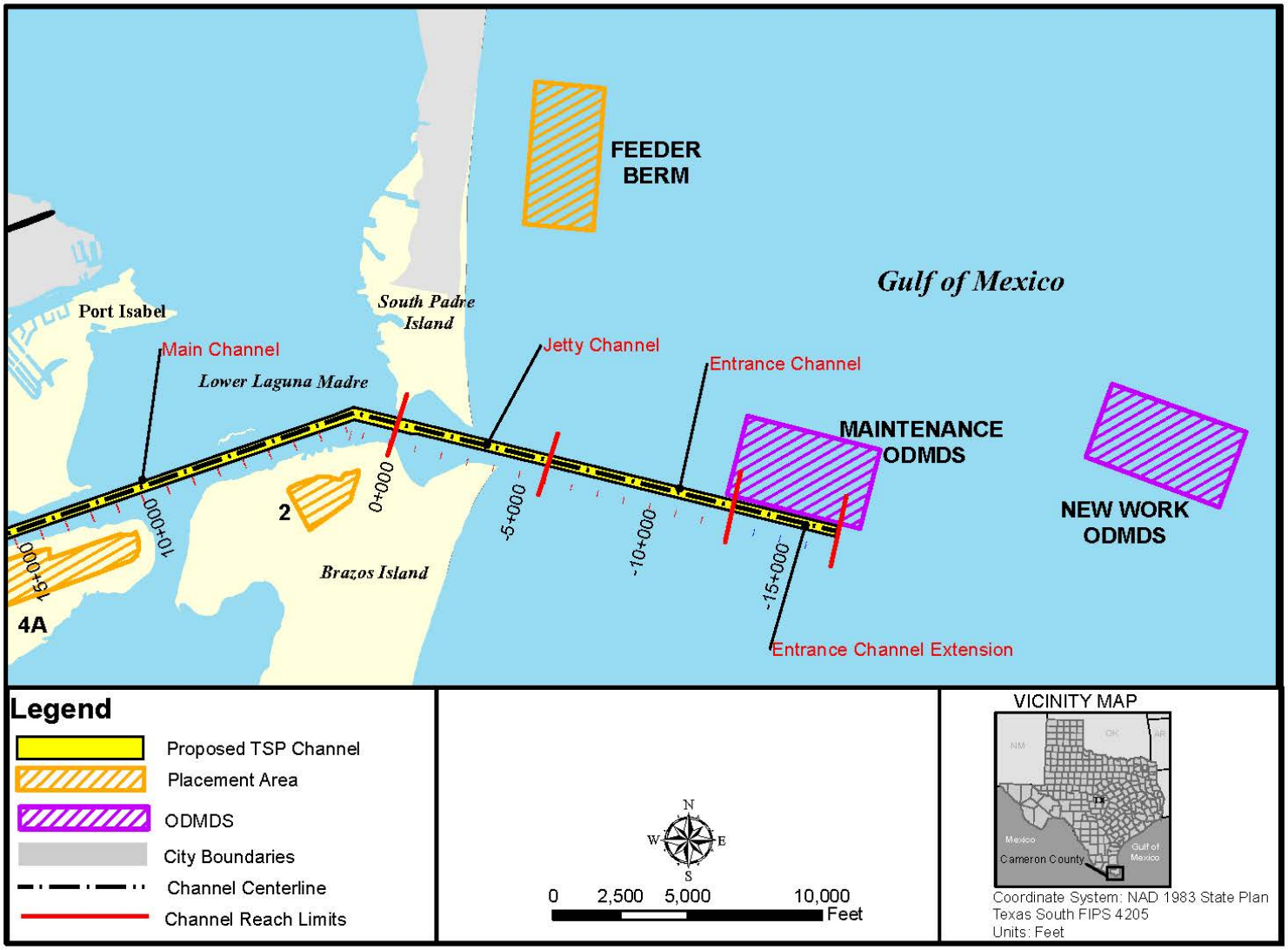

Figure 6-1. Recommended Plan - Entrance Channel Extension to Main Channel

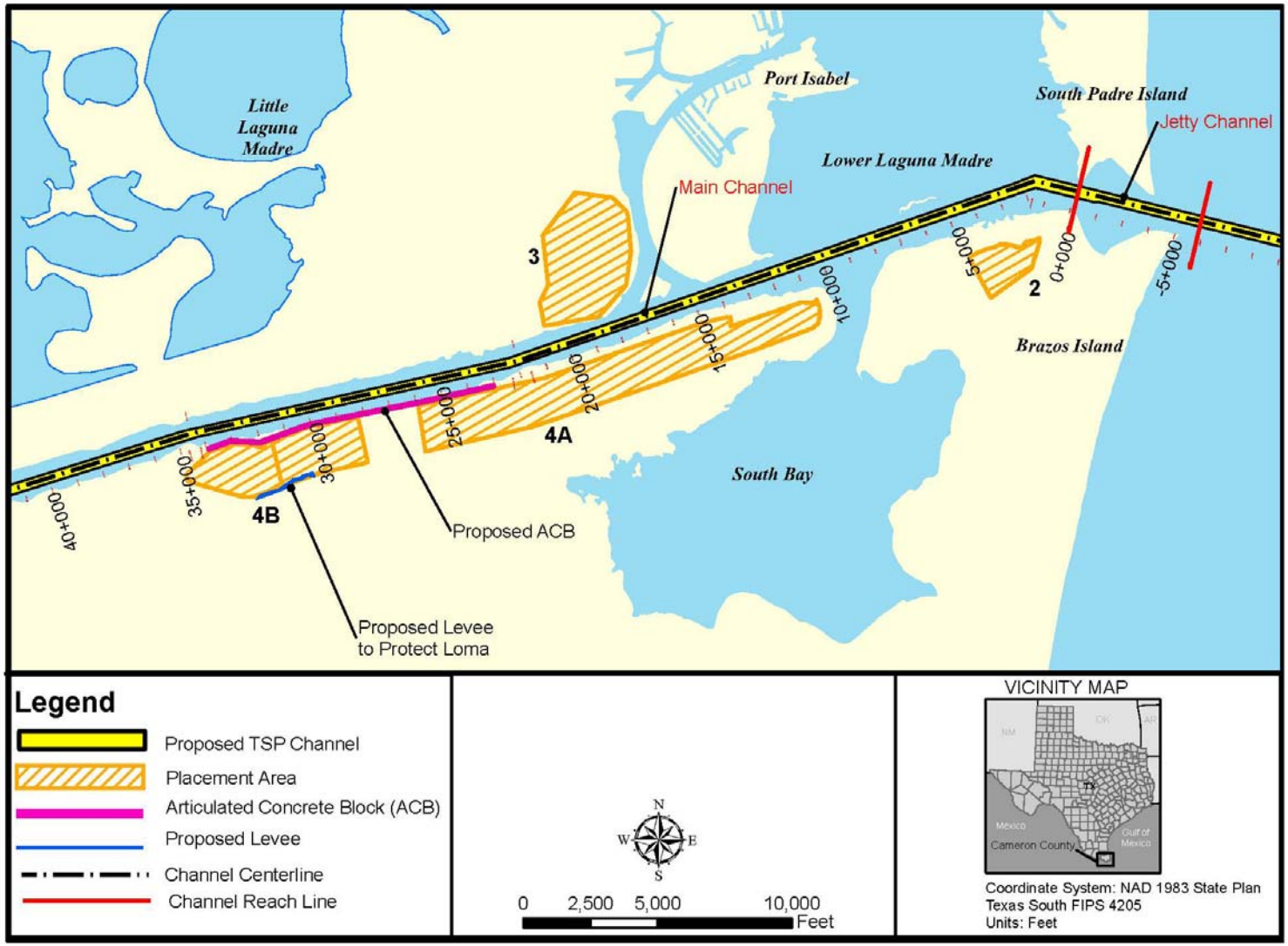

Figure 6-2. Recommended Plan - Jetty Channel to Main Channel

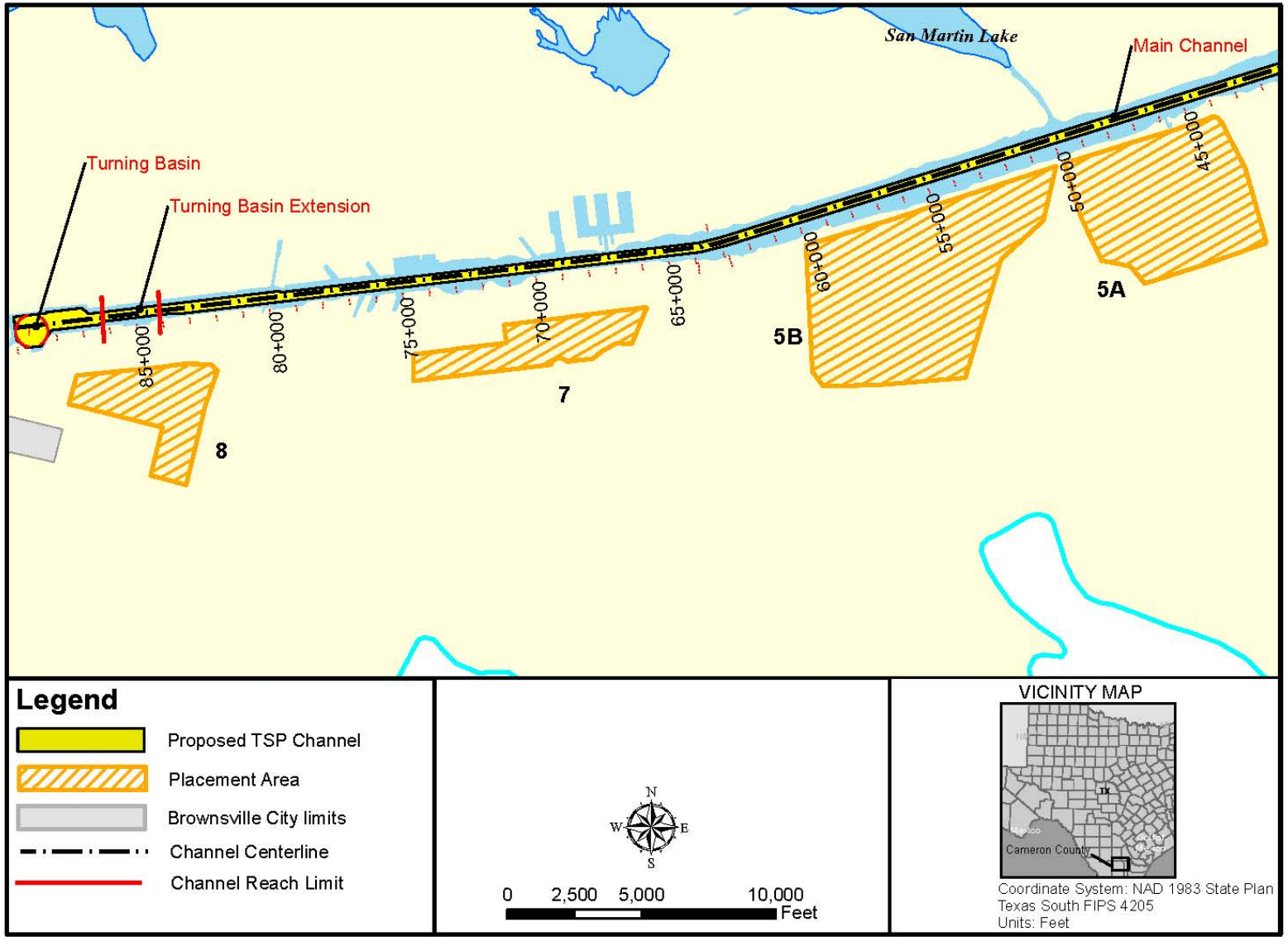

Figure 6-3. Recommended Plan – Main Channel to Turning Basin

Table 6-2. Recommended Plan –
New Work Quantities & Placement Area Dike Elevations

Channel Stations		PA Location	Current PA Size (acres)	Deepening Dredge Quantity (MCY)	Existing PA Dike Elevation in Feet (NAVD88*)	New Work Dike Elevation in Feet (NAVD88)
–17+000	0+000	New Work ODMDS	350	2.1		
0+00 0	7+000	2	71	0.9	27	36
7+000	25+000	4B	243	2.7	7	19
25+000	50+000	5A	704	3.6	6	12
50+000	70+000	5B	1,020	2.6	12	15
70+000	82+000	7	257	1.8	20	26
82+000	89+500	8	288	0.4	22	25
Total New Work Dredging Volume				14.1		

*NAVD = North American Vertical Datum

New work material from the Main Channel (Stations 0+000 through 84+200) would be pumped from the dredges through a combination of fully submerged and floating hydraulic pipelines into existing upland confined PAs owned and managed by the BND (PAs 2, 4B, 5A, 5B, 7, and 8). In addition, new work material may be placed in PA 3, a PA managed by the San Benito Navigation District and generally used for Port Isabel Channel material. The clay new work material would be stockpiled and used to raise the PA 3 dikes for later, unrelated maintenance dredging of the Port Isabel Channel. Specific quantities going to PA 3 are unknown at this time; should PA 3 be utilized, quantities going to PA 2 and/or 4B would be reduced. None of the existing PAs would need to be expanded, and no new PAs would be needed. Construction to raise the containment dikes to heights needed to accommodate new work quantities would be done within the footprints of the existing PAs. The resulting elevations of the PA dikes for the new work placement activities are also shown in Table 6-2. They would range from a total elevation of 12 feet NAVD88 around PA 5A to a total elevation of 36 feet around PA 2.

The POB is responsible for dredging their docks for the channel improvements. It is expected that material from the deepening of dock facilities would be placed in PA 5A and/or PA 8. This dredging of port facilities is expected to be completed during the deepening of the channel at the same time as the adjacent channel improvement and is relatively small compared to the dredging of the Main Channel.

Erosion along the toes of the containment dikes in PA 4A and 4B have been noted historically. This erosion is a result of wind driven waves and ship wakes in the channel. Because of this situation, erosion protection is required at the toe of the PA 4A and PA 4B containment dikes to protect the long term stability. A preliminary proposal is to place articulated concrete mattresses (ACM) with underlying geotextile along the toes of the containment dikes and between the PAs

from about Station 22+000 to Station 34+000. The location of this proposed erosion protection plan is shown in Figure 6-2 and discussed in more detail in the Engineering Appendix.

Additionally, USFWS conservation recommendations require that all impacts to the lomas adjacent to PAs must be avoided, as they are potential habitat for endangered ocelots and jaguardundis. All lomas with the exception of the one in PA 4B are already isolated from adjacent PAs by existing dikes. The proposed dike around the loma at PA 4B would consist of a typical containment dike section continued along the edges of the loma in the PA. Figure 6-2 shows the location of the dike to protect the loma with the dike just skirts the edge of the loma resulting in 100 percent of the loma residing outside of PA 4B. During final design in PED, the dike location will comply with the USFWS' recommendation that the toe of the dike at its closest point will be no closer than 30 feet from the point at which land elevation begins to rise into the loma.

PA 4A is an existing PA that would not be used for new work material during construction; however, this site would be utilized for maintenance material during the 50-year period of analysis.

6.1.2.2 Maintenance Material Placement

Maintenance dredging would generally be conducted by hopper and cutterhead dredges, with material being distributed among a nearshore Feeder Berm or the existing Maintenance ODMDS, and upland confined PAs as shown in Table 6-3. Federal dredging quantities would increase approximately 14.0 percent over the existing project. Maintenance dredging would utilize the same PAs as those utilized for existing conditions, and the duration and frequency of dredging events would be within the range occurring under current conditions. Dredging of the Entrance and Jetty Channels and the first 11,000 feet of the Main Channel (–17+000 to 11+000) would generally be performed by a hopper dredge, and material would be placed in the nearshore Feeder Berm Site 1A, located between 1.5 and 2.5 miles from the North Jetty and from 0.4 to 0.9 mile from shore (USACE, 1988a). Sediment removed by maintenance dredging would therefore be regularly placed back into the littoral system, available for cross-shore and longshore sediment transport to South Padre Island. Monitoring of material placed at the Feeder Berm has demonstrated that it moves toward the beach and disperses, with the major movement being in the alongshore direction (McLellan et al., 1997; USACE, 1989). If for some reason the Feeder Berm cannot be used, maintenance material from the Entrance and Jetty Channels (Station –17+000 to 0+000) could be placed in the Maintenance ODMDS, which is located approximately 2.5 nautical miles from shore and north of the channel (USACE, 1975, 1999). The ODMDS and Feeder Berm are located in dispersive environments and have unlimited capacities.

Table 6-3. Recommended Plan – Operations & Maintenance Quantities and Placement Area Dike Elevations

Channel Stations		Shoaling Rate (cy/yr)	PA	Size (acres)	Dredge Cycle (years)	Number of Cycles in 50 years	Quantity per Cycle (cy/Cycle)	Total O&M Quantity in 50 years (MCY) (rounded)		Total Dike Elevation in 50 years (feet NAVD88)
–17+000	0+000	470,630	Nearshore Feeder Berm Site 1A	320	1.5	33	706,000	23.3		N/A
0+000	11+000	161,595			4.5	11	727,000	8.0		N/A
11+000	28+000	183,995	4A	469	4	12	736,000	8.8		35
28+000	34+000	43,047	4B	243	4	12	172,000	2.1		24
34+000	50+000	123,527	5A	704	4	12	494,000	5.9		17
50+000	65+000	143,577	5B	1,020	5	10	718,000	7.2		19
Non-Federal Permit Dredging					5	10	831,000		6.7	
65+000	79+000	98,637	7	257	6	8	586,000	4.7		38
Non-Federal Permit Dredging					6	8	415,000		3.3	
79+000	89+500	30,377	8	288	7	7	241,000	1.7		28
Non-Federal Permit Dredging					6	8	415,000		3.3	
				Total Federal Channel O&M Dredging Volume				61.7		
				Non-Federal Permit Dredging Volume					13.3	
				Total Dredging Volume				75.0		

With regards to maintenance dredging over the 50-year period of analysis, the Port is also responsible for the cost of maintaining their facilities. It is expected that these facilities will be dredged at the same time as the adjacent reach of channel, if needed. The Port would pay the incremental costs of the facilities dredging, and for construction of placement area capacity (dike raising) for placement of maintenance material. The landlocked reaches of the channel where the Port facilities are located do not have high rates of shoaling. Additionally, the banks of these facilities are basically hardened (sheet piling, etc.) and there is very little erosion and most likely even less shoaling is expected within the dock area. Overall, the quantity of material to be removed at the Port facilities is negligible when compared to the maintenance dredging of the main channel and can easily be included within the PAs without any additional dike raises being needed to accommodate the dock material. This maintenance dredging of port facilities is expected to be completed at the same time as maintenance of the adjacent channel reaches.

Maintenance material from the remainder of the Main Channel (Stations 11+000 through 89+500) would be placed in existing PAs 4A, 4B, 5A, 5B, 7, and 8. Upland PAs and containment dikes are sized to accommodate total quantities over the 50-year period of analysis. None of the existing PAs would need to be expanded, and no new PAs would be needed. Construction to raise the containment dikes to heights needed to accommodate the 50-year maintenance quantities would be done within the footprints of the existing PAs using material stockpiled during new work construction. Dikes would be raised incrementally as needed to contain material from each maintenance cycle. An additional 13.3 MCY of material is expected to be placed in the PAs over the 50-year period of analysis from non-Federal dredging to maintain the port facilities. The resulting elevations of the PA dikes for the 50-year Dredged Material Management Plan (DMMP), including the non-Federal dredging quantities, are also shown in Table 6-3. They range from a total elevation of 17 feet NAVD88 around PA 5A to a total elevation of 38 feet around PA 7.

6.1.3 Environmental Impacts

Environmental impacts of the Recommended Plan are fully described in Section 7.0. The Recommended Plan would result in no significant environmental impacts and therefore no mitigation is required. Project impacts would be associated with dredging and placement activities, but these impacts are primarily minor and temporary. Hopper dredging during construction of the Jetty and Entrance Channels could adversely affect threatened and endangered sea turtles; however, these effects would be minimized by the adoption of RPMs developed in consultation with NMFS. The special authority regarding Bahia Grande, contained in the FY 2003 Omnibus Appropriations Bill, states that the Chief of Engineers shall provide credit to the BND for work it performed to restore the wetlands of the Bahia Grande, Lower Laguna Madre, and Vadia Ancha, and apply that credit to wetland impacts from this proposed

project. Since no wetland impacts are expected with construction of the Recommended Plan and no mitigation is required, the actions required by this authority are not needed.

6.2 DETAILED COST ESTIMATES (MCACES)

6.2.1 Cost Estimate

Based on planning level benefits and costs as presented in the Plan Selection section above, Alternative F-1d, deepening of the channel to 52 feet without channel widening, has been identified as the Recommended Plan. A detailed cost estimate for the Recommended Plan has been developed using the Micro Computer Aided Cost Engineering System (MCACES). These costs include associated non-Federal costs for berth and dock modifications that would be needed for use of the deeper channel and any lands, easements, rights-of-way, and relocations (LERRs).

The Berthing and Dock Modifications costs of $47,257,000 in Table 6.4 include dredging costs to deepen the dock areas, as well as the costs to improve the facilities (including site preparation, sheet piling and concrete work). The Port has provided a letter of commitment for the improvements of the berths and docks. The Port will pay the additional incremental cost to place this material removed from their facilities into the PAs, which includes the cost of dike raises. The non-Federal Sponsor provided these associated costs for the improvement project. The docks to be deepened include Oil Docks #3 and 5, Cargo Docks #15 and 16, and the Liquid Cargo Dock. The costs to improve these facilities are based on a recent cost of constructing a shallower dock along the BSC which was extrapolated to allow for the deeper facilities needed for the improved channel. Overall, the costs for disposing of non-Federal berthing area dredge material is insignificant compared to the project disposal costs, and the 50-year maintenance dredging will be minimal. Historical practice dictates that costs for disposing of non-Federal berthing area dredged (new work and operations and maintenance) materials are paid for by the POB as options during Invitation For Bids (for the Main Channel).

As detailed in Appendix B, the Alternative F-1d construction cost (including PED and aids to navigation [ATON]) would be $251,952,000 (Table 6-4). The fully funded costs of the project would be $279,817,000.

The MCACES estimate of first costs for construction of the Recommended Plan includes a narrative, a summary cost, and a detailed cost showing quantity, unit cost, and the amount for contingencies for each cost item. The costs of the non-construction features of the project are also included in the cost estimate. The costs have been prepared for an effective date of October 2013.

Table 6-4. MCACES Costs for Recommended Plan
($ in 1,000s rounded with October 2013 Price Level)

Cost Account	Item Description	First Cost ($)	Fully Funded Cost ($)
General Navigation Features (GNF)			
01	Lands and Damages	11	12
12	Navigation Ports and Harbors	169,820	186,296
30	Engineering and Design	21,719	25,133
31	Construction Management	13,032	15,869
GNF Total		**204,582**	**227,310**
non-Federal (LERRs/Associated) Costs			
01	Lands	5	5
12	Berthing and Dock Modifications	47,257	52,384
non-Federal Cost Total		**47,262**	**52,389**
Other Federal Cost			
12	ATON	108	118
Other Federal Cost Total		**108**	**118**
Total Navigation Costs		**251,952**	**279,817**

The USCG would be responsible for providing and maintaining navigation aids. Costs for modifications to ATON have been estimated by USACE and included in the project cost estimate, and coordination has been initiated with the USCG to obtain an estimate from that agency. Modifications are expected to be minor, and any difference in cost is not expected to significantly affect the BCR. A relatively small amount of cost is identified in the MCACES estimate to cover miscellaneous incidental costs for coordination with the USCG during and post construction.

6.2.2 Project Schedule and Interest During Construction

IDC accounts for the opportunity cost of expended funds before the benefits of the project are available and are included among the economic costs that comprise NED project costs. The amount of the pre-base-year cost equivalent adjustments depends on the interest rate; the construction schedule, which determines the point in time at which costs occur; and the magnitude of the costs to be adjusted. The current construction schedule assumes authorization of the project in a future WRDA. Assuming Congress provides funding subsequent to authorization of the project in that future WRDA, the proposed schedule of activities would follow, resulting in benefits starting in the base year 2021 for the proposed project. The IDC was computed with the October 2013 interest rate of 3.5 percent. Total construction duration is assumed to be 29 months. The following is the schedule for construction that was used in computing the IDC (Table 6-5).

Table 6-5. Construction Schedule

CONTRACT	PAs Used	DURATION (Months)	START DATE	END DATE
1	ODMDS	7	October 2017	April 2018
2	4B, 5A	15	October 2017	December 2018
3	7, 8	13	October 2017	October 2018
4	5A	16	February 2018	May 2019
5	2	6	February 2018	July 2018
6	4B	11	January 2019	November 2019
7	5B	12	March 2019	February 2020

6.3 DESIGN AND CONSTRUCTION CONSIDERATIONS

This project consists of noncomplex engineering measures such as channel dredging, earthen dike construction, and minor bank stabilization. Sufficient information is available from channel borings to adequately characterize the material to be encountered during dredging; new construction is expected to encounter clay and sand sediments. Geotechnical investigations, conducted over the majority of the project area, are sufficient for feasibility-phase planning and adequately characterize foundation conditions and soils that would be used for dike construction. Existing channel stationing would be maintained for the new project, with the addition of stationing for the 0.75-mile channel extension. The effects of RSLR on the channel and PAs have been taken in account in conformance with guidance. Little to no impact is expected over the 50-year period of analysis because elevations in uplands adjacent to the channel exceed the highest projected RSLR. The Engineering Appendix includes all design, geotechnical, and hydrologic modeling information, surveys, and plates in greater detail and is available upon request.

6.3.1 Value Engineering

A Value Engineering (VE) study was performed to identify potential savings of project costs and increase the BCR of the final plan. The VE study was performed after the ship simulation and rig geometric analysis so it was based on the preliminary results from those studies and limited to a plan for deepening the channel to 50 feet and widening to 350 feet. The recommendations for design changes from the VE study were applied to the other channel depths or widths that were evaluated in the Final Array.

The VE study resulted in three alternative suggestions:

- VE-1 – Only widen the channel to 300 feet from Station 28+000 to 79+415 in lieu of 350 feet;

- VE-2 – Only deepen the channel to 48 feet from Station 84+200 to the end of the Turning Basin in lieu of 50 feet; and
- VE-3 – Do not deepen the Turning Basin.

VE-2 and VE-3 suggestions have been incorporated into the design of the channel improvements presented in this report. VE-1 was rejected due to the need for the width based on design vessels evaluated at that time in the study process. Slight variations in the VE alternatives' stationing was made to ensure adequate deepening to port facilities that need the improved channel based on economic analysis.

6.3.2 With-Project Sea Level Rise

BIH is a very long channel with no additional sources of inflow, making it lack hydrodynamic complexity. This simplifies the sea rise level analysis, and modeling was therefore not required. Modeling was done to examine surge impacts from the project, which were minimal, and any additional impacts from RSLR on surge are again expected to be insignificant. The RSLR rates for the area, based on the tidal record analysis, are relatively low with rates for "low," "intermediate," and "high" being 0.6 foot, 1.1 feet, and 2.4 feet, respectively, over the 50-year period of analysis. The historic average rate for the project area is about 1.26 feet per 100 years according to NOAA Mean Sea Level trends using the Port Isabel, Texas, tide gage (NOAA, 2013a). Recommendations based on the results of the sea level rise analysis are:

1. RSLR of 2.0 to 2.5 feet needs to be considered in the shoaling analysis for future project considerations, or a safety factor needs to be included to account for any additional shoaling that may be contributed by additional rise in sea level. However, the effect of sea level rise on shoaling is expected to be minimal.
2. Any PAs that require protection should be armored an additional 2.0 to 2.5 feet in elevation.

6.3.3 Storm Surge

A storm surge impacts analysis was performed by the Engineer Research and Design Center's (ERDC) Coastal Hydraulics Laboratory to determine potential changes (increases and/or decreases) in storm surge considering with-project and future O&M conditions (USACE, 2013b)**.** Storm surge simulations and analyses were used to quantify the impacts of BIH widening and/or deepening alternatives, as well as to estimate 50-year future conditions based on estimated PA dike elevations. A total of 14 synthetic storms and 1 historic storm (Hurricane Allen) were simulated to compute the difference in the peak water level between the existing and the 50-year project design conditions. Differences in storm surge found in the BIH region for the future condition compared to the existing condition range from 0.1 to 2.6 feet, with the majority of differences at the low end of this range. The largest increases in surge are generally on the southern side of the channel in unpopulated areas around PA margins. Changes in surge for the

project conditions depended greatly on the intensity of the storm and the angle of approach. Overall, storm surge modeling has identified only minor potential impacts.

6.3.4 Mean Lower Low Water Conversion

Historically, USACE–Galveston used the MLT datum for its navigation channels. This datum was recently converted to MLLW for consistency with other USACE Districts. MLLW datum was used for all quantity calculations during plan formulation. For the BIH conversion, on average, the MLT/MLLW difference is +0.31 foot. Because this difference was so small and it would have little to no effect on dredging quantities, the study addresses MLT as equal to MLLW for conversion from historic dredging records and drawings. Therefore, –42 feet MLT is considered equal to –42 feet MLLW. More detailed information relating to this conversion is included in the Engineering Appendix.

6.4 REAL ESTATE CONSIDERATIONS

BND is required to furnish the LERRs for the proposed cost-shared project. The real estate requirements must support construction as well as O&M of the project after completion. Specific details of the real estate requirements can be found Appendix C of this document.

6.4.1 Lands, Easements, and Rights-of-Way

The offshore portion of the BIH Channel will be dredged to a depth of 54 feet. This dredging will occur from Station –17+000 to 0+000. From Station 0+000 to 84+200 dredging will be to a depth of 52 feet. New work dredged material and all maintenance material for the project would be placed in existing PAs. The seven existing PAs have been provided through a 50-year easement, issued in 1994, from the non-Federal sponsor to the Federal Government. Perpetual easements conveyed to the Federal Government are needed to assure all project PAs, which are built for the purpose of supporting the Federal navigation projects, are available to the Government as often and for as long as they are needed to support the project. The Real Estate Plan (Appendix C) further details the real estate requirement concerning perpetual easements. The existing 50-year easements must be converted to perpetual easements prior to the first contract being awarded. The only LERRs expense that may be creditable to the project costs is the administrative fee to convert/extend the existing easement estate from a 50-year easement to a perpetual easement. No LERRs credit would be provided for lands made available for the project since lands were previously credited as LERRs for the past project improvements with Federal funds participation. No new LERRs are required for the construction/implementation of the Recommended Plan.

All of the proposed work would be performed within the existing right-of-way of the BIH project. Access for construction would be by barge from the channel or over existing access corridors. All land that would be crossed is owned by the non-Federal sponsor and is available

for this project. The channel itself, the two existing ODMDSs, and the Feeder Berm are within the navigable waters of the U.S. and are available to the Federal Government via navigation servitude.

6.4.2 Facility Removals/Deep-Draft Utility Relocations

The USACE currently requires pipelines located below deep-draft navigation channels be buried 20 feet below the authorized project depth of the channel (*Southwestern Division - Galveston District Operations Manual 1145-2-15*). This requirement was developed taking into consideration several factors, including geotechnical, hydraulic, navigation, maintenance dredging, and pipeline placement method considerations. Exceptions to this requirement can be granted on a case-by-case basis.

Two pipelines located within or near the proposed project area were identified and investigated. The first pipeline is a 4-inch gas gathering pipeline that runs parallel to the channel. It does not cross the channel or any of the PAs being used for disposal; therefore, it would not be affected by the project. The second pipeline is a 10-inch refined products pipeline crossing under the channel near Station 80+000 at a depth of –75 feet MLLW. This pipeline is currently at such a depth that the channel deepening to –52 feet MLLW would allow adequate coverage per engineering guidance and would not require removal or relocation.

6.5 OPERATIONS AND MAINTENANCE CONSIDERATIONS

The required maintenance dredging of the 52-foot channel would increase to approximately 1,258,000 cy/yr from the current 1,103,000 cy/yr for the 42-foot channel for a net increase of 155,000 cy/yr, approximately a 14.0 percent increase. The increase in maintenance dredging quantities over the 50-year period of analysis is 7.8 MCY. Details are included in Section 6.1.2. The incremental increase in O&M dredging, Disposal Area Management Practice (DAMP) work, and dike raising costs for the Recommended Plan is estimated to be $2,971,000 annually.

6.6 ECONOMIC ANALYSIS FOR RECOMMENDED PLAN

6.6.1 Economic Optimization

Once the Recommended Plan was selected, additional efforts were made to optimize the plan. Detailed economic analysis is presented in Appendix A – Economic Appendix. The future vessel fleet composition was updated. Based on interviews with the Pilots and end-users, the speed in the reaches was increased and the loading and unloading rates were updated for some vessel types. Vessel operating costs for the oil drilling rigs in the without-project condition were also updated to be more consistent with the cost to remove a semisubmersible rig's thrusters before entering the channel. The thruster removal cost was modified to calculate only the change between removal of thrusters in channel and at sea, decreasing the cost reduction from $15

million to $8 million. Additionally, due to the timing of the project, the base year of the project was deferred to 2021 to represent a more realistic start date. Benefits were calculated in 10-year increments, rather than the beginning, midpoint, and end of the period of analysis that was used in the plan selection. HarborSym model inputs were updated based on new information and additional model runs were performed. The AAEQ benefits at 3.5 percent after this optimization are $20,539,000 with a BCR of 1.5 (Table 6-6). Details of the optimization are included in Appendix A. The details of the benefits that include Section 6009 are provided in the 6009 addendum, the BCR is 6.4. Per Section 6009 Implementation Guidance, Keppel-AmFELS provided a statement of their certification to the data related to such benefits.

Table 6-6. Economic Summary of Recommended Plan
(Costs in $1,000s, (October 2013 price levels, 3.5% interest)

	Traditional Benefits	Benefits with Section 6009
First Cost of Construction	251,952	251,952
IDC	10,563	10,563
Total Investment	262,515	262,515
Average Annual Cost	11,192	11,192
Incremental Average Annual O&M	2,971	2,971
Total Annual Cost	14,163	14,163
Average Annual Benefits	20,539	90,804
Net Excess Benefits	6,376	76,641
BCR	1.5	6.4

6.6.2 Economic Sensitivities

In order to examine areas of risk and uncertainty, sensitivity analyses were conducted to use as a comparison of the degree of reliability of the estimated benefits of the alternatives with details included in the Appendix A. The first sensitivity assumed no growth in the commodities during the period of analysis. A 1 percent growth rate was used to grow the tonnage from 2011 to 2021, which is a reasonable assumption that there would be minimal continued growth over the next decade. However, the tonnage remains constant throughout the period of analysis. The annualized benefits for the no-growth sensitivity at 3.5 percent interest rates are $17,472,000 with a BCR of 1.2.

In the second sensitivity, the current vessel fleet mix and the resultant tonnage percentage associated with the fleet sizes were carried throughout the period of analysis, while incorporating the tonnage growth. The resultant annualized benefits at 3.5 percent are $11,060,000 with a BCR of 0.8.

In addition, sensitivity analyses were performed to present the range of large semi-submersible rig arrivals. Table 6-7 presents the results of these sensitivity analyses.

Table 6-7. Economic Summary of Large Semi-Submersible Rig Sensitivity
(October 2013 Price Levels, 3.5% interest rate, $ in 1,000s)

	No Large Semi-Submersible Rigs	Fewer Large Semi-Submersible Rigs	Higher Large Semi-Submersible Rig Operating Costs
Average Annual Benefits	13,218	15,484	27,291
Total Annual Cost	14,163	14,163	14,163
Net Excess Benefits	(945)	1,321	13,128
B/C Ratio	0.9	1.1	1.9

6.7 SUMMARY OF ACCOUNTS

As stated in Section 5, the Federal process incorporates four accounts to facilitate evaluation and display of effects of alternative plans. The four accounts are NED, environmental quality (EQ), regional economic development (RED), and other social effects (OSE). They are established to facilitate evaluation and display of effects of alternative plans.

6.7.1 National Economic Development Benefits

The NED account is required. Other information that is required by law or that would have a material bearing on the decision-making process should be included in the other accounts, or in some other appropriate format used to organize information on effects. The Federal Objective is to determine the project alternative with maximum net benefits while protecting or minimizing impacts to the environment.

The economic analysis used NED to measure the benefits of the Recommended Plan; regional shifts in economics are not expected as a part of the Recommended Plan. Additional efforts were completed to optimize the Recommended Plan as described previously in Section 6.6.1.

The NED account displays changes in the economic value of the national output of goods and services. Under this account, the 52-foot-deep channel demonstrates the highest net benefits of $6,376,100 with a BCR of 1.5 as presented above in Table 6-6. With the Section 6009 benefits included, the BCR is 6.4.

6.7.2 Environmental Quality

Adverse EQ effects of the Recommended Plan are negligible and there is no required fish and wildlife or cultural resource mitigation. Incidental positive EQ effects would occur with the beneficial placement of maintenance material at the nearshore Feeder Berm. These effects were evaluated under the EQ account and are detailed in Section 7.

6.7.3 Regional Economic Development Benefits

The RED account identifies changes in the distribution of regional economic activity. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population (ER 1105-2-100). With the value of the current 42-foot BIH channel to the region, it is expected that the Recommended Plan of deepening the channel would increase benefits to the region. During project construction, the study area would likely have an increase in construction employment and local purchases of construction materials, although this would be temporary. The primary economic bases of the study area include ship and rig repair operations, ship dismantling, marine cargo activity, and commercial fishing. As a result of the Recommended Plan, the positive economic effects to the study area would be moderate at the least and substantial at best.

6.7.4 Other Social Effects

OSE effects of the Recommended Plan would normally include effects to homeowners in the project area. However, this is not a concern for the BIH project since all lands adjacent to the channel are owned by the POB and already used for port-related activities. The types of activities that would occur at the POB in the future are not expected to change significantly.

6.8 RISK AND UNCERTAINTY

Risk and uncertainty is an important part of the USACE planning process and it is emphasized in Goal 2 of the USACE Campaign Plan, which is addressed in Appendix L. This goal expresses the USACE commitment to deliver enduring and essential water resource solutions, utilizing effective transformation strategies that develop and employ risk- and reliability-based approaches that evaluate the consequences of planning, design, construction, and management decisions.

Risk and uncertainty arise from measurement errors and the underlying variability of complex natural, social, and economic situations (Schultz et al., 2010; USACE, 2000). Risk is a potential adverse consequence that may or may not be realized in the future; it is often expressed as a probability of occurrence. Uncertainty reflects a lack of knowledge and is a measure of imprecision on economic, engineering, and environmental aspects of a plan or project. This study incorporated consideration of risk in the development and evaluation of alternatives by taking into account the likelihood and variability of physical performance, economic success, and residual risk.

6.8.1 Engineering Data and Models

Engineering analysis for BIH evaluated the array of alternative plans for impacts on hydrodynamics, storm surge, shoaling and sedimentation, shoreline erosion, navigation, and the

potential to exacerbate the effects of RSLR. This section discusses risk and uncertainty in the engineering analyses conducted to determine feasibility of deepening and/or widening the BIH channel.

6.8.1.1 Relative Sea Level Rise

The project must consider possible trends that affect the area. One trend that would impact the area is RSLR. Estimates of potential sea level rise were performed as required by EC 1165-2-212 (Sea-Level Change Considerations for Civil Works Programs). RSLR estimates are based on historical data. The degree of uncertainty and values vary considerably amongst the worldwide scientific community, and this issue will likely be debated and estimating methods possibly improved over time. This study uses current USACE sea level rise guidance as required for USACE studies which incorporates many studies on projected sea level rise and predicts most likely scenarios. To account for the unknowns in sea level rise USACE requires considering "high", "medium", and 'low" scenarios of sea level rise projections. The estimated values range from 2.4 feet for the "high" scenario to 0.63 feet for "low" estimate for BIH.

In order to assess possible impacts of sea level rise for the project the "high" value (worst case scenario) was evaluated and it was determined the "high" sea level rise scenario will not produce negative impacts on the existing or proposed project. It is unlikely rising sea levels will rise above the top of jetty elevation which would impact the functionality of the project. Upland PAs would be armored to withstand the effects of rising sea levels and the cost of this armoring is included in the total project cost estimate. Minor impacts in the project vicinity would likely occur due to RSLR, but not as a consequence of the proposed project. RSLR guidance and corresponding estimates may change by the time the project goes to PED. It is recommended that these estimates be updated and reanalyzed during PED.

6.8.1.2 Shoaling

Shoaling rates estimated for the proposed project are based on historical dredged quantities. Since survey data were not analyzed, this analysis assumes that all material that shoaled was dredged. This was not the case, causing the estimated shoaling rate to be lower than actual. Causes of shoaling and pathways of shoaled material can be complex. Actual shoaling rates could be more than 10 percent greater than calculated; this could cause a linear increase in O&M costs.

This shoaling analysis method does not include possible impacts from sea level rise or changes in ship traffic through the proposed channel. It is noted that large storms that come through, such as hurricanes, could alter the amount of shoaling in any given year. Site conditions and characteristics of adjacent water bodies such as Bahia Grande and South Bay may change before PED begins and any such changes should be evaluated for impacts to shoaling. It is recommended that shoaling rates be reassessed during PED with any additional data that is

available at that time. Additional dredging histories and survey data will be available and should be used to refine shoaling estimates for PED.

BIH is currently being studied by ERDC (including site monitoring and possible hydrodynamic/sedimentation modeling) under the Monitoring of Completed Navigation Projects (MCNP) program. Additional data and study results should increase understanding of shoaling and its causes in the BIH channel and project vicinity. This information could help determine ways to decrease shoaling and related costs. This data should be utilized to reevaluate shoaling estimates, reduce uncertainty of shoaling rates, and refine cost estimates during PED.

6.8.1.3 Hydrodynamics and Storm Surge

Typical Conditions. Hydrodynamics for the channel were modeled using an Adaptive Hydraulics two-dimensional model. Simulations were performed for several widening and deepening scenarios, and the results were used to evaluate project impacts. The model was not validated against field data; therefore, these model results should be applied qualitatively. The model does show that impacts from the selected alternative to discharges, water surface elevations, and velocities in the channel are negligible and should not require any additional modeling during the PED phase (USACE, 2012a).

Storm Conditions. USACE performed a sensitivity analysis to determine potential changes in storm surge with-project and future O&M conditions. Baseline storm surges used for the analysis were composed of the suite of storm surges produced from the Federal Emergency Management Agency (FEMA) Texas Joint Storm Surge Study (JSS). The FEMA Texas JSS used the Advanced Circulation model together with the ERDC Steady State Wave model to perform storm surge and wave simulations. A total of 14 synthetic storms and 1 historic storm was simulated on the existing conditions mesh and the with-project 50-year O&M mesh to compute peak differences between existing and with-project design conditions. Changes surrounding the with-project channel are generally small. An uncertainty and error analysis of the surge impact estimates was performed, which yielded a high degree of confidence for simulations and surge impact estimates. Comparing the USACE ERDC existing conditions data versus the FEMA JSSS existing conditions data determined a correlation co-efficient of 0.97 to 0.98. The calculated root-mean-square error was between 0.36 feet and 0.34 feet. These values provide a high degree of confidence for the ERDC project simulations. No additional surge modeling should be needed during the PED phase.

6.8.2 Economic Data and Models Analysis

Economic analysis was based on data from Waterborne Commerce Statistics Center from the USACE Navigation Data Center, the Pilots, the POB, and various end-users. Traffic forecasts were projected for the "most likely" scenario. Deepening and widening benefit calculations were made using the HarborSym Model, which has risk and uncertainty built into the program, as a

result of the Monte Carlo system. Any other risk and uncertainty is related to the inputs and assumptions used in the HarborSym Model. Sensitivity analyses were conducted to determine the sensitivity of projected benefits to changes in key assumptions, such as commodity tonnage, fleet distribution, and other various growth rates. Sensitivity analyses regarding commodity forecasts, vessel fleet mix, and large semisubmersible rig arrivals were performed and are presented in Section 6.6.2 above, as well as in the Economic Appendix (Appendix A).

6.8.3 Project Cost and Schedule Risk Analysis

In compliance with ER 1110-2-1302 – Civil Works Cost Engineering, dated September 15, 2008, a formal risk analysis, Monte-Carlo-based study was conducted by the Project Delivery Team (PDT) on remaining costs. The purpose of this risk analysis study was to present the cost and schedule risks considered, and respective project contingencies at a recommend 80 percent confidence level of successful execution to project completion. The cost and schedule risk analysis report regarding the risk findings and recommended contingencies for the Recommended Plan is included in Appendix B.

6.8.4 Environmental Data and Analyses

The most current available data were used for environmental analyses of the study area, augmented by field studies where needed to comply with specific regulatory requirements. No significant environmental impacts were identified, and therefore no ecological modeling was required to quantify impacts or mitigation. No significant uncertainties have been identified in the environmental data used to evaluate Recommended Plan impacts, and no significant risks to environmental resources are expected with construction of the Recommended Plan.

6.9 CONSISTENCY WITH OTHER STATE AND FEDERAL LAWS

This EA has been prepared to satisfy the requirements of all applicable environmental laws and regulations and has been prepared using the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Part 1500–1508) and the USACE's regulation ER 200-2-2 - Environmental Quality: Policy and Procedures for Implementing NEPA, 33 CFR 230. In implementing the Recommended Plan, the USACE would follow provisions of all applicable laws, regulations, and policies related to the proposed actions. The following sections present brief summaries of Federal environmental laws, regulations, and coordination requirements applicable to this Environmental Assessment (EA).

6.9.1 Clean Air Act

Cameron County is currently designated as in attainment or unclassifiable with National Ambient Air Quality Standards, therefore a General Conformity Determination is not required. Impacts of the Recommended Plan on air quality and greenhouse gases (GHG) have been

evaluated. It is expected that air contaminant emissions from construction and maintenance dredging activities would result in short-term impacts on air quality in the immediate vicinity of the dredging site. An inventory of GHG emissions was also prepared for the Recommended Plan. Measures to reduce emissions from dredging activities would be included in USACE contracts.

6.9.2 Clean Water Act

Sections 401 and 404 of the Clean Water Act (CWA) apply to the Recommended Plan and compliance would be achieved. Section 404 of the CWA regulates dredge-and/or-fill activities in waters of the U.S. In Texas, Section 401 of the CWA (State Water Quality Certification Program) is regulated by the TCEQ. Compliance will be achieved through coordination of this final report with TCEQ to obtain water quality certification for the project. Coordination includes an evaluation of the project based on the Section 404(b)(1) Guidelines as presented in Appendix G. New work and maintenance sediments are suitable for placement in the upland PAs, the New Work and Maintenance ODMDSs, and the Feeder Berm. The USACE has requested and TCEQ has issued a 401 State Water Quality Certification for the project.

6.9.3 Section 103 of the Marine Protection, Research, and Sanctuaries Act

This Act requires a determination that dredged material placement in the ocean would not reasonably degrade or endanger human health, welfare, and amenities, or the marine environment, ecological systems, or economic potential of shellfish beds, fisheries, or recreational areas. A Marine Protection, Research, and Sanctuaries Act (MPRSA) Section 102/103 evaluation report for the proposed placement of new work dredged material within the ODMDS is provided in Appendix F. Modeling indicates the existing New Work and Maintenance ODMDSs are large enough to accommodate material from the Recommended Plan, and that future new work and maintenance material is expected to have the same properties as dredged material placed previously at both ODMDSs. The New Work ODMDS was created for the placement of new work material for the existing 42-foot Project. EPA has concluded that new work material expected with construction of the 52-foot project is suitable for placement in the new work ODMDS. Shoaled sediments that would be placed in the offshore Feeder Berm have been determined to be of sufficient quality for beneficial use. USACE would continue to use the Maintenance ODMDS, pending EPA concurrence that management and monitoring meet EPA guidelines. Use of the ODMDSs would be in accordance with a Site Monitoring and Management Plan that is under development.

6.9.4 Section 7 of the Endangered Species Act

Interagency consultation under Section 7 of the Endangered Species Act (ESA) has been undertaken and completed. A draft Biological Assessment (BA) was prepared describing the study area, federally listed threatened and endangered species of potential occurrence in the study area as identified by the NMFS and USFWS, and potential impacts of the Recommended

Plan on these protected species (Appendix I). The Draft BA was submitted to NMFS and USFWS for review and was revised based on their input. USACE has determined and the agencies agree that the Recommended Plan may affect but is not likely to adversely affect the piping plover, northern aplomado falcon, Gulf Coast jaguarundi, ocelot, the West Indian manatee, and the leatherback sea turtle. USFWS has reviewed our assessment of impacts to species under their jurisdiction and provided conservation recommendations, which have been adopted by USACE. Interagency consultation under Section 7 of the ESA has been concluded with NMFS. USACE has determined and NMFS agrees that the Recommended Plan may adversely affect but is not likely to jeopardize the continued existence of 4 sea turtle species (green, Kemp's ridley, loggerhead, and hawksbill). Potential impacts of maintenance dredging for the Recommended Plan will be covered by existing Biological Opinion (BiOp) Consultation No. F/SER/2000/01287 (NMFS, 2003, as amended by Revisions No. 1 and 2 (USACE 2006)). The Final NMFS BiOp (F/SER/2013/11766) requires USACE to adopt specific RPMs to minimize sea turtle impacts and USACE has agreed to adopt all of these RPMs. Actions that will be taken to comply with the USFWS RPMs and NMFS conservation recommendations are presented in Section 7.4.3. NMFS has provided an Incidental Take Statement for construction of the project which consists of a total of 19 turtles (3 loggerhead, 14 green, and 2 Kemp's ridley).

6.9.5 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (PL 94-265), as amended, establishes procedures for identifying EFH and requires interagency coordination to further the conservation of federally managed fisheries. EFH consists of those habitats necessary for spawning, breeding, feeding, or growth to maturity of species managed by Regional Fishery Management Councils in a series of Fishery Management Plans. Submittal of the Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) to NMFS initiated EFH consultation. USACE anticipates minor and temporary impacts to benthic organisms and turbidity during construction, but no significant or long-term effects.

6.9.6 Section 106 of the National Historic Preservation Act

Compliance with the National Historic Preservation Act of 1966, as amended, requires identification of all historic properties in the project area and development of mitigation measures for those adversely affected in coordination with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation. It has been determined, in consultation with the Texas SHPO, that no historic properties would be affected by the proposed undertaking.

6.9.7 Coastal Zone Management Act

Under the Texas Coastal Management Program (TCMP), enacted under the Coastal Zone Management Act in 1972, the GLO reviews Federal activities to determine whether they are

consistent with the policies of the TCMP. USACE has prepared a Consistency Determination that evaluates the Recommended Plan for consistency with the TCMP and has concluded that it is fully consistent to the maximum extent practicable with the enforceable policies of the Texas program (Appendix H). GLO has concurred that the Recommended Plan in consistent with the TCMP.

6.9.8 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act provides for consultation with the USFWS and, in Texas, with TPWD whenever the waters or channel of a body of water are modified by a department or agency of the U.S. A Coordination Act Report (CAR) was prepared by the USFWS and is included in Appendix J. Submittal of the DIFR-EA initiated coordination with TPWD. The CAR recognizes that the Recommended Plan avoids significant impacts to fish and wildlife resources, including federally listed, threatened and endangered species. USACE has adopted the CAR conservation recommendations that provide better protection for several listed species as described in Section 7.0.

6.9.9 Marine Mammal Protection Act of 1972

The Marine Mammal Protection Act was passed in 1972 and amended through 1997. It is intended to conserve and protect marine mammals and establish the Marine Mammal Commission, the International Dolphin Conservation Program, and a Marine Mammal Health and Stranding Response Program. The Recommended Plan is not expected to impact any marine mammals.

6.9.10 Federal Water Project Recreation Act

This 1995 Act requires consideration of opportunities for outdoor recreation and fish and wildlife enhancement in planning water-resource projects. The Recommended Plan is not expected to have any long-term effects on outdoor recreation opportunities in the area.

6.9.11 Coastal Barrier Improvement Act of 1990

This Act is intended to protect fish and wildlife resources and habitat, prevent loss of human life, and preclude the expenditure of Federal funds that may induce development on coastal barrier islands and adjacent nearshore areas (Coastal Barrier Resources System, 2010). Portions of two Coastal Barrier Resources System units (TX 12 and TX 12P) are located south of the Main Channel on Brazos Island and in the Boca Chica area. The boundaries encompass existing PA 2 and a small part of existing PA 4A. Exceptions to the Federal expenditure restrictions include maintenance of constructed improvement(s) to existing Federal navigation channels and related structures, including the disposal of dredged material related to maintenance and construction.

Thus, Recommended Plan use of the existing PAs is exempt from the prohibitions identified in this act.

6.9.12 Farmland Protection Policy Act of 1981 and the CEQ Memorandum Prime and Unique Farmlands

In 1980, the CEQ issued an Environmental Statement Memorandum "Prime and Unique Agricultural Lands" as a supplement to the NEPA procedures. Additionally, the Farmland Protection Policy Act was passed in 1981, requiring consideration of those soils that the U.S. Department of Agricultural defines as best suited for food, forage, fiber, and oilseed production, with the highest yield relative to the lowest expenditure of energy and economic resources. No new lands would be impacted by construction of the Recommended Plan, and therefore there is no potential for impacts to prime or unique farmlands.

6.9.13 Executive Order 11988, Floodplain Management

This Executive Order (EO) directs Federal agencies to evaluate the potential effects of proposed actions on floodplains. Such actions should not be undertaken that directly or indirectly induce growth in the floodplain unless there is no practicable alternative. The Main Channel and existing PAs are located in the floodplain of the Rio Grande. There is no practicable alternative to proposed improvements to the existing channel or to the use of existing PAs. Impacts to the floodplain have been minimized by restricting all impacts to the footprints of existing PAs.

6.9.14 Executive Order 11990, Protection of Wetlands

This EO directs Federal agencies to avoid undertaking or assisting in new construction located in wetlands, unless no practicable alternative is available. The Recommended Plan does not impact wetlands. Impacts to wetlands have been avoided by restricting all construction to the footprints of existing PAs.

6.9.15 Executive Order 12898, Environmental Justice

This EO directs Federal agencies to determine whether the Recommended Plan would have a disproportionately adverse impact on minority or low-income population groups within the project area. An evaluation of potential Environmental Justice (EJ) impacts has been conducted, and the Recommended Plan is not expected to significantly affect any low-income or minority populations.

6.9.16 Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds and the Migratory Bird Treaty Act

The Migratory Birds and the Migratory Bird Treaty Act (MBTA) of 1918 (as amended) extends Federal protection to migratory bird species. Among other activities, nonregulated "take" of

migratory birds is prohibited under this Act in a manner similar to the ESA prohibition of "take" of threatened and endangered species. Additionally, EO 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds" requires Federal activities to assess and consider potential effects of their actions on migratory birds (including, but not limited to, cranes, ducks, geese, shorebirds, hawks, and songbirds). The effect of the Recommended Plan on migratory bird species has been assessed, and no impacts are expected to migratory birds or their habitat in the project area. Construction contracts would include instructions to avoid impacts to migratory birds and their nests from construction-related activities.

6.9.17 Executive Order 13045, Protection of Children from Environmental and Safety Risks

This EO requires Federal agencies to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and to ensure that policies, programs, activities, and standards address these risks. This report has evaluated the potential for the Recommended Plan to increase these risks to children, and it has been determined that children in the project area would not likely experience any adverse affects from the proposed project.

7 ENVIRONMENTAL CONSEQUENCES

Environmental consequences of the No Action and Recommended Plan alternatives are compared below. A detailed comparison of all factors compared in evaluating the Final Array of Alternatives, including environmental effects, is presented in Section 5.4 of this report.

7.1 Impacts to Protected/Managed Lands

Federal and State lands would not be affected by either the No Action Alternative (FWOP) or the Recommended Plan alternative. Under the FWOP, Federal and State lands in the study area would continue to be unaffected by maintenance activities. No direct impacts would occur because Federal and State lands do not exist within the Recommended Plan project footprint.

7.2 Impacts to Physical and Hydrological Characteristics

Under the No Action Alternative (FWOP condition), the existing BIH channel would continue in operation at its current depth and length. The existing PAs, Maintenance ODMDS and the Feeder Berm would continue in use. RSLR over the 50-year period of analysis would be expected to range between 0.6 foot and 2.4 feet, resulting in small increases in inundation and tidal circulation in the Laguna Madre, Bahia Grande complex, and Back Bay. Overall, base land elevations along the channel are high enough that even the high range estimate would result in few changes to navigation features or industrial infrastructure.

The Recommended Plan alternative would result in minor changes to the physical and hydrological characteristics of the study area. The Entrance Channel would be extended an additional 4,000 feet (0.76 mile) into the Gulf of Mexico and the navigation channels would be deepened an additional 10 feet from offshore to the beginning of the Turning Basin Extension at Station 84+200. Hydrodynamic modeling has determined that negligible differences in water surface elevations would occur with construction of the Recommended Plan (Tate and Ross, 2012). No effect on tidal range in the Laguna Madre was discernible. The deepening would result is a small change in phasing of flows and in the peak velocity magnitudes in the channel, but velocities are quite low and therefore the increased velocity would result in a negligible effect. Typically, concerns when deepening a navigation channel focus on salinity intrusion. Salinity intrusion is not an issue in the BIH study area because overall salinities are already high in this dead-end man-made channel and there is little vertical stratification. A MPRSA Section 102/103 evaluation report for the proposed placement of new work dredged material within the ODMDS is provided in Appendix F. Modeling indicates the existing ODMDSs are large enough to accommodate all material from the Recommended Plan, and that future new work and maintenance material is expected to have the same properties as dredged material placed previously at both ODMDSs.

Upland PAs and containment dikes would be sized to accommodate total quantities over the 50-year period of analysis. None of the existing PAs would need to be expanded and no new PAs would be needed. Construction to raise the containment dikes to heights needed to accommodate the new work material and 50-year maintenance quantities would be done within the footprints of the existing PAs. Dikes would be raised incrementally as needed to contain quantities resulting from construction and maintenance contracts. The resulting elevations of the PA dikes for the 50-year DMMP would range from a total elevation of 12 feet NAVD 88 around PA 5A to a total elevation of 36 feet around PA 2. Effects of the increased elevations of these features and the increased depth of the channel were modeled to determine if the Recommended Plan would exacerbate the effects of tidal surge in the study area (Ratcliff and Massey, 2013). Since PA containment dikes are higher than most surrounding topography, storm surges that overtop the channel flow around the PAs and flood surrounding low areas. It was projected that, depending upon the storm's intensity and angle of approach, surge could increase between 0.1 foot and 2.6 feet due to the Recommended Plan; however, in most cases, surge increases would be at the lower end of this range. The highest increases in surge are generally in undeveloped areas on the southern side of the channel, especially from PA 5B eastward. The smallest effects would occur at the developed end of the channel near the Turning Basin, and in many cases, surge is projected to be lower with the project in this area.

The longer and deeper channel would result in an approximately 14.1 percent overall increase in maintenance dredging quantities over the period of analysis. Maintenance material from the Entrance and Jetty Channels and the first 11,000 feet of the Main Channel would generally be placed in the nearshore Feeder Berm (USACE, 1988a). Sediment removed by maintenance dredging would therefore be regularly placed back into the littoral system, available for cross-shore and longshore sediment transport to South Padre Island. Monitoring of material placed at the Feeder Berm has demonstrated that it disperses and moves alongshore toward the beach (McLellan et al., 1997; USACE, 1989). If for some reason the Feeder Berm cannot be used, maintenance material from the Entrance and Jetty Channels (station –17+000 to 0+000) could be placed in the Maintenance ODMDS, which is located approximately 2.5 nautical miles from shore and north of the channel (USACE, 1975, 1999). The ODMDS and Feeder Berm are located in dispersive environments and have unlimited capacities.

7.3 Impacts to Biological Communities

Under the No Action Alternative (FWOP condition), no effects would occur to the sensitive biological communities found in the study area. Most of the land along the BIH Main Channel is owned by the BND or is managed by Federal, State, and local agencies. Therefore, development that might be expected under the FWOP condition would be limited.

Under the Recommended Plan, no effects would occur to the following biological communities:

Thornscrub Forest and Brush, Coastal Dunes, Wetlands and Oyster Reef – none of these habitats occur within construction or maintenance footprints.

Mesquite Savannahs – impacts to mesquite savannahs located south of existing PAs would be avoided by project construction and maintenance activities. Access for PA dike construction would be obtained from the Main Channel wherever possible, and construction equipment and local transportation would be restricted to existing dirt roads in the vicinity of the PAs.

Lomas – impacts to all clay lomas would be avoided by project construction and maintenance activities. A new dike would be constructed to protect a large loma on the south side of PA 4B from impacts associated with dredged material placement; all other lomas in the project area are already protected by similar dikes. As recommended by USFWS (2013), the new dike would be constructed a minimum of 30 feet from the toe of the existing loma.

Tidal and Algal Flats – although these are present in areas surrounding existing PAs, none occur within construction or maintenance footprints. USFWS (2013b) has observed that a significant storm surge could breach PA containment dikes and spread dredged material over the adjacent flats. As recommended by USFWS, elevations of these tidal flats immediately adjacent to PAs would be documented during dike design activities and USACE would consult with USFWS should these impacts occur.

Bays and Deepwater Habitats – temporary and minor effects would occur to bays and deepwater habitats. Construction of the Recommended Plan would result in temporary disruption of benthic habitats within the channel and offshore PAs, and impacts associated with maintenance dredging would continue. These impacts would include short-term increases in water column turbidity and benthic impacts, although no long-term effects would be expected.

With construction of the Recommended Plan, aquatic organisms would be impacted by the increased water column turbidity during project construction. Conditions during dredging of the new project would be similar to existing maintenance activities. Such effects are usually temporary and local and can be expected to return to near-ambient conditions within a few hours after dredging ceases or moves out of a given area (Newcombe and Jensen, 1996; Clarke and Wilber, 2000). Finfish and shellfish are mobile enough to avoid highly turbid areas and under most conditions are only exposed to localized suspended-sediment plumes for short durations (minutes to hours) (Clarke and Wilber, 2000; Wilber and Clarke, 2001; Newcombe and Jensen, 1996). Notwithstanding the potential harm to some individual organisms, no long-term impacts to finfish or shellfish populations are anticipated from dredging and placement activities associated with the Recommended Plan compared with the existing condition.

Dredging operations would alter benthic habitats through evacuation of bay bottom and dredged material placement; evacuation buries and removes benthic organisms and placement smothers or buries benthic communities (Montagna et al., 1998). The impact to benthic organisms is likely

to be confined to the immediate vicinity of the area dredged (Newell et al., 1998) and recovery of benthic macroinvertebrates following burial (in the ODMDSs and Feeder Berm) is typically rapid (recovering within months rather than years) (VanDerWal et al., 2011; Wilber et al., 2006; Wilber and Clarke, 2001). No long-term impacts are expected in the area dredged or disposal areas.

Shoal, turtle, and manatee grasses are the primary SAV in the study area. During a field visit in January 2013, it was verified that seagrasses grow in patchy strips within approximately 75 to 250 feet of the construction footprint (mostly near the East and West Wye and the South Bay entrance) where water depths and clarity are sufficient to allow light penetration. Under the Recommended Plan, seagrasses could be affected by temporary and localized turbidity, but any potential effects are anticipated to be negligible and short term.

7.4 Impacts to Fish and Wildlife and Their Habitats

7.4.1 Fish and Wildlife Impacts

Potential impacts to fish and wildlife are similar for both the No Action Alternative (FWOP condition) and Recommended Plan. All sediments from deepening the BIH channels would be placed in upland, confined PAs or in the existing New Work ODMDS. Maintenance dredged material would be placed in the same areas as those used under existing conditions, i.e., in existing upland, confined PAs, the Feeder Berm, and if necessary, the existing Maintenance ODMDS. The frequency and duration of maintenance dredging would be within the range occurring under existing maintenance dredging. Direct impacts to fish or wildlife would be restricted to benthic organisms and these would be minor and temporary, occurring only during dredging periods. Potential impacts to sensitive habitats surrounding the terrestrial PAs would be avoided by restricting construction activities to the existing PA footprints and existing access roads.

The mild climate and diverse habitats of Cameron County also support a rich variety of migrant and nesting birds, and many of the bird species recorded for Cameron County sites are spring and/or fall migrants. Of particular importance to the activities of the BIH Project construction and maintenance activities are ground-nesting avian species that utilize the sparse or unvegetated substrates which might be found on the containment dikes and within the PAs. These include the snowy plover (*Charadrius nivosus*), Wilson's plover (*Charadrius wilsonia*), killdeer (*Charadrius vociferus*), and least tern (*Sterna antillarum*). If depressional ponds and some emergent wetland vegetation develops within a PA, other bird species could opportunistically nest within the project area such as the black-necked stilt (*Himantopus mexicanus*), and American avocet (*Recurvirostra americana*). The greater the time period between dredging cycles, the more likely a given PA may stabilize with vegetation and other features that could support nesting birds.

In fulfillment of requirements of the MBTA, USACE would implement the following USFWS (2013b) recommendations. Activities requiring vegetation removal or disturbance would avoid the peak nesting period of March 1 through August 31 to avoid destruction of individuals, nests or eggs. If project activities must be conducted during this time, surveys for nests would be conducted prior to commencing work. If a nest is found, and if possible, a buffer of vegetation (≥165 feet for songbirds, >330 feet for wading birds, and >590 feet for terns, skimmers and birds of prey) would be allowed to remain around the nest until young have fledged or the nest is abandoned.

7.4.2 Essential Fish Habitat Impacts

Under the No Action Alternative (FWOP condition), the impacts associated with maintenance dredging would continue. Impacts from current maintenance dredging include temporary increases in water column turbidity during and for a short time after dredging and burial of benthic organisms at the maintenance ODMDS and nearshore Feeder Berm (Newcombe and Jensen, 1996; Clarke and Wilber, 2000). Recovery of benthic macroinvertebrates following burial is typically rapid (recovering within months rather than years) (VanDerWal et al., 2011; Wilber et al., 2006; Wilber and Clarke, 2001) and, consequently, no long-term effects are expected.

This DIFR-EA initiated EFH consultation for the Recommended Plan under the Magnuson-Stevens Fishery Conservation and Management Act. EFH would not be significantly affected by construction of the Recommended Plan. However, the Recommended Plan could temporarily reduce the quality of EFH (submerged soft bottom habitats) in the vicinity of the study area and some individual species may be displaced. The displacement of finfish and shrimp species (including estuarine dependent organisms that serve as prey for federally managed species) during project construction and maintenance dredging would likely be temporary and individuals should move back into these specific areas once the project is completed. Benthos, as a food source, would be lost at the ODMDS and Feeder Berm until recovery occurs; however, recovery of benthic macroinvertebrates following burial is typically rapid (recovering within months rather than years) (VanDerWal et al., 2011; Wilber et al., 2006; Wilber and Clarke, 2001) and, consequently, no long-term effects are expected.

The potential harm of some individual finfish and shellfish from turbidity-related impacts would be minimal and would not reduce any populations of federally managed species or their prey. No mitigation would be required for these temporary disruptions to federally managed species as these species are motile and avoid areas during dredging and placement activities and would be able to return to the area after these activities are completed (Clarke and Wilber, 2000).

7.4.3 Threatened and Endangered Species Impacts

Potential impacts to federally listed species are similar for both the No Action Alternative (FWOP condition) and Recommended Plan. Both the FWOP and the Recommended Plan would have no effect on the following listed animal and plant species: blue whale, finback whale, humpback whale, sei whale, sperm whale, nesting sea turtles (green, Kemp's ridley, loggerhead, hawksbill and leatherback), South Texas ambrosia, and Texas ayenia (USACE, 2013c; USFWS, 2013a). No placement of dredged material or other construction activities would occur on Gulf beaches in the study area, thereby precluding impacts to nesting sea turtles. Furthermore, it has been determined that the Recommended Plan would have no effect on designated piping plover critical habitat. The BIH Recommended Plan would also have no effect on the following Candidate species and SOC: red knot, red-crowned parrot, Sprague's pipit, scalloped hammerhead shark, boulder star coral and star coral, elliptical star coral, Lamarck's sheet coral, mountainous star coral, pillar coral, rough cactus coral, dusky shark, sand tiger shark, opossum pipefish, warsaw grouper and speckled hind (USACE, 2013c; USFWS, 2013a). The FWOP may affect swimming sea turtles. Potential impacts of FWOP maintenance dredging for the existing project are covered by existing GRBO (NMFS, 2003 and 2007).

7.4.3.1 Determinations of "May Affect But Not Likely to Adversely Affect"

The Recommended Plan may affect but is not likely to adversely affect the piping plover, Northern aplomado falcon, Gulf Coast jaguarundi, ocelot, the West Indian manatee and the swimming leatherback sea turtle. To provide better protection for these species, USACE has agreed to specific USFWS (2013) conservation recommendations provided in the Fish and Wildlife Coordination Act Report (CAR, 2013;Appendix J). As recommended by the USFWS CAR, if construction of the Recommended Plan does not commence within the next three years, USACE would coordinate with the USFWS prior to initiation of construction to determine if changes need to be made to the project plan to avoid impacts to threatened or endangered species and to determine if formal Section 7 consultation is needed. USFWS recommended and USACE has agreed to implement the following.

Piping plover. Located within the area designated as critical habitat unit TX-01, PAs 2, 4A, and most of 4B may contain unvegetated sand flats that may be utilized by piping plovers for foraging or roosting. Prior to the placement of dredged material into these PAs, USACE would survey unvegetated sand flats in the PAs for the presence of roosting piping plovers if two of the following weather conditions occur in combination: cold temperatures (below 40 °F), high winds (above 15 to 20 miles per hour), and precipitation. When these conditions apply in combination, piping plovers are likely to roost to conserve energy and body reserves, and disturbing birds under these conditions would cause harm by stressing the birds. If roosting birds are identified in the area, placement activities in the area would be delayed until weather conditions ameliorate and two of these three weather conditions are no longer occurring in combination.

Northern aplomado falcon. While acknowledging that impacts would be avoided, USFWS (2013b) notes that endangered aplomado falcons may use mesquite savannahs and grasslands south of the PAs for foraging and nesting, though no nests are known in the area at this time. Nest structures that could be utilized by the aplomado falcon have been documented approximately 0.5 mile south of PAs 7 and 5A. All construction activities would occur within the footprint of existing PA dikes, avoiding direct impacts to potential grassland and savannah habitat near the PAs. However, construction activities on the PA dikes or use of access roads south of the PAs may disturb birds in nests within 100 yards of these activities. Prior to commencing dike maintenance activities for new work and future maintenance during the months of March through June, areas within 100 yards of the PA dikes and access roads would be examined for use by nesting aplomado falcons. If they are found, further surveys and coordination with USFWS would be conducted. With implementation of this conservation recommendation, it has been determined that the Recommended Plan may affect but is not likely to adversely affect the northern aplomado falcon.

Gulf Coast jaguarundi and ocelot. These cats are known to occur around the project area and may use a variety of habitats for moving between preferred habitat sites. All construction activities would occur within the footprint of existing PA dikes, avoiding direct impacts to lomas and brush habitat adjacent to PAs 4A and 4B. A new dike would be constructed at least 30 feet from the outer edge of the loma on the south side of PA 4B to protect brush habitat on that landform. To prevent possible harm to a jaguarundi or ocelot moving through the area during construction, USACE would require that construction activities for dike rehabilitation or construction be conducted only during daylight hours. With implementation of this conservation recommendation, it has been determined that the Recommended Plan may affect but is not likely to adversely affect the jaguarundi and ocelot.

West Indian manatee. Although sightings of manatees are rare along the Texas coast, they do occur. To avoid potential impacts to the West Indian manatee, USACE would advise all contractors and staff that manatees may be found in the Entrance Channel, Jetty Channel, and Main Channel, and in adjacent areas of the Lower Laguna Madre. USACE would also incorporate specified education measures into construction and maintenance contracts for the Recommended Plan (USFWS, 2013b).

Leatherback sea turtles. It is unlikely that leatherback sea turtles would be found in the study area but since they could potentially occur, it has been determined that the Recommended Plan may affect, but is not likely to adversely affect the leatherback sea turtle (USACE, 2013c). RPMs would be implemented to minimize impacts to listed sea turtle species that may be adversely affected by the project as described below. These measures would also serve to minimize impacts to leatherbacks, in the unlikely event that they are encountered in the project area.

7.4.3.2 Determinations of "May Adversely Affect"

USACE has determined that sea turtles from four species (green, Kemp's ridley, loggerhead, and hawksbill) may be adversely affected by construction of the Recommended Plan during hopper dredging to deepen the BIH Entrance and Jetty Channels. It has been well documented that hopper dredging activities occasionally result in sea turtle entrainment and death, even with seasonal dredging windows. Between 1995 and 2012, a total of 31 sea turtles were taken as a result of hopper dredging of the BIH Entrance and Jetty Channels. To construct the Recommended Plan, one hopper dredge would be operated continuously for an estimated duration of 7 months to remove approximately 2.1 mcy of new work material from the Entrance and Jetty Channels. Because hopper dredging during construction may affect listed sea turtles under NMFS jurisdiction, USACE requested formal Section 7 consultation with NMFS to address potential adverse impacts (USACE, 2013c).

Section 7 consultation has been completed and NMFS has issued a Final BiOp for the BIH Recommended Plan (NMFS F/SER/2013/11766, 2014). The BiOp is presented in Appendix I. NMFS concluded that the project is not likely to jeopardize the continued existence or recovery of the affected turtle species. USACE has agreed to adopt NMFS' RPMs in the Recommended Plan and to fully implement the BiOp Terms and Conditions. The Incidental Take Statement for construction of the proposed project was set at a total of 19 sea turtles (3 loggerheads, 14 greens, and 2 Kemp's ridley).

7.4.3.3 Reasonable and Prudent Measures to Minimize Sea Turtle Impacts

The Final BiOp established the following Terms and Conditions to implement the RPMs needed to minimize impacts of the incidental take of sea turtles during construction of the proposed project (NMFS, 2014). Compliance with the RPMs' implementing Terms and Conditions is mandatory in order for incidental takes not to be considered prohibited takings under the ESA. Hopper dredging contracts for the Recommended Plan would comply with the following:

1. Hopper Dredging (RPM 1): Hopper dredging activities shall be completed, whenever possible, between December 1 and March 31, when sea turtle abundance is lowest throughout Gulf coastal waters.

2. Non-hopper Type Dredging (RPM 1): Pipeline or hydraulic dredges, because they are not known to take turtles, must be used whenever possible between April 1 and November 30.

3. Operational Procedures (RPM 1): During periods in which hopper dredges are operating and NMFS-approved protected species observers are *not* required, (December 1 through March 31, if water temperatures are under 11°C), the USACE must:

a. Advise inspectors, operators, and vessel captains about the prohibitions on taking, harming, or harassing sea turtles.

b. Instruct the captain of the hopper dredge to avoid any turtles and whales encountered while traveling between the dredge site and offshore disposal area, and to immediately contact the USACE if sea turtles or whales are seen in the vicinity.

c. Notify NMFS immediately by e-mail (takereport.nmfsser@noaa.gov with reference to this biological opinion - F/SER/2013/11766) if a sea turtle or other threatened or endangered species is taken by the dredge, and reference this biological opinion.

4. Dredging Pumps (RPM 1): Standard operating procedure shall be that dredging pumps shall be disengaged by the operator when the dragheads are not firmly on the bottom, to prevent impingement or entrainment of sea turtles within the water column. This precaution is especially important during the cleanup phase of dredging operations when the draghead frequently comes off the bottom and can suck in turtles resting in the shallow depressions between the high spots the draghead is trimming off.

5. Dredge Lighting (RPM 1): From May 1 through October 31, sea turtle nesting and emergence season, all lighting aboard hopper dredges and hopper dredge pumpout barges operating within 3 nautical miles of sea turtle nesting beaches shall be limited to the minimal lighting necessary to comply with U.S. Coast Guard and/or Occupational Safety and Health Administration requirements. All non-essential lighting on the dredge and pumpout barge shall be minimized through reduction, shielding, lowering, and appropriate placement of lights to minimize illumination of the water to reduce potential disorientation effects on female sea turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches.

6. Sea Turtle Deflecting Draghead (RPM 1): A state-of-the-art solid, plow-type rigid deflector dragheads must be used on all hopper dredges at all times. The use of alternative, experimental dragheads is not authorized without prior written approval from NMFS, in consultation with USACE ERDC. Slotted draghead deflectors or chain-type deflectors are currently not authorized.

7. Training – Personnel on Hopper Dredges (RPM 1): The USACE must ensure that all contracted personnel involved in operating hopper dredges (whether privately-funded or federally-funded projects) receive thorough training on measures of dredge operation that

will minimize takes of sea turtles. It shall be the goal of the hopper dredging operation to establish operating procedures that are consistent with those that have been used successfully during hopper dredging in other regions of the coastal United States, and which have proven effective in reducing turtle/dredge interactions. Therefore, USACE Engineering Research and Development Center experts or other persons with expertise in this matter shall be involved both in dredge operation training, and installation, adjustment, and monitoring of the rigid deflector draghead assembly.

8. Observers (RPM 2): The USACE shall arrange for NMFS-approved protected species observers to be aboard the hopper dredges to monitor the hopper bin, screening, and dragheads for sea turtles and their remains. Observer coverage sufficient for 100 percent monitoring (i.e., two observers) of hopper dredging operations is required aboard the hopper dredges between April 1 and November 30, or whenever surface water temperatures are 11°C or greater.

9. Screening (RPM 2): When sea turtle observers are required on hopper dredges, 100 percent inflow screening of dredged material is required and 100 percent overflow screening is recommended. If conditions prevent 100 percent inflow screening, inflow screening may be reduced gradually, as further detailed in the following, but 100 percent overflow screening is then required.

    a. Screen Size: The hopper's inflow screens should have 4-inch by 4-inch screening. If the USACE, in consultation with observers and the draghead operator, determines that the draghead is clogging and reducing production substantially, other than in sand borrow areas the screens may be modified sequentially. Mesh size may be increased to 8-inch by 8-inch; if that fails to solve the clogging problem, then 16-inch by 16-inch openings may be used. Clogging should be greatly reduced or eliminated with these options; however, further clogging may compel removal of the screening altogether, in which case effective 100 percent overflow monitoring and screening is mandatory. The USACE shall notify NMFS beforehand if inflow screening is going to be reduced or eliminated, what attempts were made to reduce the clogging problem, and provide details of how effective overflow screening will be achieved.

    b. Need or Flexible, Graduated Screens: NMFS believes that this flexible, graduated-screen option is necessary, since the need to constantly clear the inflow screens will increase the time it takes to complete the project and therefore increase the exposure of sea turtles to the risk of impingement or entrainment. Additionally, there are increased risks to sea turtles in the water column when the inflow is

halted to clear screens, since this results in clogged intake pipes, which may have to be lifted from the bottom to discharge the clay by applying suction.

10. Dredge Take Reporting and Final Report (RPM 2): Observer reports of incidental take by hopper dredges must be emailed to the Southeast Regional Office (takereport.nmfsser@noaa.gov with reference to this biological opinion - F/SER/2013/11766) by onboard NMFS-approved protected species observers, the dredging company, or the USACE within 24 hours of any sea turtle or other listed species take observed.

    A final report summarizing the results of the hopper dredging and any documented sea turtle or other listed species takes must be submitted to NMFS (takereport.nmfsser@noaa.gov with reference to this biological opinion - F/SER/2013/11766) within 60 working days of completion of the dredging project. The reports shall contain information on project location (specific channel/area dredged), start-up and completion dates, cubic yards of material dredged, problems encountered, incidental takes and sightings of protected species, mitigative actions taken (if relocation trawling, the number and species of turtles relocated), screening type (inflow, overflow) utilized, daily water temperatures, name of dredge, names of endangered species observers, percent observer coverage, and any other information the USACE deems relevant.

11. Sea Turtle Strandings (RPM 2): The USACE Project Manager or designated representative shall notify the STSSN state representative (contact information available at: http://www.sefsc.noaa.gov/seaturtleSTSSN.jsp) of the start-up and completion of hopper dredging operations and bed-leveler dredging operations and ask to be notified of any sea turtle strandings in the project area that, in the estimation of STSSN personnel, bear signs of potential draghead impingement or entrainment, or interaction with a bed-leveling type dredge.

    a. Information on any such strandings shall be reported in writing within 30 days of project end to NMFS' Southeast Regional Office (takereport.nmfsser@noaa.gov with reference to this biological opinion - F/SER/2013/11766) with a report detailing incidents, with photographs when available, of stranded sea turtles that bear indications of draghead impingement or entrainment. Because the deaths of these turtles, if hopper dredge related, have already been accounted for in NMFS' jeopardy analysis, these strandings will not be counted against the USACE's take limit if they do not exceed the take limits set forth in this consultation.

12. Conditions Requiring Relocation Trawling (RPM 1): The USACE shall require trawling to start as soon as possible within 72 hours of either:

    a. Two or more turtles are taken by hopper dredges in a 24-hour period, or

    b. Total dredge takes in the project approach 75 percent (rounded-down) of any of the incidental take limits; i.e., 2 loggerheads, 10 greens, or 1 Kemp's ridley taken.

13. Relocation Trawling (RPM 1): Any relocation trawling conducted or contracted by the USACE to temporarily reduce abundance of these listed species during hopper dredging in order to reduce the possibility of lethal hopper dredge interactions, is subject to the following conditions:

    a. Trawl Time: Trawl tow-time duration shall not exceed 42 minutes (measured from the time the trawl doors enter the water until the time the trawl doors are out of the water) and trawl speeds shall not exceed 3.5 knots.

    b. Protected Species Handling During Trawling: Handling of sea turtles captured during relocation trawling in association with the dredging project shall be conducted by NMFS-approved protected species observers. Sea turtles captured pursuant to relocation trawling shall be handled in a manner designed to ensure their safety and viability, and shall be released over the side of the vessel, away from the propeller, and only after ensuring that the vessel's propeller is in the neutral, or disengaged, position (i.e., not rotating). Resuscitation guidelines are provided in Appendix B of the Biological Opinion.

    c. Captured Sea Turtle Holding Conditions: Sea turtles may be held briefly for the collection of important biological information, prior to their release. Captured sea turtles shall be kept moist, and shaded whenever possible, until they are released, according to the requirements of Term and Condition No. 13-e, below.

    d. Biological Data Collection: When safely possible, all turtles shall be measured (standard carapace measurements including body depth), tagged, weighed, and a tissue sample taken prior to release. Any external tags shall be noted and data recorded into the observers' log. Only NMFS-approved protected species observers or observer candidates in training under the direct supervision of a NMFS-approved protected species observer shall conduct the tagging/measuring/weighing/tissues sampling operations.

e. Take and Release Time During Trawling – Turtles: Turtles shall be kept no longer than 12 hours prior to release and shall be released not less than 3 nautical miles from the dredge site. Turtles to which satellite tags will be affixed may be held up to 24 hours before release. If two or more released turtles are later recaptured, subsequent turtle captures shall be released not less than 5 nautical miles away. If it can be done safely, turtles may be transferred onto another vessel for transport to the release area to enable the relocation trawler to keep sweeping the dredge site without interruption.

f. Injuries: Injured sea turtles shall be immediately transported to the nearest sea turtle rehabilitation facility. Minor skin abrasions resulting from trawl capture are considered non-injurious. The USACE shall ensure that logistical arrangements and support to accomplish this are pre-planned and ready. The USACE shall bear the financial cost of all sea turtle transport, treatment, rehabilitation, and release.

g. Flipper Tagging: All sea turtles captured by relocation trawling shall be flipper-tagged prior to release with external tags which shall be obtained prior to the project from the University of Florida's Archie Carr Center for Sea Turtle Research. This Opinion serves as the permitting authority for any NMFS-approved protected species observer aboard these relocation trawlers to flipper-tag with external tags (e.g., Inconel tags) captured sea turtles. Columbus crabs or other organisms living on external sea turtle surfaces may also be sampled and removed under this Opinion's authority.

h. PIT-Tag: This opinion serves as the permitting authority for any NMFS-approved protected species observer aboard a relocation trawler to PIT-tag captured sea turtles. Tagging of sea turtles is not required to be done if the NMFS-approved protected species observer does not have prior training or experience in said activity; however, if the observer has received prior training in PIT tagging procedures, then the observer shall tag the animal prior to release (in addition to the standard external tagging):

(1) Sea turtle PIT tagging must then be performed in accordance with the protocol detailed at NMFS' Southeast Fisheries Science Center's Web page: http://www.sefsc.noaa.gov/seaturtlefisheriesobservers.jsp. (See Appendix C on SEFSC's "Fisheries Observers" Web page);

(2) PIT tags used must be sterile, individually-wrapped tags to prevent disease transmission. PIT tags should be 125-kHz, glass-encapsulated tags–the smallest ones made. Note: If scanning reveals a PIT tag and it was not

difficult to find, then do not insert another PIT tag; simply record the tag number and location, and frequency, if known. If for some reason the tag is difficult to detect (e.g., tag is embedded deep in muscle, or is a 400-kHz tag), then insert one in the other shoulder.

i. PIT-Tag Scanning and Data Submission Requirements: All sea turtles captured by relocation trawling or dredges shall be thoroughly scanned for the presence of PIT tags prior to release using a multi-frequency scanner powerful enough to read multiple frequencies (including 125-, 128-, 134-, and 400-kHz tags) and read tags deeply embedded in muscle tissue (e.g., manufactured by Trovan, Biomark, or Avid). Turtles whose scans show they have been previously PIT tagged shall nevertheless be externally flipper tagged. Sea turtle data collected (PIT tag scan data and external tagging data) shall be submitted to NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All sea turtle data collected shall be submitted in electronic format within 60 days of project completion to Lisa.Belskis@noaa.gov. Sea turtle external flipper tag and PIT tag data generated and collected by relocation trawlers shall also be submitted to the Cooperative Marine Turtle Tagging Program (CMTTP), on the appropriate CMTTP form, at the University of Florida's Archie Carr Center for Sea Turtle Research.

j. Handling Fibropapillomatose Turtles: NMFS-approved protected species observers are not required to handle viral fibropapilloma tumors if they believe there is a health hazard to themselves and choose not to. When handling sea turtles infected with fibropapilloma tumors, observers must maintain a separate set of sampling equipment for handling animals displaying fibropapilloma tumors or lesions.

k. Additional Data Collection Allowed During the Handling of Sea Turtles and Other Incidentally-caught ESA-listed species: The USACE shall allow NMFS-approved protected species observers to conduct additional investigations that may include more invasive procedures (e.g., blood-letting, laparoscopies, external tumor removals, anal and gastric lavages, mounting satellite or radio transmitters, etc.) and partake in or assist in research projects but only if 1) the additional work does not interfere with any project operations (dredging activities, relocation trawling, etc), 2) the observer holds a valid federal research permit (and any required state permits) authorizing the activities, either as the permit holder, or as designated agent of the permit holder, 3) the additional work does not incur any additional expenses to the USACE or the USACE approves of the expense, and 4) the observer has first coordinated with USACE Galveston District and notified

NMFS's Southeast Regional Office, Protected Resources Division (takereport.nmfsser@noaa.gov with reference to this biological opinion - F/SER/2013/11766).

14. Relocation Trawling Report (RPM 2): The USACE shall provide NMFS' Southeast Regional Office (takereport.nmfsser@noaa.gov with reference to this biological opinion - F/SER/2013/11766) with an end-of-project report within 30 days of completion of any relocation trawling. This report may be incorporated into the final report summarizing the results of the hopper dredging project.

15. Requirement and Authority to Conduct Tissue Sampling for Genetic Analyses (RPM 2): This opinion serves as the permitting authority for any NMFS-approved protected species observer aboard a relocation trawler or hopper dredge to tissue-sample live- or dead-captured sea turtles without the need for an ESA Section 10 permit. All live or dead sea turtles captured by relocation trawling and hopper dredging shall be tissue-sampled by a NMFS approved protected species observer prior to release.

    Sea turtle tissue samples shall be taken in accordance with NMFS SEFSC's procedures for sea turtle genetic analyses (Appendix II of this opinion). The USACE shall ensure that tissue samples taken during the dredging project are collected, stored properly, and mailed no later than 60 days of completion of the dredging project to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149.

Other conditions may also apply. A detailed outline of the conditions of the USACE's activities to minimize impacts of sea turtle takes during maintenance dredging project is included in the NMFS Biological Opinion for dredging of Gulf navigation channels and sand mining areas using hopper dredges (NMFS, 2003, as amended by Revisions Number 1 and 2 (USACE, 2006).

7.5 Water and Sediment Quality Impacts

In the No Action Alternative (FWOP condition) condition, water and sediment quality are not expected to substantially change in the BIH channel, its surrounding waters, and the near-shore Gulf of Mexico. The Gulf of Mexico would continue to dominate water quality in the study area. TCEQ water quality standards should continue to be met in South Bay, the Lower Laguna Madre, and the near-shore Gulf of Mexico. Episodes of low dissolved oxygen and occasional elevated levels of *Enterococcus* bacteria in the BSC, believed to result from nonpoint source pollution, would probably continue to occur (TCEQ, 2011). Three decades of water and chemistry data from the BIH have documented no concerns with contaminated sediments in the project area. Information describing the results of water, sediment, and elutriate water testing under current conditions are available upon request.

With the Recommended Plan, increases in turbidity would occur at dredging locations during construction and maintenance dredging. Temporary increases in turbidity would also occur in the vicinity of the ODMDSs when dredge material is placed at those locations. Temporary changes in turbidity have not been modeled; however, they are not expected to significantly impact water quality. The Main Channel is a dead-end channel with low tidal exchange, little fresh water inflow, and low velocities, all of which contribute to low dissolved oxygen in some areas at some times. This would be expected to continue. Analyses of water, sediment, and elutriate samples, combined with toxicity and bioaccumulation tests on sediments and suspended sediments, indicate no unacceptable negative impacts can be expected to water quality or sensitive marine organisms during dredging or dredged material placement (SOL and Atkins, 2013).

Deepening the Entrance and Jetty Channels at Brazos Santiago Pass would only minimally increase water exchange between the Gulf of Mexico, South Bay, and the Lower Laguna Madre (Tate and Ross, 2012). Recent data show southern portions of the formerly hypersaline Lower Laguna Madre now have salinities approximating those of the Gulf of Mexico (Basin and Bay Expert Science Team, 2012). Hydrodynamic modeling has determined that no effect on tidal range in the Laguna Madre was discernible. However, the minor increase in circulation in those southern portions of the Lower Laguna Madre may slightly extend periods when salinities are similar to those of the Gulf of Mexico.

7.6 Air Quality Impacts

Cameron County is currently designated as in attainment or unclassifiable with National Ambient Air Quality Standards (TCEQ, 2013a). No new construction or dredging air contaminant emission sources are associated with the No Action Alternative (FWOP condition). However, it is anticipated that air contaminants in the project area would increase due to continued operational constraints on the existing system that would result in a possible increase in ship traffic due to growth of existing business and from new business.

Air contaminant emissions that may result from ongoing maintenance dredging activities would include exhaust emissions from fuel combustion in engines that power the marine vessels (dredge and support) and on-shore construction equipment for dredged material placement. Emissions associated with maintenance dredging are not expected to change from current conditions.

7.6.1 Recommended Plan Impacts of Construction Dredging Equipment

Dredge and support equipment would primarily include marine vessels (dredges, tug boats, survey boats, trawlers, spill barges, and crew boats) and on-shore construction equipment used for working dredged material PAs. The rate of air contaminant emissions from this equipment is directly related to the horsepower rating of each engine, load factor, duration of use, and the amount of material to be dredged. The combustion of diesel fuel in equipment engines would

result in emissions of carbon monoxide (CO), nitrogen oxide (NOx), particulate matter (PM), sulfur dioxide (SO2), volatile organic compounds (VOC), and GHG (carbon dioxide [CO2], methane (CH4], and nitrous oxide [N_2O]).

Project emissions were estimated for new work construction. Estimated emissions were based on projected equipment use and scheduling for offshore and onshore construction activities. The construction emissions inventory included emissions associated with dredging vessels and equipment, nonroad construction equipment, and on-road mobile sources, such as dredging vessels, equipment and support marine vessels; nonroad construction equipment such as amphibious trackhoes, dozers, draglines, excavators and rolligon; and on-road mobile sources such as employee commuter vehicles. A summary of estimated emissions resulting from the new work construction is shown in Table 7-1.

Table 7-1. Annual New Work Emissions Summary

(tons per year)

	Yr 1	Yr 2	Yr 3	Yr 4
NOx	196	1,216	1,068	88
VOC	9	35	31	2
CO	62	310	274	22
PM_{10}	8	38	34	3
$PM_{2.5}$	8	37	33	3
SO_2	19	159	139	12
CO_2e	20,033	80,055	62,662	5,071

It is expected that air contaminant emissions from construction dredging activities would result in short-term impacts on air quality in the immediate vicinity of the dredging site. Each dredging operation would be relatively independent of the other, although, there may be some overlap. In addition, construction dredging activities would not continue past the date of completion and thus would be considered one-time activities. Due to the phased, one-time construction dredging, it is expected there would be no long-term impacts to air quality in the area. Furthermore, over the long-term, the Recommended Plan is expected to result in fewer vessel trips than the without project condition. As a result, total future emissions should be slightly lower if the Recommended Plan is constructed.

7.6.2 Recommended Plan Impacts of Maintenance Dredging

Routine dredging would be required to maintain the channel due to shoaling. The additional maintenance emissions due to the channel improvement project were conservatively estimated based on the ratio of the total volume of new work dredging by the total volume of dredged material displaced from maintenance dredging activities inclusive of the channel improvements. It is estimated that periodic maintenance dredging and dike raisings would result in the following emissions (Table 7-2).

Table 7-2. Annual Maintenance Dredging Emissions Summary
(tons per dredging cycle)

NOx	VOC	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
187.42	5.55	48.34	5.99	5.81	24.13	13925	0.39	1.72

It is expected that air contaminant emissions from maintenance dredging activities would result in short-term impacts on air quality in the immediate vicinity of the dredging site. Each dredging operation would be relatively independent of the other, although there may be some overlap. Emissions from the maintenance dredging would not be expected to differ significantly from present maintenance dredging activities, and thus, should not result in a significant increase in the regional air quality.

Measures that may be used to reduce emissions from dredging activities should consider the equipment used over the expected life of the project and the feasibility and practicality of such measures. Measures would include the following:

- Encouraging construction contractors to apply for Texas Emission Reduction Plan grants or similar programs offering the opportunity to apply for resources for upgrading or replacing older equipment to reduce NO_x emissions;
- Encouraging contractors to use cleaner, newer equipment with lower NO_x emissions;
- Directing contractors and operators that would use nonroad diesel equipment to use clean, low-sulfur fuels;
- Directing contractors and operators that would use tugboats during construction to use clean, low-sulfur fuels;
- Directing operators of the assist tugboats used in maneuvering dredge vessels to use clean, low-sulfur fuels; and
- Directing operators of the dredging vessels to use clean, low-sulfur fuels.

7.6.3 Greenhouse Gas Emissions and Climate Change

An inventory of GHG emissions was also prepared for the Recommended Plan in terms of carbon dioxide equivalents (CO_2e). CO_2e measures the global warming potential of certain emissions. Those which result from the combustion of fuel (CO_2, CH_4, and N_2O) are the most relevant for this project and are reported here. It is estimated that total annual GHG emissions would be 20,033 tons in Year 1, 89,344 tons in Year 2, 79,133 in Year 3 and 6,339 tons in Year 4 of project construction. GHG emissions during each maintenance dredging cycle are estimated to be 14,083 tons.

Measures that may be used to reduce GHG emissions from the proposed dredging and placement activities should consider the equipment used over the expected life of the project and the feasibility and practicality of such measures. Alternatives considered for their ability to reduce or

mitigate GHG emissions are those that may provide for enhanced energy efficiency, lower GHG-emitting technology, renewable energy, as appropriate for the dredging and construction equipment to be used and could include the following:

Dredging Mitigation Options – designing the dredging operation and schedule so as to reduce overall fuel use, if possible; repowering/refitting with cleaner diesel engines, if possible; selection of newer dredges with more efficient engines, if possible.

Land-side Construction Mitigation Options – use of biodiesel fuels if possible and available in sufficient quantities; repowering/refitting with cleaner diesel engines, if possible.

The proposed project would increase GHG emissions; however, it would be unlikely that GHGs emitted would cause an individually discernible impact on global climate change. GHG emissions accumulate in the atmosphere because of their relatively long lifespan. Consequently, their impact on climate change is independent of the point of emission. Because GHGs accumulate in the atmosphere and affect climate change on a global scale, it is not reasonable to predict the impact on climate change based on a project level evaluation. This analysis is more reasonably done on a regional or global scale.

7.7 Noise Impacts

Potential noise impacts would be similar for both the No Action Alternative (FWOP condition) and Recommended Plan. Noise sensitive receptors would be limited to recreational users of nearby parks such as Isla Blanca County Park. No permanent noise sources would be installed as part of this project. The Recommended Plan would create short-term noise level increases similar to increases during maintenance dredging for the existing project. Therefore, the Recommended Plan would have no significant noise impacts.

7.8 Hazardous, Toxic and Radioactive Waste Impacts

Potential HTRW impacts would be similar for both the No Action and Recommended Plan. Based on current sediment and water quality analysis, no sites in the study area are causing regulatory threshold exceedances in channel sediments at this time. No sites on the National Priorities List were identified along the Main Channel, and recent chemical analyses of sediments in the channel indicate no cause for concern for the Main, Jetty, or Entrance Channels. No change to this status quo is anticipated in the FWOP condition.

The Recommended Plan is not expected to induce changes in land use or industrial practices that would increase the occurrence or impact of HTRW sites in the project area. Future releases from known sites in the study area (see Section 2.3.8) may impact the channel, regardless of channel deepening activities. However, no evidence exists that demonstrates a known contaminant

migration pathway from these sites to the channel. Therefore, no impacts are expected due to the presence of HTRW sites in the study area.

7.9 Cultural Resources Impacts

Potential effects to cultural resources would be similar for both the No Action Alternative and Recommended Plan. The activities associated with the proposed undertaking are limited to the dredging (deepening) of the BIH channel and the placement of dredged material within existing PAs. Information from previously conducted marine and terrestrial cultural resource investigations as well as a recent marine cultural resources investigation of the BSC (Enright et al., 2012) have been compiled and evaluated to determine potential impacts to historic properties. All areas to be impacted by deepening of the channel and upland PAs have been covered by these surveys. The New Work ODMDS (EPA, 1991), Maintenance ODMDS (EPA, 1990), and the Feeder Berm (USACE, 1988b) were evaluated for cultural resources as part of NEPA compliance by the EPA and the USACE. It was determined that the three offshore PAs are located in tracts with a low probability for shipwrecks and would have no effect upon historic properties; the SHPO concurred with these determinations. These investigations have identified a total of 44 previously recorded archeological sites and 139 potential shipwrecks within the study area. None of these previously recorded cultural resources is located within the footprint of the Recommended Plan. The marine survey conducted as part of the feasibility study (Enright et al., 2012) identified an element of one historic property, 41CF4 (Brazos Santiago Depot), adjacent to the project area. This element consists of the partial remains of a railroad line constructed in 1864. This site element lies more than 165 feet south of the toe of the existing BSC and since the Recommended Plan does not include widening of the channel there would be no effect upon this resource. Based on the disturbed nature of the terrestrial portions of the project area and the absence of cultural resources within the project area, it was determined, in consultation with the SHPO, that no historic properties would be affected by the proposed undertaking. SHPO coordination regarding this determination is provided in Appendix K.

7.10 Energy and Mineral Resources Impacts

Potential effects to energy and mineral resources would be similar for both the No Action Alternative and Recommended Plan. In the FWOP and Recommended Plan, there would be no change in the accessibility of barge transport of bulk materials generated by the mining industry out of the port. The Recommended Plan would have no impact on the two pipelines in the project area. The Nustar Logistics 10-inch pipeline crosses the channel at an approximate depth of 75 feet, well below any deepening impacts. The other pipeline in the area, the Port Isabel Natural Gas Gathering Line, runs parallel to the north side of the Main Channel near the Bahia Grande and the Channel to Port Isabel. It would not be affected by channel improvements.

7.11 Socioeconomic Impacts

Under the No Action Alternative (FWOP condition), no project would be implemented by the Federal Government or local interests. The existing 42-foot-deep by 250-foot-wide navigation channel would continue to be operate with existing draft constraints, limiting the loads of vessels entering the channel, and preventing larger vessels from utilizing the waterway. Shipyards along the waterway would continue to have limited ability to receive the larger oil rigs that are currently operating in the Gulf of Mexico, potentially causing oil rig repair operations and jobs to relocate to Mexico. Up to 5,000 jobs are attributed to these operations, and this would result in a negative economic impact to the South Texas region and to the national economy (Siegesmund et al., 2008).

No channel modifications to the BIH would also discourage long-range industrial growth and eventually reduce the volume of imports and exports at the POB. This would likely result in a gradual loss of economic operating efficiency for the port, and regional economic growth would slow. Based on the strong public support that has been demonstrated for improving the existing navigation channel, it may be concluded that the FWOP alternative (No Action Alternative) lacks social and institutional acceptance.

The Recommended Plan includes the least cost disposal option. The least cost dredging disposal alternative includes the beneficial use of the material for placement in the nearshore Feeder Berm off of South Padre Island. The Recommended Plan would have an overall favorable impact on social well-being of affected interests because of the economic benefits it would generate.

Activities associated with the proposed project have the potential to create additional waterborne commerce and temporary construction jobs and jobs in related industries. Benefits associated with job creation would be manifested in increased economic output and would increase revenues and local, State, and Federal tax collections.

7.11.1 Environmental Justice

The analysis of potential impacts is based on the location of the project relative to minority and low-income populations in the study area. The three census tracts nearest the project area are 123.04, 127, and 142. Census tract 123.04 is a geographically small census tract located on the north side of the channel near Port Isabel and contains one PA. Census Tract 127 encompasses most of the project and all of the remaining upland PAs. Census Tract 142 lies north and west of the channel and contains no PAs. No new PAs are planned as part of this project, and the existing PAs are not located near any existing neighborhoods. Land use near the project area is industrial and would likely remain industrial. No changes in the types of industries in the project area would be anticipated and no increases in pollution would be expected under the with-project condition. No contamination issues are associated with the water or the dredged sediments in the project area and no contamination issues would result from construction of the project. Air

quality in the study area is in attainment and construction of the project would not have adverse impacts on air quality. This study area, particularly Census Tracts 123.04, 127, and 142, with minority populations of 76.6 percent, 93.4 percent, and 94.3 percent, respectively, and populations below the poverty level of 37.7 percent, 27.4 percent, and 33.6 percent, respectively, consists of minority and low-income populations, as do all census tracts in this region of Texas (U.S. Census Bureau, 2010). However, the neighborhoods where they live are not located near the project and PAs. Therefore, project construction would not disproportionately impact the minority and low-income populations in the economically stressed census tracts identified in the EJ analysis.

Positive impacts of the project would include increased spending in all 13 of the census tracts of the study area generated by construction and related activities that would temporarily boost the local economy, resulting in temporary job creation or preservation of jobs in the construction and service sectors. Newly created jobs would potentially be distributed among all groups equally. It is expected that the proposed project would positively impact EJ populations and other residents by increasing local employment opportunities and incomes.

7.11.2 Protection of Children From Environmental and Safety Risks

Potential environmental and safety effects to children would be similar for both the No Action Alternative and the Recommended Plan. EO 13045 of 1997 entitled, "Protection of Children from Environmental and Safety Risks" requires Federal agencies to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and to ensure that policies, programs, activities, and standards address these risks. Land use near the project area is primarily industrial and would likely remain industrial. There are no schools, day care centers, or residences located immediately adjacent to the channel. Children currently use recreational areas on South Padre and Brazos Islands in the project area and this would be expected to continue under both the FWOP and Recommended Plan. No contamination issues are associated with the water or the dredged sediments in the project area, and no contamination issues are expected from construction of the project. Analyses of water, sediment, and elutriate samples from the navigation channel indicate there would be no unacceptable negative impacts from the Recommended Plan to water quality that would adversely affect children (SOL and Atkins, 2013). No changes to the types of commodities currently carried through the channel are expected with the Recommended Plan. In addition, since vessels can be loaded more fully with the Recommended Plan, the number of vessel trips in the channel is projected to stay the same or slightly decrease over the 50-year period of analysis. Children in the project area would not likely experience any adverse affects from the proposed project.

7.12 Cumulative Impacts

Cumulative impacts are defined in 40 CFR 1508.7 as . . . " the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Cumulative impacts for the Recommended Plan were assessed in accordance with guidance provided by the President's CEQ.

7.12.1 Individual Project Impact Evaluations

Past, present, and reasonably foreseeable projects/activities within the study area were compared to the Recommended Plan, to determine whether the Recommended Plan, when combined with the impacts of other actions, could have cumulatively significant impacts on the environment.

7.12.1.1 Past or Present Actions

The first Federal involvement in navigation improvements for the BIH occurred in 1880 and 1881 (USACE, 1988a, 1990). The RHAs of 1880 and 1881 provided for deepening of the natural channel through the Brazos Santiago Pass to 10 feet, widening the channel through the pass to 70 feet, and the construction of two parallel jetties at the pass. Construction of the south jetty was started in 1882 and continued until 1884, when operations were suspended due to a lack of funds.

In 1930, Congress authorized the construction of navigation channels to Brownsville and Port Isabel and new jetty construction at the pass. The jetties were completed in 1935 in conjunction with construction of a 25-foot by 100-foot channel to Port Isabel. Dredging of the new 25-foot channel from the pass to the Brownsville Turning Basin was completed in 1936, at widths varying from 100 to 300 feet. The new BSC was not constructed in a natural waterway; it was dug through the Rio Grande deltaic plain in order to provide a navigation channel and port for the City of Brownsville. Several subsequent authorizations provided for progressive deepening and widening of the BSC, and other modifications, with the last project authorization in 1986 bringing it to the current authorized 42-foot-deep by 300-foot-wide project (USACE, 1988a, 1990).

Bahia Grande Restoration Project. Historically, Bahia Grande (located between Brownsville and Port Isabel, north of the BSC) served as an important nursery for a wide variety of fish and shellfish and was important habitat for wildlife and wintering waterfowl. The natural tidal flow between Bahia Grande and the Laguna Madre was negatively affected by construction projects in the 1930s and 1950s. For nearly 70 years, the degraded wetland was a source of blowing dust, a site of massive fish kills, and was a complicated natural resource problem. These problems are being addressed by the Bahia Grande Restoration Project, the largest wetlands restoration project

in North America. The Bahia Grande restoration objectives include reestablishment of nursery habitat for fish and shell fish, wetland habitat for resident and migratory wildlife and waterfowl, opportunities for public recreation, and tidal exchange, eliminating dry basins and total evaporation of Bahia Grande (Ocean Trust, 2009). These objectives have been only partially fulfilled to date. In particular, restoration efforts to reestablish tidal exchange are still underway, and establishment of higher tidal flows are needed to complete reestablishment of fish and wildlife habitat.

The USFWS's LANWR acquired the 21,700-acre Bahia Grande Unit in 2000. In 2005, a pilot channel was constructed that connected the Main Channel to the Bahia Grande and the waters began flowing into the main basin and refilling the wetland. In 2007, two interior channels were cut that reconnected the larger basin to two smaller interior basins. These efforts attempted to reestablish natural tidal flow and exchange throughout the whole system; however, only weak tidal circulation has resulted. Currently, average salinities are still too high to support most wetland vegetation, and hypersaline conditions develop each summer that result in a massive die-off of all organisms in the system. Planning for additional hydrologic restoration efforts is continuing (Ocean Trust, 2009).

Port of Brownsville. The POB proposed amending its existing permit to deepen an existing lay berth at the International Shipbreaking facility on the Main Channel and install a bulkhead around the entire berth. The depth of the berth would be increased from –33 feet MLT to –38 feet MLT. Approximately 600,000 cy of clay material would be dredged by hydraulic or mechanical means and placed into an existing disposal area onsite, and/or into PAs 5 A/B, 7, and 8. The POB anticipates the need to dredge approximately 15,000 cy of maintenance material at approximate 10-year intervals. Construction of the bulkhead would be done in two phases with 977 linear feet constructed during the first phase and 2,149 feet constructed in the second phase (USACE, 2011a).

Brownsville Navigation District. In June 2012, the BND proposed amending their existing permit, which authorizes the deepening of the existing loading area and construction of bulkheads along the waterfront of the Keppel-AmFELS facility on the Main Channel. They requested authorization to increase the depth in several areas to –70 feet MLT. Approximately 1.2 MCY of dredged material would be hydraulically excavated from a 41-acre area and disposed of in PA 5A, 5B, and/or 7 (USACE, 2012b).

Bay Bridge Texas, LLC. Bay Bridge Texas, LLC proposed amending its permit to include PA 8 in addition to PA 7 in its maintenance dredging plan for a commercial ship-breaking facility on the southern bank of the Main Channel. Dredging would be by both mechanical and hydraulic methods, which would allow flexibility in the selection of dredging equipment for the project (USACE, 2011b).

Cameron County Regional Mobility Authority. The Cameron County Regional Mobility Authority proposes to amend its mitigation project and place articulated concrete mats along the eastern shoreline strip of the site instead of the edges of the three circulation channels adjoining the Port Isabel Channel and the Main Channel. The project site is located adjacent to the Main Channel on the southern end of Long Island, south of Port Isabel. They anticipate that this would increase shoreline protection from erosive wave action, thus protect plantings more effectively. They further propose to replace the previously approved wave barrier fencing with staked hay bales moved closer to the shoreline. It is anticipated that this would be safer for marine mammals and would be more effective than the original fencing in protecting mitigation plantings from wave action. In addition, they propose to use black mangrove as the vegetation species for planting the 5.16-acre area previously approved for planting with smooth cordgrass; higher survival rates are anticipated (USACE, 2012c).

7.12.1.2 Reasonably Foreseeable Future Actions

BIH Channel Improvement Project. The Recommended Plan for the BIH Channel Improvement Project is a reasonably foreseeable future action for the project area. Refer to Section 6.1 of this report for a detailed description of the Recommended Plan and Section 7.0 for impacts.

Port of Brownsville. The POB is planning to expand its previously permitted lay berths at the International Ship Breakers, Ltd. facility. The project is located on the south side of the Main Channel. Regulated activities would include the following: hydraulic dredging and/or mechanical excavation to widen and lengthen lay berth at USACE Station 75+000; increase the dredge depth of the current lay berth to –28 feet MLT; and install approximately 1,500 feet of Combi-Wall retaining wall along the east side of the lay berth slip and along the south side of the Main Channel. The lay berth would be expanded to 155 feet wide by 1,147 feet long (west side) and 1,300 feet long (east side). Hydraulically dredged material would be placed in PA 7. The project is estimated to produce approximately 211,700 cy of material (USACE, 2013d).

Space Exploration Technologies (SpaceX). SpaceX plans to construct facilities, structures, and utility connections in order to support the launch of the Falcon 9 and Falcon Heavy launch vehicles into space. A vertical launch area and control center would be located along FM Route 4, well south of the Main Channel and near the Gulf shoreline. The launch site is located in tidal wetlands along the Gulf of Mexico. The Federal Aviation Administration (FAA) Office of Commercial Space Transportation is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts that may result from the FAA proposal to issue launch licenses and/or experimental permits to SpaceX. A draft EIS (FAA, 2013) was completed in April 2013. Compensatory mitigation would be required for all wetland impacts.

Long Island Village Owners Association. The association proposes to conduct maintenance dredging within the existing canal development to –5 feet mean sea level. The project site is

located within the Long Island Village subdivision, which abuts the Port Isabel Channel, on Long Island in Port Isabel, Cameron County, Texas. Department of the Army Permit 12266, and subsequent amendments, authorized the dredging of canals to a –6.5-foot MLT. The proposed project would remove 38,860 cy of sand and silt from the canals and place it within the proposed upland PA (USACE, 2013e).

7.12.2 Resource Impact Evaluation

In assessing cumulative impacts, only those resources expected to be directly or indirectly impacted by the Recommended Plan, as well as by other actions within the geographic scope and time frame were chosen for cumulative impact analysis. Based on these criteria, the following resources were identified as relevant resources for the cumulative impacts analysis:

- bays and deepwater habitats;
- EFH;
- threatened and endangered species;
- air quality;
- water quality;
- commercial fisheries; and
- recreational fisheries.

7.12.2.1 Bays and Deepwater Habitats

The primary effects to bays and deepwater habitats in the project area would be to benthos. Organisms present on water bottoms are affected by dredging and placement of dredged materials. Past or present projects (the existing BIH navigation project, Port of Brownsville, Brownsville Navigation District, and Bay Bridge Texas, LLP) and potential projects (Port of Brownsville and Long Island Village Owners Association) in the study area have resulted in benthic community impacts that are similar to those that would be caused by the Recommended Plan. Previously dredged areas were deepened or maintained, resulting in minor and temporary direct impacts to benthic organisms that had recolonized those areas after prior dredging. Recommended Plan impacts would not result in the addition of permanent new benthic impacts and would not significantly increase the area of water bottom that is affected by dredging.

Dredged material placement at ODMDSs and nearshore Feeder Berm buries and temporarily smothers benthic organisms within those areas. With the exception of the existing BIH navigation project, none of the other past or present projects evaluated here utilize the ODMDSs or Feeder Berm. Recommended Plan impacts associated with use of the New Work and Maintenance ODMDS would not change the existing impact areas or frequency. The impact would be limited and of a relative short duration. The area is dispersive and material would be

carried off by currents within 6 months. The use of the Maintenance ODMDS would be necessary only if the nearshore Feeder Berm cannot be used. The nearshore Feeder Berm, which is dispersive, would likely be subjected to reuse every 1.5 to 3 years. Placement of dredged material in the nearshore zone would impact benthos in a limited area, and the material would be rapidly dispersed from the area due to wave action and longshore currents. The Recommended Plan would not be expected to contribute to long-term benthic organism impacts. No cumulative benthic impacts are expected related to the Recommended Plan and other projects.

7.12.2.2 Essential Fish Habitat

EFH would not be significantly affected by construction of the Recommended Plan. The Recommended Plan would temporarily reduce the quality of submerged soft bottom habitats in the vicinity of the dredging and some individual fishes of managed species may be temporarily displaced. Past or present projects (the existing BIH navigation project, Port of Brownsville, Brownsville Navigation District, Bay Bridge Texas, LLP, and Cameron County Regional Mobility Authority) and potential projects (Port of Brownsville and Long Island Village Owners Association) in the study area have resulted in minor EFH impacts to the study area that are similar to those that would be caused by the Recommended Plan. Inasmuch as all of these impacts are minor and temporary, the Recommended Plan would not permanently add to cumulative EFH impacts. The Recommended Plan would not exacerbate temporary EFH effects because the foreseeable projects would not overlap with the Recommended Plan in time or space.

7.12.2.3 Threatened and Endangered Species

Four sea turtle species (green, Kemp's ridley, loggerhead, and hawksbill) could be adversely impacted by hopper dredging activities for the proposed Recommended Plan (USACE, 2013c). As described in Section 7.4.3.2 and Appendix I, hopper dredging activities occasionally result in sea turtle entrainment and death, even with seasonal dredging windows. Entrainment involves the direct uptake of sea turtles by the suction field generated at the hopper draghead. However, these impacts are not likely to jeopardize the continued existence or recovery of these species. RPMs have been developed to minimize adverse impacts to sea turtles from hopper dredging during construction of the Recommended Plan. Section 7 consultation with NMFS has been completed and the final BiOp is presented in Appendix I. NMFS has determined that the estimated incidental take for the project would not jeopardize the existence or recovery of the affected species. Therefore, the overall potential cumulative impacts are not expected to adversely impact sustainable populations. None of the other projects compared here have utilized or propose to use hopper dredges, and therefore do not have the potential to contribute to cumulative impacts on sea turtles.

7.12.2.4 Air Quality

The GHG emissions that would result from the Recommended Plan would be negligible relative to the total national emissions inventory, and would not have a significant effect on global warming. Furthermore, increased air contaminant emissions are not expected with Recommended Plan channel improvements. The more efficient use of the deep draft tanker fleet is projected to result in a small decrease in vessel trips, which would result in a small decrease in air contaminant emissions. No increase in the number of oil rigs being repaired or fabricated is projected by the economic analysis, and therefore no increase in air contaminant emissions associated with these activities is anticipated. Should a small unanticipated increase occur, it would likely be offset by the forecasted reduction in tanker emissions.

7.12.2.5 Water Quality

The historical and most recent testing data for the study area indicates an absence of contamination. Dredging and placement at open-water and upland PAs may increase suspended solids, bound nutrients, and deplete oxygen. However, this impact is temporary, localized, and except for turbidity, insignificant. If temporary degradation occurs, the area should rapidly return to ambient conditions upon completion of dredging. The impacts of the other dredging projects included in this analysis would be similar. With implementation of BMPs and other permitting requirements, no cumulative surface water quality impacts are expected related to the Recommended Plan and other projects.

7.12.2.6 Commercial and Recreational Fisheries

Fish would likely leave dredging areas and PAs for more-favorable, less-turbid locations; however, once construction and placement are complete, water and foraging conditions would improve, and fish would return to the area. No long-term cumulative impacts are expected from the Recommended Plan combined with area projects.

7.12.3 Conclusions

Cumulative impacts due to past, existing, and reasonably foreseeable future projects, along with the proposed Recommended Plan, are not expected to have significant adverse effects in the study area. Many of the projects occurring in the vicinity of BIH, including the Recommended Plan impacts, are part of the continuing port and shipping industry development. Impacts associated with Recommended Plan would be temporary and minor, requiring no compensatory mitigation. With compliance to environmental regulations, use of BMPs during construction, and compliance with NMFS RPMs to minimize impacts to listed sea turtles, these projects are not expected to have long-term detrimental effects on environmental resources in the area.

8 IMPLEMENTATION REQUIREMENTS

8.1 Division of Plan Responsibilities and Cost-Sharing Requirements

As is shown in Table 9-1, ER 1105-2-100 specifies cost shares for GNFs that vary according to the channel depth: 20 feet or less, greater than 20 feet but not more than 45 feet, and greater than 45 feet. The percentage applies as well to mitigation and other work cost shared the same as GNFs. The cost share is paid during construction. Section 101 also requires the project sponsor to pay an additional amount equal to 10 percent of the total construction cost for GNFs. This may be paid over a period not to exceed thirty years, and LERRs may be credited against it.

Table 8-1. General Cost Allocation

Feature	Federal Cost[1]	non-Federal Cost[1]
GNF	• 90% from 0 to 20 feet • 75% from 20 to 45 feet • 50% from 46 feet and deeper	• 10% from 0 to 20 feet • 25% from 20 to 45 feet • 50% from 46 feet and deeper
GNF costs for this project include mobilization, all dredging costs, and all disposal area construction costs.		
Navigation Aids	• 100%	• 0%
Operation and Maintenance		
GNF	• 100% except cost share 50% cost for maintenance greater than 50 feet	• 0% except cost share 50% cost for maintenance greater than 50 feet
Mitigation	• 75%	• 25%

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 of WRDA 1986. The value of LERRs shall be credited toward the additional 10% payment.

8.2 Cost for the Recommended Plan

The project cost for the Recommended Plan is $251,952,000, as previously shown in Table 6-4. Costs include implementation costs and associated costs. Implementation costs include post authorization planning and design costs, construction costs, construction contingency costs, and O&M costs. Construction costs include costs for dredging and PA construction required for initial channel deepening. There are no costs for fish and wildlife mitigation expected for this project. No cultural resource mitigation costs are expected at this time. ATON would be provided by the USCG, and are a Federal cost included in the economic justification, but are not subject to project cost sharing. Costs for modifications to ATON have been estimated by USACE and included in the project cost estimate, and coordination has been initiated with the USCG to obtain an estimate from that agency. Modifications are expected to be minor and any difference in cost is not expected to significantly affect the BCR. A relatively small amount of cost is identified in the estimate to cover miscellaneous incidental costs for coordination with the USCG during and post construction. Construction General funding would fund Federal share of all project construction.

Project costs and price escalation (calculated by estimating the midpoint of the proposed contracts) are combined to create the Fully Funded Cost.

8.3 Cost-Sharing Apportionment

The project cost for determining the cost-sharing requirements is based on the Total Project Cost.

The Total Project Cost for all project components is separated into expected non-Federal and Federal cost shares and detailed in Table 8-2. These costs differ from those in Table 6-4 due to the inclusion of PED and Construction Management costs across the different channel segments. The costs are separated into expected Federal and non-Federal shares and detailed in Table 8-3.

Table 8-2. Cost Apportionment
($ in 1,000s, rounded with October 2013 Price Level and 3.5% interest rate)

Cost Apportionment Navigation*	First Cost ($)	Fully Funded Cost ($)
Federal Navigation:		
BIH Channel	116,000	128,811
Lands & Damages	8	9
Total Federal GNF	**116,008**	**128,820**
non-Federal Navigation:		
BIH Channel	88,571	98,487
Land & Damages	3	3
Total non-Federal GNF	**88,574**	**98,490**
Total GNF	**204,582**	**227,310**
Other Federal Costs		
Federal: ATON	108	118
Total Other Federal Costs	**108**	**118**
Other non-Federal Costs		
Lands	5	5
Associated Costs: Berths and Docks	47,257	52,384
Total non-Federal Costs	**47,262**	**52,389**
Total Project Costs	**251,952**	**279,817**

* Costs include PED and Construction Management totals

The USCG is responsible for ATON, and the cost is allocated as a Federal expense because the installation of new navigation aids on the Channel Extension is related to deepening.

Non-Federal costs include non-Federal sponsor and berthing/dock owner costs to include construction of capacity for maintenance dredged material. The non-Federal sponsor is responsible for 100 percent of LERRs. All project construction is on lands that are currently owned by the non-Federal sponsor. Pipeline relocations are defined as “deep-draft utility

Table 8-3. Recommended Plan First Cost Allocation
(October 2013 price levels, $ in 1,000s)

General Navigation Features	Costs Allocated for Depth Increment from 42 to 45 feet			Costs Allocated to Depth Increment From 45 to 52 feet			Total Federal Share ($)	Total Non-Federal Share ($)	Total First Cost ($)
	Total ($)	Federal Share ($) (75% of 45-Ft Costs)	Non-Federal Share ($) (25% of 45-Ft Costs)	Total ($)	Federal Share ($) (50% of Cost - Depth Increment Greater than 45 Feet)	Non-Federal Share ($) (50% of Cost - Depth Increment Greater than 45 Feet)			
Construction Dredging and Placement Areas	50,946	38,210	12,737	118,874	59,437	59,437	97,647	72,174	169,820
Engineering and Design	-	-	-	21,719	10,860	10,860	10,860	10,860	21,719
Construction Management	3,910	2,932	977	9,122	4,561	4,561	7,493	5,538	13,032
Lands	11	8	3				8	3	11
Subtotal	54,867	41,150	13,717	149,715	74,858	74,858	116,008	88,574	204,582
Lands, Easements, ROW, and Relocations (LERRs)	100% Non-Federal			100% Non-Federal					
Lands	5	-	5	-	-	-	-	5	5
Subtotal	5	-	5	-	-	-	-	5	5
Total First Costs	54,872	41,150	13,722	149,715	74,858	74,858	116,008	88,579	204,587
Other Federal Costs	100% Federal			100% Federal					
Aids to Navigation - USCG Channel Markers	-	-	-	108	108	-	108	-	108
Subtotal	-	-	-	108	108	-	108	-	108
Associated Non-Federal Costs	100% Non-Federal			100% Non-Federal					
Berthing Area & Dock Modifications		-	-	47,257	-	47,257	-	47,257	47,257
Subtotal	-	-	-	47,257	-	47,257	-	47,257	47,257
Total Project Costs	54,872	41,150	13,722	197,080	74,966	122,115	116,116	135,836	251,952
Note: Figures may not add to totals due to rounding									

relocations" pursuant to Planning Guidance Letter (PGL) 44. No pipeline relocations are anticipated. Owners of berth and dock facilities that require modification in conjunction with the project would be responsible for 100 percent of those associated costs. Berth deepening and structural modifications would be incurred and are included in the project cost.

The maintenance of project features, including dredging, dike raisings, and DAMP work costs, would be funded through annual appropriations of the O&M program. The actual amounts would vary on a year-to-year basis because of variability in the volume of material removed during each dredging cycle and the variability of the cycles. Costs for maintenance of the BIH would be in accordance with Section 101(b) of WRDA 1986, as modified by Section 2102(b) of the Water Resources Reform and Development Act (WRRDA) of 2014, which allocates the increment of costs for maintenance of channel depths to 50 feet as 100 percent Federal and the increment of costs for channel depths below 50 feet as 50 percent non-Federal and 50 percent Federal. Costs for dike raising for dredging of berthing areas and development of other local service facilities is 100 percent a non-Federal sponsor responsibility. Additional PA capacity for the Recommended Plan would be constructed regularly over the 50-year period of analysis in conjunction with maintenance dredging cycles.

The increase in O&M dredging, DAMP work, and dike raising costs has been calculated to be an additional $2,971,000 annually. The cost allocation for this O&M is an increase in approximately $2,674,000 in Federal cost and $297,000 in non-Federal cost annually.

8.4 Additional non-Federal Sponsor Cash Contribution

Section 101 of Public Law 99-662 requires for all navigation channel depths that the non-Federal sponsor must provide an additional cash contribution equal to 10 percent of fully funded GNF costs (minus costs for LERRs). This total is detailed in Table 8-4 below. These costs may be paid over a period not to exceed 30 years.

Table 8-4. Total General Navigation Features Costs and Credits
(October 2012 Price Level)

Cost-Shared GNF	$204,582,000
10% of GNF	$20,458,000
Creditable Land Costs	$5,000
Cash Contribution	$20,453,000

8.5 Views of non-Federal Sponsor and Others

The non-Federal sponsor for the existing project, BND, has actively participated in the entire planning process. Their primary concern has been to provide the community with a channel

design, preferably 52 feet deep in the Main Channel, to increase navigation efficiency and safety. BND is supportive of the Recommended Plan and has indicated a strong interest in beginning construction as soon as possible.

8.6 Recommended Plan and Recent USACE Initiatives

As discussed in the Appendix L (Plan Formulation), the USACE has implemented the USACE Campaign Plan over the past few years. These initiatives were developed to ensure USACE success in the future by improving the current practices and decision-making processes of the USACE organization. The application of those principles as they relate to the Recommended Plan for BIH is described below.

8.6.1 USACE Actions for Change as Reflected in the Campaign Plan

Goal 2: Transform Civil Works - Deliver enduring and essential water resource solutions, utilizing effective transformation strategies.

- BIH study analyzed potential effects over the study area.
- Direct and indirect effects of the project on the environment were avoided by changes in project design.
- All environmental impacts of the proposed project have been addressed and no compensatory mitigation is required.
- Dredged material placement plans were analyzed to beneficially use the material to the benefit of the entire system (inshore and offshore) to the greatest extent possible. Dredged material placed at the Feeder Berm would be beneficial in slowing shoreline erosion and resupplying sediment to the longshore drift.
- Close coordination among the USACE, non-Federal sponsor, resource agencies, and interested parties occurred throughout the study process. Interactions were professional and respectful, and opinions and expertise of others were obtained and utilized where appropriate. Coordination with the resource agencies and interested parties ensured that the spectrum of environmental habitats of the study and project area was adequately understood and that potential impacts accurately identified.
- Developed plans over long-term, 50-year period of analysis.
- Utilized latest development in engineering, economic, and environmental modeling.
- Risk analyses conducted throughout the study are summarized in Section 6.8.
- Review and inspection of work would be conducted during design and construction.
- Project risks will be communicated during the public review of the study findings.
- Unlike flood risk management and hurricane protection projects, navigation projects involve minimal risk to the public.

- Independent review of the project documents and analyses was performed internally to the USACE and externally by professionals from academia and expert consultants. Comments from those reviews have been incorporated into the study documents, as appropriate.

8.6.2 Environmental Operating Principles

Throughout the study process, USACE Environmental Operating Principles (EOP) were considered during alternatives and plan development. The re-energized EOP principles are considered at the same level as economic issues. The seven EOP principles are:

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

The application of EOP principles resulted in a Recommended Plan which minimizes the extent of channel widening and deepening impacts, restricts terrestrial impacts of the DMMP to existing PA footprints, adopts measures recommended by USFWS to avoid impacts to threatened and endangered species which may occur in the project area, adopts RPMs recommended by NMFS to minimize impacts to threatened and endangered sea turtles which may be adversely affected by hopper dredging during channel construction, protects important adjacent habitat with the installation of a protective dike, and promotes the beneficial use of maintenance material by placing sediment back into the littoral system in a nearshore Feeder Berm. An open and transparent process was employed to scope environmental and social issues of concern to resource agencies, local governments and the general public, and the DIFR-EA was circulated for public review and comment.

9 PUBLIC INVOLVEMENT

Public input was solicited through a public scoping meeting held at the Mary Yturria Education Center in Brownsville, Texas on January 31, 2007. Public input was received concerning the following topics:

1) Economic development opportunities;
2) Operational constraints associated with the BIH channel;
3) Current dredged material placement practices;
4) Opportunities for environmental restoration; and
5) The proposed channel improvement project.

The public was provided an opportunity to express comments in person or in writing. The following is an overview of the comments and concerns expressed by interested parties throughout the study process. These comments were received from the general public, State, and Federal resource agencies, and others. Detailed information including the transcript from the 2007 scoping meeting and comments received throughout the public involvement process is included in Appendix D.

At the scoping meeting, strong expressions of support were provided by members of the U.S. Congress, Texas Senate, Cameron County, the City of South Padre Island, local chambers of commerce, local business, and private citizens. Concerns were expressed about the inability of the current channel to support larger and deeper draft vessels needed for future economic growth, shoaling issues and maintenance dredging of the existing channel, blowing dust from potentially new or larger PAs, and beach erosion on South Padre Island. Officials from the Town (now City) of South Padre Island requested that sand from channel dredging be beneficially used for beach nourishment at South Padre Island. The GLO has partnered with USACE to place sandy maintenance material on the Gulf beach north of the jetties at Brazos Santiago Pass in the past and the City would like to continue this practice in the future.

Public and agencies were given an opportunity to review the draft report and responses to these comments were summarized in Appendix D of the final report. No public comments were received on the draft report. The notice of the availability of the draft report was sent to 225 individuals, agencies, businesses, local governments, and wildlife refuges. Digital copies of the draft report were also provided and the draft document was posted on the Galveston District website.

Comments were received from the EPA regarding the sufficiency of a draft Contaminant Sampling report and potential ODMDS mounding heights. USACE worked to resolve issues

with the draft report and has completed a final report. The original report conclusions regarding suitability of material for disposal and mounding heights were sustained.

10 RECOMMENDATIONS

10.1 Overview

It is recommended that the existing projects for BIH, Texas, authorized by the resolution of the Committee on Public Works, U.S. House of Representatives dated May 5, 1966, be modified generally as described in this report as the Recommended Plan, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to cost-sharing and financing arrangements satisfactory to the President and the Congress, to provide deep-draft channel improvements to the BIH Channel from the enlargement and continued maintenance of a portion of the BIH Channel.

For the purpose of calculating the Section 902 limit, the total estimated first cost of the GNF is $204,587,000, including an estimated Federal share of $116,008,000 and an estimated non-Federal share of $88,579,000. The Total Project Cost of all project components, minus inflation and IDC, totals $251,952,000. Total average annual costs for the project are $14,163,000, which includes $11,192,000 in average annual costs for construction and $2,971,000 incremental annual O&M costs. The Federal government would be responsible for $2,674,000 of the incremental O&M costs and the non-Federal sponsor would be responsible for the remaining $297,000. Fully Funded Cost of the project, which includes Project Costs and expected escalation totals, is $279,817,000.

These recommendations are made with the provision that, prior to implementation of the recommended improvements, the non-Federal sponsor shall enter into binding agreements with the Federal government to comply with the following requirements:

BND shall:

a. Provide 10 percent of the total cost of construction of the GNFs attributable to dredging to a depth not in excess of 20 feet; plus 25 percent of the total cost of construction of the GNFs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet; plus 50 percent of the total cost of construction of the GNFs attributable to dredging to a depth in excess of 45 feet as further specified below:

    1) Provide 50 percent of design costs allocated by the Government to commercial navigation in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

    2) Provide, during construction, any additional funds necessary to make its total contribution for commercial navigation equal to 10 percent of the total cost of construction of the GNFs attributable to dredging to a depth not in excess of

20 feet; plus 25 percent of the total cost of construction of the GNFs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet; plus 50 percent of the total cost of construction of the GNFs attributable to dredging to a depth in excess of 45 feet;

b. Provide all LERRs, including those necessary for the borrowing of material and placement of dredged or excavated material, and perform or assure the 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 LERRs, 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 LERRs, including utility relocations, provided by the sponsor equals or exceeds 10 percent of the total cost of construction of the GNF, the sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of LERRs, 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 Federal Government;

e. Provide 50 percent of the excess cost of O&M of the project over that cost, which the Federal Government determines would be incurred for O&M if the project had a depth of 50 feet;

f. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating and maintaining the GNFs;

g. Hold and save the U.S. free from all damages arising from the construction or O&M of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the U.S. or its contractors;

h. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction 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;

i. Perform, or ensure performance of, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601–9675, that may exist in, on, or under LERRs that the Government determines to be necessary for the construction or O&M of the GNFs. However, for LERRs that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

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

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

l. Comply with Section 221 of PL 91-611, Flood Control Act of 1970, as amended (42 USC 1962d-5b), and Section 101(e) of the WRDA 86, Public Law 99-662, as amended (33 USC 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;

m. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended (42 USC 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 disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

n. 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, as well as 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 USC 3141-3148 and 40 USC 3701-3708 (revising, codifying and enacting without substantive changes the provision of the Davis-Bacon Act (formerly 40 USC 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 USC 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 USC 276c);

o. 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

p. Not use funds from other Federal programs throughout, including any non-Federal contribution required as a matching share, therefore, to meet any of the 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.

Construction of the recommended channel improvements is estimated to take 2.4 years to complete. During this period, the Government and the non-Federal sponsor shall diligently maintain the projects at their previously authorized dimensions according to the previous cooperation agreement. Maintenance materials will be removed from the channel prior to the beginning of construction and dredging profiles then will be taken. Maintenance materials that have accumulated in the channels after the time that "before dredging" profiles are taken for construction payment shall be considered as new work material and cost-shared according to the new cooperation agreement. Any dredging in a construction contract reach after the improvements have been completed and the construction contract closed will be considered to be maintenance material and cost-shared according to the new agreement.

The recommendations contained herein reflect no current removal of pipelines. Pipeline removal/relocation is recommended, in most cases, for pipelines with less than 20 feet of cover after project construction over the width of the channel plus an additional 25 feet of width on each channel edge. It is proposed that all of the lines remain at their current depth based on several criteria, including type of product transported in the line, whether the line has a casing, type of material the line is buried in, and scour in the portion of the channel the line is located in. Based on these considerations, all pipelines after project construction will remain at their current depth. Additional consideration will be given to cover requirements during design of the project. Should the decision be made that more cover is needed on lines not previously scheduled for removal, the District Engineer will update the project economic evaluation to reflect the additional associated costs and submit the economic update to the Chief of Engineers for approval prior to advertising the first construction contract and notify the affected pipeline

owners that they will have to remove these pipelines. Since pipeline removals are not a project cost, no changes to the Baseline Cost Estimate or Sponsor and Federal cost-sharing will be required.

10.2 Categorical Exemption

A categorical exemption for navigation projects exists to deviate from selection of the NED plan in accordance with ER 1105-2-100, E-3.b (5) that states:

> "Categorical Exemption for Flood Control and Navigation Projects. If the non-Federal sponsor identifies a constraint to maximum physical project size or a financial constraint due to limited resources, and if net benefits are increasing as the constraint is reached, the requirement to formulate larger scale plans in an effort to identify the NED plan is suspended. The constrained plan may be recommended. ..."

The proposed project meets the requirements for a categorical exemption due to the sponsor's financial constraint and is recommended as the Recommended Plan. Additional deepening beyond 52 feet was not evaluated in this study so the NED plan could not be identified. This constrained Recommended Plan consists of deepening of the channel to 52 feet as described in Section 6.0 of this report.

10.3 Recommendation

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels with the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorizations 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 modifications and will be afforded an opportunity to comment further.

3 JUL 14
Date

Richard P. Pannell
Colonel, Corps of Engineers
District Engineer

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