



**U.S. Army Corps
of Engineers**

**Galveston District
Southwestern Division**

Freeport Harbor Channel Improvement Project, Brazoria County, Texas

Final Integrated General Reevaluation Report - Environmental Assessment



February 2018 (*Revised 29 March 2018*)

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Draft Finding of No Significant Impact

FREEMPORT HARBOR CHANNEL IMPROVEMENT PROJECT, BRAZORIA COUNTY, TEXAS FINAL INTEGRATED GENERAL REEVALUATION REPORT AND ENVIRONMENTAL ASSESSMENT

FEBRUARY 2018

The U.S. Army Corps of Engineers, Galveston District (Corps), has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The Corps assessed the effects of the following actions in the Final Integrated General Reevaluation Report-Environmental Assessment, dated February 2018, for the Freeport Harbor Channel Improvement Project, which is incorporated herein by reference:

- Channel Widening to 400 feet from approximately Station (Sta.) 142+00 to Sta. 185+00 would deepen about 9.9 acres of submerged bottom to 46 feet mean lower low water (MLLW) with a hydraulic cutterhead dredge. The widening would require removal of the underwater berm around the perimeter of the Dow Thumb. Removal of the underwater berm could reduce the stability of a portion of the Old River North Levee, part of the existing Freeport Hurricane Flood Protection Project (HFPP). Prior to widening the channel a stability wall would be inserted into the terrestrial portion of the Dow Thumb at the waterside toe of the HFPP levee to provide foundation reinforcement; this HFPP modification is expected to be implemented under Section 408.
- Bend Easing would be constructed at the west end of the HFPP North Wave Barrier from Sta. 147+00 to Sta. 160+00, requiring excavation that would affect approximately 16.4 acres of emergent land and dredging that would affect approximately 7.5 acres of submerged lands. Construction would be conducted with a hydraulic cutterhead dredge and mechanical excavator. Prior to constructing the bend easing, this portion of the existing HFPP wave barrier would be relocated through a re-designation of a segment of the Old Quintana Road to serve as the wave barrier; implementation of the re-designation is expected to occur under Section 408. At this time, it is believed that no modifications to the existing roadway would be required. Old Quintana Road currently serves as the wave barrier for the east side of the North Wave Barrier.

- Turning Notch would be constructed at the Upper Turning Basin (Sta. 175+00 to 182+00) by a hydraulic cutterhead dredge. Construction of the turning notch would require dredging that would affect about 8.3 acres of submerged bottom.
- Construction of the Recommended Plan would generate approximately 1.7 million cubic yards (MCY) of new work material, which would be placed in existing Placement Area 1. Maintenance material would be placed in the Maintenance Ocean Dredged Material Disposal Site 1A (ODMDS).

In addition to the “no action” alternative, two channel widening alternatives of 400-foot (Alternative 2) and 425-foot (Alternative 3) widths were evaluated in the final screening. The bend easing and turning notch features were included in and identical in both Alternatives. It is not known if Alternative 2 is the National Economic Development (NED) plan, which maximizes net excess benefits because the net excess benefits were still increasing and a deeper alternative was not included in the Final Array of alternatives. However, Alternative 2 was the most cost effective of the Final Array of alternatives considered to the 46 feet MLLW depth requested by the non-Federal sponsor. If a plan with lesser benefits is preferred by the sponsor, USACE guidance allows for a categorical exemption to be granted and this lesser plan to be selected as the Recommended Plan. Therefore, Alternative 2, widening the channel to 400 feet in Reach 2, and constructing the bend easing and turning notch, all to 46 feet MLLW, is considered the Recommended Plan and the environmentally preferable alternative.

All practicable means to avoid and minimize adverse environmental effects have been incorporated into the Recommended Plan. No significant impacts have been identified and no compensatory mitigation is required. The Recommended Plan would have no effect on existing salinity, long-term water quality, threatened or endangered species, essential fish habitat, wetlands, submerged aquatic vegetation, or prime farmlands, and historic properties, and there would be no negative socio-economic effects. Temporary and minor impacts to water quality, turbidity, benthic organisms, and noise would occur during dredging and placement activities in the project area. A General Conformity Determination for nitrogen oxide (NOx) emissions has been approved as these emissions are estimated to exceed the current applicability threshold. Emissions are well within emissions budgets in the most recent State Implementation Plan

Alternative plans were formulated, evaluated, and selected for implementation in compliance with the framework provided in the Water Resource Council’s 1983 Economic and Environmental Principles for Water and Related Land Resources Implementation Studies, and in compliance with the procedures, policies, and analytical requirements in the USACE Engineering Regulation “Planning Guidance” ER 1105-2-100, as well as all other applicable laws, executive orders, regulations, policies, and guidance. It is my determination that the recommended plan does not

constitute a major federal action that would significantly affect the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date

Lars N. Zetterstrom
Colonel, Corps of Engineers,
District Commander

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EXECUTIVE SUMMARY* (NEPA required)

REPORT

This Final Integrated General Reevaluation Report and Environmental Assessment (FIGRR-EA), documents the formulation and evaluation of plans to modify the recommended plan from the *Freeport Harbor Channel Improvement Project Final Feasibility Report (2012 Feasibility Report) and Environmental Impact Statement (2012 FEIS)*, dated September 2012 (2012 Feasibility Report/FEIS). The 2012 Feasibility Report Recommended Plan was authorized for construction in Section 7002 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014). The 2012 FEIS provided National Environmental Policy Act (NEPA) compliance for the 2012 Feasibility Report.

This reevaluation study has identified and screened alternatives to address a navigation problem and is presenting a Recommended Plan. This FIGRR-EA has undergone public review, policy review, and Agency Technical Review (ATR).

STUDY INFORMATION

Authority. This report is an interim response to the study authority, Section 216 of the Flood Control Act (FCA) of 1970 (Public Law [P.L.] 91-611), as amended.

Purpose and Scope. The overall purpose of this this reevaluation study and report is to address modifications to the project authorized in WRRDA 2014, that are necessary to facilitate the safe and efficient navigation of the Panamax design vessel around the Dow Thumb and to and from the Velasco Container Terminal, and determine whether those modifications are economically justified as a separable element. Additionally, an economic update of the overall project authorized in WRRDA 2014 has been performed to determine whether the project is still in the Federal Interest.

Location. The FIGRR-EA study area is located on the middle Texas coast, bounded generally by the Brazos River on the west, Oyster Creek on the north and east, and the Gulf of Mexico on the south. The study area for the Freeport GRR mirrors the study area identified for the 2012 Feasibility Report/FEIS (**Figure ES-1**).



Figure ES-1 – GRR Study Area

The EA for the Freeport FIGRR-EA covers the impact areas of the Recommended Plan, which are outside the footprint of the 2012 Feasibility Report/FEIS. The 2012 Feasibility Report was divided into four separable reaches (Reach 1 through Reach 4, as shown in **Figure ES-2**).

Study Sponsor. The non-Federal Sponsor (NFS) is Port Freeport. Port Freeport is providing the environmental analyses and most engineering products as Work-In-Kind (WIK) products.

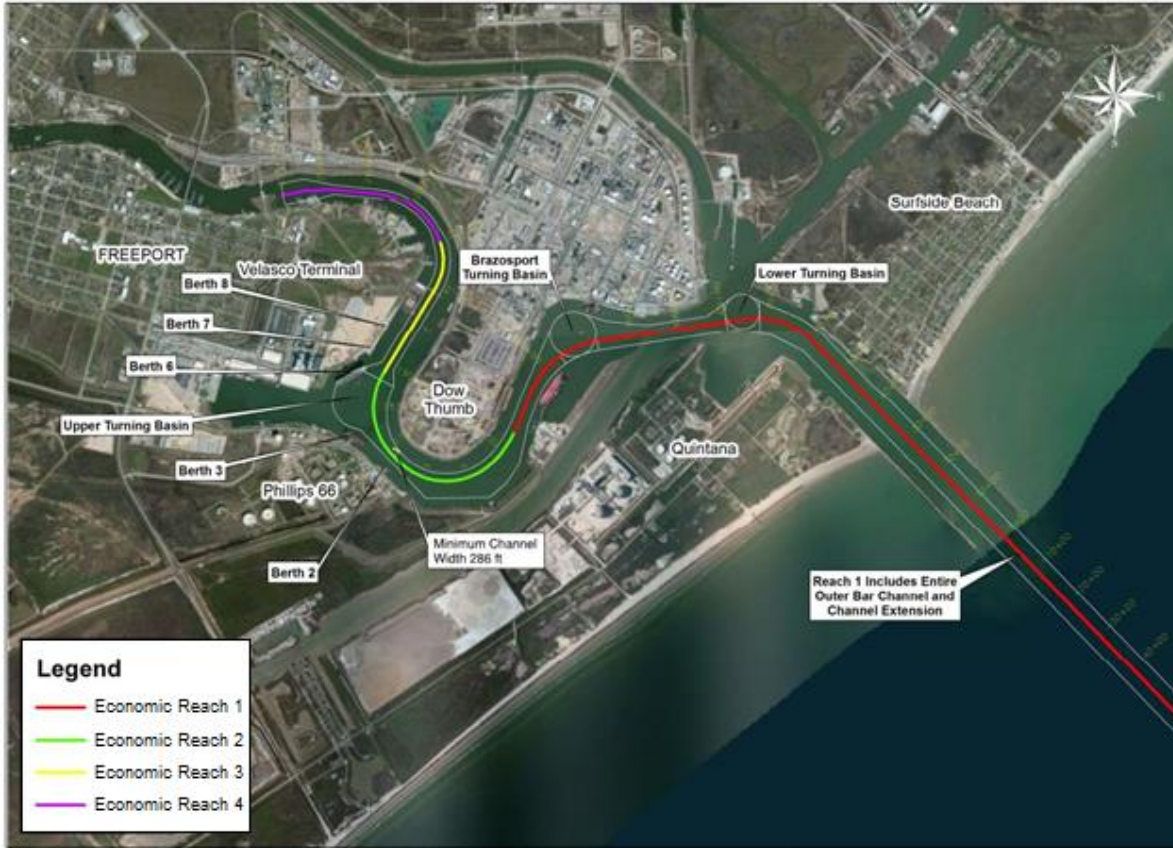


Figure ES-2 –GRR Project Area (Reach 2 and Reach 3)

AUTHORIZED PROJECT

The plan authorized under WRRDA 2014, was the locally preferred plan (LPP) from the 2012 Feasibility Report. The LPP plan was comprised of the following improvements referenced in mean lower low water (MLLW) datum with the associated Reach identified in parenthesis:

- Deepen the Outer Bar Channel into the Gulf of Mexico to 58 feet [**Reach 1**];
- Deepen from the end of the Jetties in the Gulf of Mexico to the Lower Turning Basin to 56 feet [**Reach 1**];
- Deepen from the Lower Turning Basin to Station 132+66 near the Brazosport Turning Basin to 56 feet [**Reach 1**];
- Enlarge the Brazosport Turning Basin from 1,000 foot diameter to 1,200 foot diameter [**Reach 1**];
- Deepen from Station 132+66, above the Brazosport Turning Basin, through the Upper Turning Basin to 51 feet [**Reach 2**];
- Deepen and widen the lower 3,700 feet of the Stauffer Channel to 51 feet and 300 feet wide [**Reach 3**];

- Dredge the remainder of the Stauffer Channel to 26 feet (previously authorized to 30 feet) [Reach 4];

A dredged material management plan (DMMP) was developed during the study. Mitigation was required to compensate for impacts that would result from the future construction of two new placement areas, PA 8 and PA 9.

GENERAL REEVALUATION TRIGGER

Panamax Concerns. Shortly after the feasibility study was concluded, Port Freeport, and the Brazos Pilots expressed concerns regarding the ability of the Panamax design vessel to reach the Velasco Container Terminal in Reach 3. The channel narrows around the Dow Thumb in Reach 2 (**Figure ES-3**) and the Panamax design vessel cannot safely transit around the Dow Thumb to allow travel to and from the Velasco Container Terminal in Reach 3.



Figure ES-3 - Channel Constriction

Previous Ship Simulations. In 2005 and 2007, ship simulations conducted for the feasibility study showed that Post Panamax vessels could not navigate the channel. An assumption was made that both Panamax and Sub Panamax sized vessels could safely navigate the channel. The assumption; however, was not verified through an additional ship simulation during that feasibility study.

Decision to Reevaluate. The decision was made to proceed with a general reevaluation report (GRR) to examine ship passage under different scenarios around the Dow Thumb. In addition, the GRR would determine any needed modifications to allow for the Panamax design vessel to safely and efficiently transit around the Dow Thumb to and from the Velasco Container Terminal in Reach 3. The sponsor requested the modifications be investigated to a depth of 46 feet MLLW. The sponsor intends to eventually construct the project authorized under WRRDA 2014, to its full dimensions. Additionally, an economic update of the 2012 Feasibility Report inclusive of the GRR modifications must be conducted to determine whether the project is still in the Federal interest.

PRIOR REPORTS AND EXISTING WATER PROJECTS

The **Flood Control Act (FCA) of 1962** authorized the Freeport Hurricane Flood Protection Project (HFPP). Many existing features were adopted into the HFPP as is. Two of those features are located within the GRR project area (circled in **Figure ES-4**). They are the Old River North Levee located around the Dow Thumb (purple line) and the North Wave Barrier (pink line).



Figure ES-4 – GRR Study Area

The Rivers and Harbors Act (RHA) of 1970 authorized the Freeport Harbor Project commonly referred to as the *45-Foot Project* (at mean low tide or MLT). Construction completed in 1993, generally deepened, and widened the previously authorized project from the 1950s. During the construction process the channel in the area of the Dow Thumb (Reach 2), was shifted, reducing the 1958 project width of 400 feet to “generally 350-375” with the current day narrowest constriction of 279 feet. This was the result of a series of shifts of the channel for the express purpose of protecting the underwater berm at the base of the Old River North Levee for stabilization.

The project authorized under WRRDA 2014, has not yet been constructed; therefore, the existing condition nearly matches the dimensions of the 45-Foot Project authorized to 45-foot MLT (46-foot MLLW). The difference between the 45-Foot Project and the existing condition is widening of the channels (Outer Bar Channel and Jetty Channel) conducted by Port Freeport under Department of the Army Regulatory (DA) Permit SWG-2004-02311. The authorized depths and widths for both projects are included in **Table ES-1**. For orientation purposes, the channel segments involved in this GRR evaluation for modifications are highlighted in the table.

Table ES-1 - Authorized Depths / Widths: 45 Foot (RHA 1970) & 2012 Feasibility Report

Channel Segment	45 Foot Project		WRRDA 2014	
	Depth (MLLW) ¹	Width (Feet)	Depth (MLLW) ¹	Width (Feet)
Outer Bar Channel				
(New) Future Channel Extension ²	N/A	N/A	58	600
Outer Bar Channel	48	400	58	600 ³
Jetty Channel	46	400	56	600 ³
Lower Turning Basin	46	750	56	Existing (750)
Main Channel				
Channel to Brazosport Turning Basin	46	400	56	Existing (400)
Brazosport Turning Basin	46	1,000	56	1,200
Channel to Upper Turning Basin	46	Generally 350-375 ⁴	51	Generally 350-375 ⁴
Upper Turning Basin	46	1,200	51	Existing (1,200)
Brazos Harbor				
Channel to Brazos Harbor	37	200	N/A	N/A
Brazos Harbor Turning Basin	37	750	N/A	N/A
Stauffer Channel				
Channel to Stauffer Turning Basin	Deauthorized		51	300
Stauffer Turning Basin	Deauthorized		26	200

¹ Does not include advance maintenance or allowable overdepth.

² Not surveyed or constructed. Extension authorized from end of Outer Bar Channel to the -58 MLLW Contour.

³ Widened from 400 to 600 feet per Department of the Army (DA) Regulatory Permit (SWG-2004-02311) by Port Freeport (not deepened).

⁴ Channel is constructed to a width of approximately 279-feet at the waist of the Dow Thumb.

Sabine Pass to Galveston Bay Study (S2G) developed recommendations to reduce the risk of coastal storm surge impacts in this study area. The S2G would modify the Old River North Levee located in Reaches 2 and 3 of the GRR project area. The Chief's Report was signed on December 7, 2017.

WORK-IN-KIND APPROVED UNDER MEMORANUM OF UNDERSTANDING

On October 8, 2015, the Assistant Secretary of the Army (Civil Works) or ASA (CW) approved execution of a memorandum of understanding (MOU) with Port Freeport to construct a portion of the Lower Stauffer Channel concurrent with this study. The work would be accomplished by Port Freeport for Section 221 credit to be applied upon a finding that the work is integral to the channel improvement project and the execution of the Project Partnership Agreement. The work to be conducted under the MOU involves dredging a portion of the Lower Stauffer Channel to 46 feet MLLW to serve Berths 7 and 8 and allow the project to yield the benefits from this modification of the channel around Dow Thumb. Note the Lower Stauffer Channel is authorized to 51 feet MLLW under WRRDA 2014. The dredge quantities for the WIK effort are included with the placement plan developed for the Recommended Plan.

ALTERNATIVE PLANS AND SCREENING

Formulation for this study was limited to determining what modifications to the 2012 Feasibility Report would allow the Panamax vessel to safely transit around the Dow Thumb (Reach 2) to and from the Velasco Container Terminal (Reach 3) and accrue the benefits intended by Congress. During the formulation process, it was determined using previous ship simulation information, and based on meetings with the Brazos Pilots, that in addition to channel widening around the Dow Thumb, bend easing and a turning notch in the Upper Turning Basin would be critical components to the alternative. The alternatives considered construction to a depth of 46 feet are listed in **Table ES-2**. All depths will be presented in MLLW datum from this point forward unless specifically stated otherwise. For information concerning tidal datum see **Section 3.4 of the Engineering Appendix**.

Table ES-2 - Alternatives to 46 feet MLLW

Alternative	Description
No Action Alternative	No Action or Future Without-Project Condition
Alternative 1	Widening at Dow Thumb (375 feet) + Bend Easing + Notch at Upper Turning Basin (required for incremental justification)
Alternative 2	Widening at Dow Thumb (400 feet) + Bend Easing + Notch at Upper Turning Basin
Alternative 3	Widening at Dow Thumb (425 feet) + Bend Easing + Notch at Upper Turning Basin (required for incremental justification and if the ship simulation does not pass the design vessel with 400-foot at Dow Thumb)

Final Array Screening Based on 2016 Ship Simulation

A limited ship simulation study was performed at the STAR Center based in Dania Beach, Florida. The Engineer Research and Development Center (ERDC) provided technical oversight. The simulation used the hydrodynamic model of a Panamax sized container vessel, the *CMA CGM Virginia* for the study (964.6 feet length overall or LOA, 105.6 feet Beam, and 42.6 feet draft). The ship simulation examined the 375-foot and 400-foot alternatives. The simulation failed for the 375 foot width and was successful with the 400 foot width. The recommendations of the 2016 Ship Simulation concluded that safe inbound and outbound transits with the Panamax sized vessel are possible with the 400-foot channel width, and three assist tugboats for both inbound and outbound transits. The Brazos Pilots confirmed, by letter dated September 8, 2016 (see **Engineering Appendix, Attachment 3**), that the 400 foot width would provide for the safe transit of the Panamax design vessel around the Dow Thumb, to the upper Turning Basin.

The ship simulation results were used for screening those alternatives from the Final Array that would not provide for the transit of the Panamax vessel around the Dow Thumb. The remaining alternatives carried forward for the final screening process were Alternative 2 (Widening at Dow

Thumb (400 feet) + Bend Easing + Notch) and Alternative 3 (Widening at Dow Thumb (425 feet) + Bend Easing + Notch). See the **Ship Simulation Report** provided as **Engineering Appendix, Attachment 3**, for additional information on the 2016 Ship Simulation.

Final Comparison of Alternative Plans

Criteria used to evaluate the remaining two alternatives included an evaluation of costs and benefits of the proposed modification as a separable element (**Table ES-3**). Benefits were calculated utilizing the HarborSym model. The Project First Cost includes widening of the channel, bend easing, and dredging of a turning notch, all to 46 feet deep. The estimated costs for the HFPP modifications (stability wall and relocation of the wave barrier to allow for widening of the channel and construction of the bend easing) are included as associated costs. Neither of the alternatives would result in environmental impacts requiring mitigation. Therefore, no environmental mitigation or monitoring costs are included in the estimated Project First Cost.

Table ES-3 – Benefit¹ Analysis for GRR Alternatives to 46 feet (\$000)

Screening Criteria		Alternative 2 Widening at Dow Thumb (400 feet) + Bend Easing + Notch	Alternative 3 Widening at Dow Thumb (425 feet) + Bend Easing + Notch
		<i>Oct 2016 Price Levels and 2.875% Interest Rate</i>	
Total Costs	Project First Cost ²	\$41,664	Greater than \$41,664
	O&M Cost	\$100,646	\$100,646 or Greater
	Environmental Mitigation / Monitoring	\$0	\$0
	HFPP Modifications (Associated Cost) ³	\$15,342	\$15,342
Average Annual	Average Annual Costs	\$4,374	Greater than \$4,374
	Average Annual Benefits	\$6,452	\$6,452
	BCR	1.47	Less than 1.47
	Net Excess Benefits	\$2,078	Less than \$2.078

¹First cost of construction, O&M, and associated costs of HFPP modifications (implementation expected under Section 408) are included in this cost; cost for reassignment of wave barrier was not included but is the same across the structural alternatives.

² Includes costs for Lower Stauffer WIK.

³ Associated financial cost; not part of the recommended Federal project but a necessary non-Federal responsibility.

A comparison against the four criteria in the Water Resource Council's 1983 Economic and Environmental Principles for Water and Related Land Resources Implementation Studies (Principles and Guidelines or P&G): completeness, effectiveness, efficiency, and acceptability, was also made for the remaining two alternatives. The two remaining alternatives in the final array are considered acceptable. While both alternatives would allow the transit of the Panamax design

vessel around the Dow Thumb 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. **Table 5-7** in the main report provides a comparison of P&G Criteria for Alternatives 2 and 3. Alternative 2 was selected over Alternative 3 due to efficiency criteria. Alternative 2 (Widening at Dow Thumb (400 feet) + Bend Easing + Notch) is the plan which best meets the four P&G criteria.

RECOMMENDED PLAN

The Recommended Plan was identified as Alternative 2. Alternative 2 is the most cost effective of the Final Array of alternatives. This plan involves widening the channel at the Dow Thumb to 400 feet, and constructing the bend easing and turning notch, all to 46 feet deep (**Figure ES-5**). The pilots concurred that the Recommended Plan would allow for the efficient, safe transit of the Panamax around the Dow Thumb and to and from the Velasco Container Terminal. No environmental mitigation would be required for Alternative 2.

It is not known if Alternative 2 is the National Economic Development (NED) plan, which maximizes net excess benefits because the net excess benefits were still increasing and a deeper alternative was not included in the Final Array of alternatives. However, Alternative 2 was the most cost effective of the Final Array of alternatives considered to the 46 foot depth requested by the non-Federal sponsor. If a plan with lesser benefits is preferred by the sponsor, USACE guidance allows for a categorical exemption to be granted and this lesser plan to be selected as the Recommended Plan. Therefore, Alternative 2, widening the channel to 400 feet in Reach 2, and constructing the bend easing and turning notch, all to 46 feet deep, is considered the Recommended Plan.

RECOMMENDED PLAN COMPONENTS

The Recommended Plan consists of the following features to 46 feet deep:

Channel Widening to 400 feet from approximately Sta. 142+00 to Sta. 185+00 would require dredging approximately 9.9 acres of submerged bottom. The widening would require removal of the underwater berm situated around the perimeter of the Dow Thumb. Removal of the underwater berm would reduce the HFPP Old River North Levee global stability factor of strength (FOS) in this area to about 1.0. USACE guidance recommends a FOS value of 1.3. To bring the FOS up to recommended levels, a stability wall (implementation expected under Section 408) would be inserted into the terrestrial portion of the Dow Thumb at the waterside toe of the HFPP levee to provide foundation reinforcement. Preliminary slope stability analysis demonstrates a possibility of increasing the factor of safety to 1.697 by constructing the stability wall to 55 feet below zero feet, North American Vertical Datum of 1988 (NAVD).



Figure ES-5 – Recommended Plan

Bend Easing would be constructed at the west end of the HFPP North Wave Barrier from Sta. 147+00 to Sta. 160+00 and require excavation that would affect approximately 16.4 acres of emergent land and dredging that would affect approximately 7.5 acres of submerged lands. Prior to constructing the bend easing, the wave barrier would be relocated (implementation expected under Section 408) through a re-designation of a segment of the Old Quintana Road, which is of higher elevation, to serve as the wave barrier. At this time, it is believed that no modifications to the existing roadway would be required. Old Quintana Road currently serves as the wave barrier for the east side of the North Wave Barrier. This relocation or re-designation would be required prior to construction of the bend easing.

Turning Notch would be constructed at the Upper Turning Basin (Sta. 175+00 to 182+00) and situated adjacent to the Brazos Port Harbor. Construction of the turning notch would require dredging that would affect about 8.3 acres of submerged bottom.

Construction of the Recommended Plan would generate approximately 1.734 MCY of new work material. An additional 270,000 cubic yards (CY) of material would be generated by the sponsors WIK effort on the Lower Stauffer Channel, bringing the total to approximately 2 MCY of material. Placement options were evaluated to determine the best placement alternative for all material from the Recommended Plan, both new work and O&M. These alternatives considered possible beneficial use (BU) of dredged material, as well as traditional PAs. The least cost placement plan for the Recommended Plan provides for the new work going to PA 1 and approximately 2.7 MCY of maintenance over the 50-year period of analysis (Recommended Plan and sponsor WIK) going offshore to the Ocean Dredged Material Disposal Area designated for maintenance (ODMDS 1A).

ENVIRONMENTAL IMPACTS AND COMPLIANCE

The Recommended Plan would result in no significant environmental or historic property impacts and therefore no mitigation is required. The impact analysis determined there would be no effects to existing salinity, long-term water quality, threatened or endangered species, essential fish habitat (EFH), wetlands, submerged aquatic vegetation, or prime farmlands, and historic properties, and that there would be no negative socio-economic effects. Temporary and minor impacts to water quality, turbidity, benthic organisms, and noise would occur during dredging and placement activities in the project area.

The U.S. Fish and Wildlife Service (USFWS) prepared a Fish and Wildlife Coordination Act Report (**CAR, Appendix I**). The CAR recognizes that the Recommended Plan avoids significant impacts to fish and wildlife resources, including Federal threatened and endangered species. USACE has agreed to fully adopt four CAR recommendations, and partially adopt two recommendations. USACE has agreed to utilize specific Best Management Practices (BMPs) to

avoid wildlife impacts, coordinate with the National Marine Fisheries Service (NMFS), and reevaluate mitigation and endangered species impacts if the Recommended Plan changes. USACE also agreed to properly dispose of contaminated sediments should they be identified and encourage Port Freeport to work with tenants and operators to beneficially use dredged material where feasible. Two recommendations cannot be adopted due to USACE policy. Adoption of a standard policy regarding the BU of new work and maintenance material is beyond the purview of this study. A review of potential BU options determined that the least-cost disposal plan is use of existing PA 1. The USFWS recommendation that USACE construct a bird island with dredged material was not adopted because no wildlife mitigation is required and ecosystem restoration is not an authorized study purpose. Recommendations and all partial or non-adopts are fully explained in **Section 7.6** of the FIGRR-EA.

The DIGRR-EA was circulated for a 30-day public, tribal, and agency review beginning on April 11, 2017. The Biological Assessment (BA) concluded the Recommended Plan would have no effect on federally listed threatened and endangered species. The BA was submitted to USFWS and NMFS. Neither agency provides concurrence when a “no effect” call is made by the action agency. A General Conformity Determination has been obtained from the Texas Commission on Environmental Quality (TCEQ) because nitrogen oxide (NO_x) are estimated to exceed the current applicability threshold. However, the emissions are well within emissions budgets in the most recent State Implementation Plan as documented in **Appendix J**. The TCEQ has also provided State water quality certification, concluding that the project would be conducted in a way that will not violate water quality standards. The Texas General Land Office has determined that the project is consistent with the Texas Coastal Management Plan. The National Marine Fisheries Service has concluded that the project would have no significant impacts to essential fish habitat or managed species. No National Register of Historic Places-listed or eligible sites or State Antiquities Landmarks are located within the project’s area of potential effect.

BENEFITS AND COST OF THE RECOMMENDED PLAN

Benefits were calculated using the USACE approved HarborSym model. Benefits and costs were calculated with a base year of 2022 and a 50-year period of analysis (2022-2071) using the FY 2018 discount rate of 2.75 percent. Construction of the Recommended Plan would generate total average annual benefits of \$7,237,000 with total average annual costs of \$3,082,000 producing a benefit-to-cost ratio (BCR) of 1.74 at the 2.75 percent discount rate.

The construction costs were developed using October 2017 price levels. The project first cost of all project components totals \$38,499,000. The fully funded project cost of all components totals \$41,183,000. The construction costs of the Recommended Plan are provided in **Table ES-4**.

Table ES-4 – Costs for GRR Recommended Plan (\$000)

Cost Account and Feature		Project First Cost	Fully-Funded Cost
		<i>October 2017 Price Level</i>	
01	Lands & Damages (100% non-Federal)	\$4,529	\$4,833
12	Navigation, Ports & Harbors	\$26,561	\$28,203
16	Bank Stabilization	\$1,389	\$1,483
30	Preconstruction Engineering & Design (PED)	\$3,923	\$4,301
31	Construction Management (E&D, S&A)	\$2,097	\$2,363
Total Project First Cost¹		\$38,499	\$41,183

¹Totals do not include \$14,000,000 in associated costs at October 2017 price levels (\$14,794,000 Fully Funded) for HFPP Modifications (100 percent non-Federal) to be conducted under a separate Section 408 approval.

In reference to the costs shown in the table for the 12 Account, these costs include the dredging for the Recommended Plan channel widening, bend easing and turning basin. The costs in the 01 Account are for the land to be excavated/dredged for the bend easing and the costs in the 16 Account are for bank stabilization. Not included in the Project costs are the cost for modifications to the HFPP features (Old River North Levee and HFPP North Wave Barrier) necessary to allow for construction of the Recommended Plan. These costs for HFPP modifications expected to be implemented under Section 408, are associated costs estimated at \$14,000,000 and are 100-percent non-Federal costs. Additionally, costs for the initial Lower Stauffer dredging (270,000 CY) being done as WIK under the WRRDA 2014 authorization are not GRR costs; they are WRRDA 2014 project costs captured under Contract 7, in the updated Total Project Cost Summary.

TOTAL PROJECT FIRST COST COMPARISON

Table ES-5 provides the Project First Cost for 1) the WRRDA 2014 authorized cost at October 2013 price levels, 2) the WRRDA 2014 authorized cost updated to current price levels, and 3) the Project First Cost for the WRRDA 2014 updated costs at current prices levels with the costs for the GRR Recommended Plan included.

Construction of the Total Project (GRR and WRRDA 2014 authorized project) would generated total average annual benefits of \$37,322,000 with total average annual costs of \$25,855,000 producing a BCR of 1.44.

Table ES-5 - Project First Cost Comparison Summary (\$000)

<u>Cost Account and Feature</u>	Project First Cost		
	WRRDA 2014 Authorized	WRRDA 2014 Authorized	WRRDA 2014 Updated + GRR Recommended Plan
	Price Levels		
	Oct 2013	Oct 2017	Oct 2017
01 Lands & Damages (100% Non-Federal)	\$1,702	\$1,843	\$6,372
06 Fish & Wildlife Facilities	\$166	\$204	\$204
12 Navigation, Ports & Harbors ¹	\$209,432	\$198,721	\$225,281
16 Bank Stabilization (GRR only)	\$0	\$0	\$1,389
30 Preconstruction Engineering & Design (PED) ²	\$18,449	\$19,817	\$23,740
31 Construction Management (E&D, S&A)	\$9,567	\$14,919	\$17,015
Project First Cost	\$239,316	\$235,504	\$274,003
Associated Costs (Other Federal and non-Federal)³			
Other Federal Costs (100% Federal)³			
12 Aids to Navigation –USCG ²	\$1,392	\$1,384	\$1,384
Associated Cost Subtotal (Other Federal Costs)³	\$1,392	\$1,384	\$1,384
Associated Costs (100% Non-Federal Cost)³			
11 Levees & Floodwalls (GRR only) ^{3,4}	\$0	\$0	\$14,000
12 Berth Improvements/Dock Dredging ³	\$58,878	\$58,028	\$58,028
Associated Cost Subtotal (Non-Federal Costs)³	\$58,878	\$58,028	\$72,028
Total Associated Costs (Other Federal and Non-Federal)³	\$60,270	\$59,412	\$73,412
Project First Cost plus Associated Costs	\$299,586	\$294,916	\$347,416

¹ Cost decreased due to changes in labor rates, fuel costs, and interest rates.

² Includes \$1,871,000 in Spent Costs (GRR & PED)

³ Associated costs that are not part of the recommended Federal project but are a necessary non-Federal responsibility.

⁴ Implementation of HFPP modifications is expected under Section 408

Note: There may be slight differences due to rounding.

COST SHARING

A cost estimate utilizing Microcomputer Aided Cost Engineering System (MCACES) software tools was developed for the Recommended Plan to October 2017 price levels. The Project First Cost for all project components of the Recommended Plan is separated into expected Federal and non-Federal cost shares, and presented in **Table ES-6**.

Table ES-6 – Cost Apportionment (WRRDA 2014 + Recommended Plan Costs) (\$000)

Project Feature		Project First Cost		
		October 2017 Price Levels		
		Federal	Non-Federal	Total
General Navigation Features (GNF)¹				
06	PA Mitigation-Contract 8 (90/10)	\$44	\$5	\$49
06	PA Mitigation-Contract 8 (75/25)	\$297	\$99	\$395
06	PA Mitigation-Contract 8 (50/50)	\$167	\$167	\$333
12 ²	Navigation Ports & Harbors (90/10)	\$4,584	\$509	\$5,093
12 ²	Navigation Ports & Harbors (75/25)	\$68,379	\$22,793	\$91,171
12 ²	Navigation Ports & Harbors (50/50)	\$67,374	\$67,374	\$134,747
12 ²	GRR-Navigation Ports & Harbors (90/10)	\$0	\$0	\$0
12 ²	GRR-Navigation Ports & Harbors (75/25)	\$24,353	\$8,118	\$32,471
12 ²	GRR-Navigation Ports & Harbors (50/50)	\$0	\$0	\$0
16	Bank Stabilization (90/10)	\$0	\$0	\$0
16	Bank Stabilization (75/25)	\$1,125	\$375	\$1,500
16	Bank Stabilization (50/50)	\$0	\$0	\$0
Spent Costs		\$1,871	\$0	\$1,871
Total GNF Cost		\$168,192	\$99,439	\$267,631
LERR Costs				
01	Land & Damages (100% Non-Federal)	\$0	\$6,372	\$6,372
Total LERR Cost		\$0	\$6,372	\$6,372
Total Project First Cost		\$168,192	\$105,811	\$274,003
Associated Costs (Other Federal and Non-Federal)³				
Other Federal Costs³				
12	Navigation Aids (USCG) 100% Federal ³	\$1,384	\$0	\$1,384
Associated Cost Subtotal (Other Federal Costs)³		\$1,384	\$0	\$1,384
Associated Costs (100% Non-Federal Costs)³				
11	Levees and Floodwalls (HFPP Modifications) ^{3,4}	\$0	\$14,000	\$14,000
12	Associated Costs (Berthing) ³	\$0	\$58,028	\$58,028
Associated Cost Subtotal (Non-Federal Costs)³		\$0	\$72,028	\$72,028
Total Associated Costs (Other Federal and Non-Federal)		\$1,384	\$72,028	\$73,413
Project First Cost plus Associated Costs		\$169,577	\$177,839	\$347,416

¹ Costs included PED and Construction Management totals.

² The Water Infrastructure Improvements for the Nation Act (WIIN Act) dated January 4, 2017, under Section 1111, modified the cost share percentages for the new work originally stated in WRDA 1986.

³ Associated costs that are not part of the recommended Federal project but are a necessary non-Federal responsibility

⁴ Implementation for HFPP modifications expected to occur under Section 408

PUBLIC COORDINATION

The public was provided with the opportunity to comment on the Recommended Plan during the 30-day public review of the DIGRR-EA which began on April 11, 2017 and closed for comments on May 11, 2017. All comments submitted during that process have been considered and addressed. 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, Public Coordination**, of the final report.

NON-FEDERAL SPONSOR SUPPORT

Port Freeport, the non-Federal sponsor for the existing project 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.

POTENTIAL RISKS

The FIGRR-EA is very limited in scope and non-controversial. However, there is risk associated with the implementation of the Recommended Plan. The GRR modifications are dependent upon the completion of the HFPP modifications (stability wall and wave barrier re-designation), expected to be implemented by the non-Federal sponsor under Section 408. Completion of the HFPP modifications is required prior to construction of the channel widening or bend easing. USACE Office of Counsel determined that neither the Chief's discretionary authority nor the 2014 WRRDA authorization is sufficient to allow USACE modifications to the existing HFPP.

MAJOR FINDINGS AND CONCLUSIONS

The proposed actions of this report are in the national interest and provide a modification that would allow the authorized project to accrue the benefits for which congress intended. The recommendations contained herein reflect the information available at this time.

The proposed project meets the requirements for a categorical exemption and is recommended as the Recommended Plan. This plan involves widening the channel at the Dow Thumb to 400 feet, and constructing the bend easing and turning notch, all to 46 feet deep. Construction of these components beyond 46 feet was not evaluated in this study; therefore, the NED plan could not be identified. HFPP modifications are necessary for construction of the Recommended Plan and are expected to be implemented by the non-Federal Sponsor under Section 408.

This Recommended Plan is in support of two of the four goals for USACE contained in the latest (as of 1 May 2015) USACE Campaign Plan. Specifically, the Recommended Plan supports Goal 2 (Transform Civil Works) and Goal 4 (Prepare for Tomorrow). This plan is available on the internet at the following address: <http://www.usace.army.mil/about/campaignplan.aspx>.



**DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229**

**Freeport Harbor Channel Improvement Project, Brazoria
County, Texas**

**Final Integrated General Reevaluation Report –
Environmental Assessment**

February 2018

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- K Dredged Material Management Plan

List of Acronyms

ADCIRC	Advanced Circulation Model
ASA(CW)	Assistant Secretary of the Army (Civil Works)
BA	Biological Assessment
BCR	Benefit-to-Cost Ratio
BMP	Best Management Practice
CAR	USFWS Coordination Act Report
CBRA	Coastal Barrier Improvement Act
CEQ	Council on Environmental Quality
CWA	Clean Water Act
CY	Cubic Yards
DA	Department of the Army
dB	Decibel
DIGRR-EA	Draft Integrated General Reevaluation Report and Environmental Assessment
DMMP	Dredged Material Management Plan
DO	Dissolved Oxygen
EA	Environmental Assessment
EFH	Essential fish habitat
EJ	Environmental Justice
EM	Engineer Manual
EO	Executive Order
EOP	Environmental Operating Principles
EPA	U.S. Environmental Protection Agency
EQ	Environmental Quality
ER	Engineer Regulation
ERDC	Engineer Research and Design Center
ESA	Endangered Species Act
ETL	Engineer Technical Letter
FCA	Flood Control Act
FCSA	Feasibility Cost Sharing Agreement
FHC	Freeport Harbor Channel
FHCIP	Freeport Harbor Channel Improvement Project
FIGRR-EA	Final Integrated General Reevaluation Report - Environmental Assessment
FM	Farm-to-Market Road

FR	Federal Register
FWOP	Future Without-Project
FY	Fiscal Year
GDM	General Design Memorandum
GIWW	Gulf Intracoastal Waterway
GLO	Texas General Land Office
GNF	General Navigation Feature
GRR	General Reevaluation Report
HAPC	Habitat Areas of Particular Concern
H&H	Hydrology and Hydraulics
HFPP	Hurricane Flood Protection Project
HGB	Houston-Galveston-Brazoria
HTRW	Hazardous, Toxic and Radioactive Waste
IDC	Interest During Construction
LERRD	Lands, Easements, Rights-of-Way, Relocations, and Disposal
LNG	Liquefied Natural Gas
LOA	Length Overall
LPG	Liquid Petroleum Gas
LPP	Locally Preferred Plan
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
MMPA	Marine Mammal Protection Act
MOU	Memorandum of Understanding
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAVD 88	North American Vertical Datum of 1988
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor or Sponsor
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO _x	Nitrogen Oxide
NPTA	Native Prairies Association of Texas
O&M	Operations and Maintenance

ODMDS	Ocean Dredged Material Disposal Site
OSE	Other Social Effects
P&G	Principles and Guidelines
PA	Placement Area
PDT	Project Delivery Team
PED	Preconstruction Engineering and Design
PF	Port Freeport
P.L.	Public Law
PPT	Parts Per Thousands
PSI	Professional Service Industries
RED	Regional Economic Development
RHA	Rivers and Harbors Act
ROD	Record of Decision
ROW	Right-of-Way
RSLR	Relative Sea Level Rise
S2G	Sabine to Galveston
SAV	Submerged Aquatic Vegetation
SH	State Highway
SHPO	State Historic Preservation Officer
STWAVE	ERDC's Steady State Wave model
TCEQ	Texas Commission on Environmental Quality
TCMP	Texas Coastal Management Program
TPWD	Texas Parks and Wildlife Department
TSP	Tentatively Selected Plan
TxDOT	Texas Department of Transportation
USACE	U.S. Army Corps of Engineers
U.S.	United States
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VE	Value Engineering
VOC	Volatile Organic Compounds
WIK	Work-In-Kind
WIIN Act	Water Infrastructure Improvements for the Nation Act of 2016, Section 1111
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform Development Act

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1 STUDY INFORMATION

1.1 INTRODUCTION

This is a Final Integrated General Reevaluation Report and Environmental Assessment (FIGRR-EA), for channel improvements of the Freeport Harbor Channel (FHC), Texas deep-draft navigation channel. Report sections required for compliance with the National Environmental Policy Act (NEPA) are indicated with an asterisk following the section heading. The Feasibility Cost Sharing Agreement (FCSA) for this study was signed on June 10, 2015, with the non-Federal sponsor (NFS or sponsor), Port Freeport. The study alternatives have been screened, resulting in identification of the Recommended Plan. Port Freeport and the U.S. Army Corps of Engineers (USACE) propose to modify the FHC to facilitate the safe and efficient navigation of the Panamax design vessel to and from the Velasco Container Terminal.

1.2 STUDY AUTHORITY

This FIGRR-EA is being performed under the authority of Section 216 of the Flood Control Act (FCA) of 1970 (Public Law [P.L.] 91-611), as amended:

The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest.

The *Freeport Harbor Channel Improvement Project Final Feasibility Report* (2012 Feasibility Report) and *Final Environmental Impact Statement* (2012 FEIS) dated September 2012 (2012 Feasibility Report/FEIS), was authorized for construction in Section 7002 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014). **Table 1-1** provides dates and descriptions of authorized features for the Freeport Harbor, Texas Project.

Table 1-1 – Authorization Documents under Freeport Harbor, Texas Authorization

Date Authorizing Act	Project and Work Authorized for Freeport Harbor, Texas	Documents
Jun 14, 1880	Provided for construction of jetties for controlling and improving the channel over the bar at the mouth of the Brazos River	Rivers and Harbors Act (RHA) of 1880
Mar 03, 1899	Dredging and other work necessary in judgment of Secretary of War for improving harbor; for taking over jetties and privately built works at mouth of river	(RHA of 1899, 55th Congress, Ch. 425
Mar 02, 1907	Examination authorized. Work later confined to maintenance of jetties	H. Doc. 1087, 60th Cong., 2nd Sess.
Feb 27, 1911	Repairs to jetties and dredging	RHA of 1911, P.L. 61-425
Mar 04, 1913	Construct seagoing hopper dredge	RHA of 1913, P.L. 62-429
Aug 08, 1917	Purchase of one 15-inch pipeline dredge and equipment, its operation of 3 years, operation of seagoing dredge one-half time for 3 years, and repairs to jetties	RHA of 1917, P.L. 65-37
Mar 03, 1925 ¹	Diversion dam, diversion channel, and necessary auxiliary works	Rivers and Harbors Committee Doc. 10, 68th Cong., 2nd Sess.
Jul 03, 1930	Maintenance of diversion channel at expense of local interest	Rivers and Harbors Committee Doc. 18, 70th Cong., 1st Sess.
Aug 30, 1935	Deepening channels and basins	Rivers and Harbors Committee Doc. 15, 72nd Cong., 1st Sess.
May 17, 1950	Deepen outer bar channel to 38 feet from gulf to a point within jetties, thence 36 feet in authorized channels to and including upper turning basin	H. Doc. 195, 81st Cong., 1st Sess.
Aug 30, 1935	Maintenance of present project dimensions of channels and basins at Federal expense	Rivers and Harbors Committee Docs. 15, 72nd Cong., 1st Sess., and 29, 73rd Cong., 2nd Sess.
Jul 03, 1958	Relocate outer bar channel on straight alignment with jetty channel and maintain Brazos Harbor entrance channel and turning basin (constructed by local interests)	RHA of 1958 (House Doc. 433, 84th Cong., 2nd Sess.)
Oct 05, 1961	Modification of HD 1469 revoking certain provisions of local cooperation	P.L. 394, 87th Cong.
Dec 31, 1970 ²	Relocation of entrance channel and deepen to 47 feet; enlargement to a depth of 45 feet and relocation of jetty channel and inside main channel; deepening to 45 feet of channel to Brazosport; enlargement of the widened area of Quintana Point to provide a depth of 45 feet with a 750-foot diameter turning area; Brazosport turning basin to 45 feet deep with a 1,000 foot turning area; a new turning basin with a 1,200 foot diameter turning area and 45 feet deep; deepening Brazosport channel to 36 by 750 feet diameter; flared approaches from Brazos Harbor Channel; relocation of north jetty and rehabilitation of south jetty	RHA of 1970, PL 91-611; 84 Stat.1818.3 ³
Nov 17, 1986	Modified local cooperation requirements for the 1970 Act	Sec. 101, PL 99-662
Nov 08, 2007	Amends Sec 101 of RHA of 1970 to make all costs for removal of the sunken vessel COMSTOCK a Federal responsibility	Sec. 3148, PL 110-114
Jun 10, 2014	Deepen channel generally greater than 50 feet and reauthorization of Stauffer Channel.	H.R. 3080, P.L. 113-121, 113 th Cong. 2 nd Sess., Sec 7002

¹ Construction of lock in diversion dam at local expense considered inactive.

² It was during the construction of the project that the channel in Reach 2 was shifted away from the underwater berm, resulting in the 279-foot constrained waist at the Dow Thumb.

³ Extension of north jetty 1,950 feet and south jetty 1,265 feet considered inactive (1975 Deauthorization list).

1.3 STUDY PURPOSE AND SCOPE*

This report is an interim response to the study authority. The purpose of this report is to document the findings of the investigations and analyses conducted to determine what modifications to the authorized project are necessary to facilitate the safe and efficient navigation of Panamax vessels around the Dow Thumb and to and from the Velasco Container Terminal and whether those modifications are economically justified as a separable element. Additionally, an economic update of the 2012 Feasibility Report inclusive of the GRR modifications has been performed to determine whether the overall project as authorized is still in the Federal Interest. This report also provides all of the information normally included in an Environmental Assessment and meets the requirements of NEPA. It thoroughly compares the environmental impacts of the Final Array of alternatives and fully describes the impacts of the Recommended Plan. All sections marked with an asterisk (*) are required for NEPA compliance.

1.4 NON-FEDERAL SPONSOR

The NFS is Port Freeport. Port Freeport is providing the environmental and most of the engineering products as Work-In-Kind (WIK) products.

1.5 STUDY AREA

The Freeport GRR study area is located on the middle Texas coast, bounded generally by the Brazos River on the west, Oyster Creek on the north and east, and the Gulf of Mexico on the south. The study area for the Freeport GRR mirrors the study area identified for the 2012 Feasibility Report (**Figure 1-1**), which was divided into four separable reaches (as shown in **Figure 1-2**) The 2012 FEIS provided NEPA compliance for the authorized project.

1.6 PROJECT AREA

The project area for this FIGRR-EA is a subset of the authorized project study area. It is located immediately south of the City of Freeport, in Brazoria County, Texas. This FIGRR-EA focuses on the area affected by the construction modifications proposed around the Dow Thumb within Reaches 2 and 3. The Environmental Assessment (EA) for the Freeport FIGRR-EA covers the impact areas of the Recommended Plan, which are outside the footprint of the 2012 Feasibility Report/FEIS.

The following congressional representatives serve the project area: Senators John Cornyn and Ted Cruz, and Representative Randy Weber (District 14).



Figure 1-1 - Freeport GRR Study Area

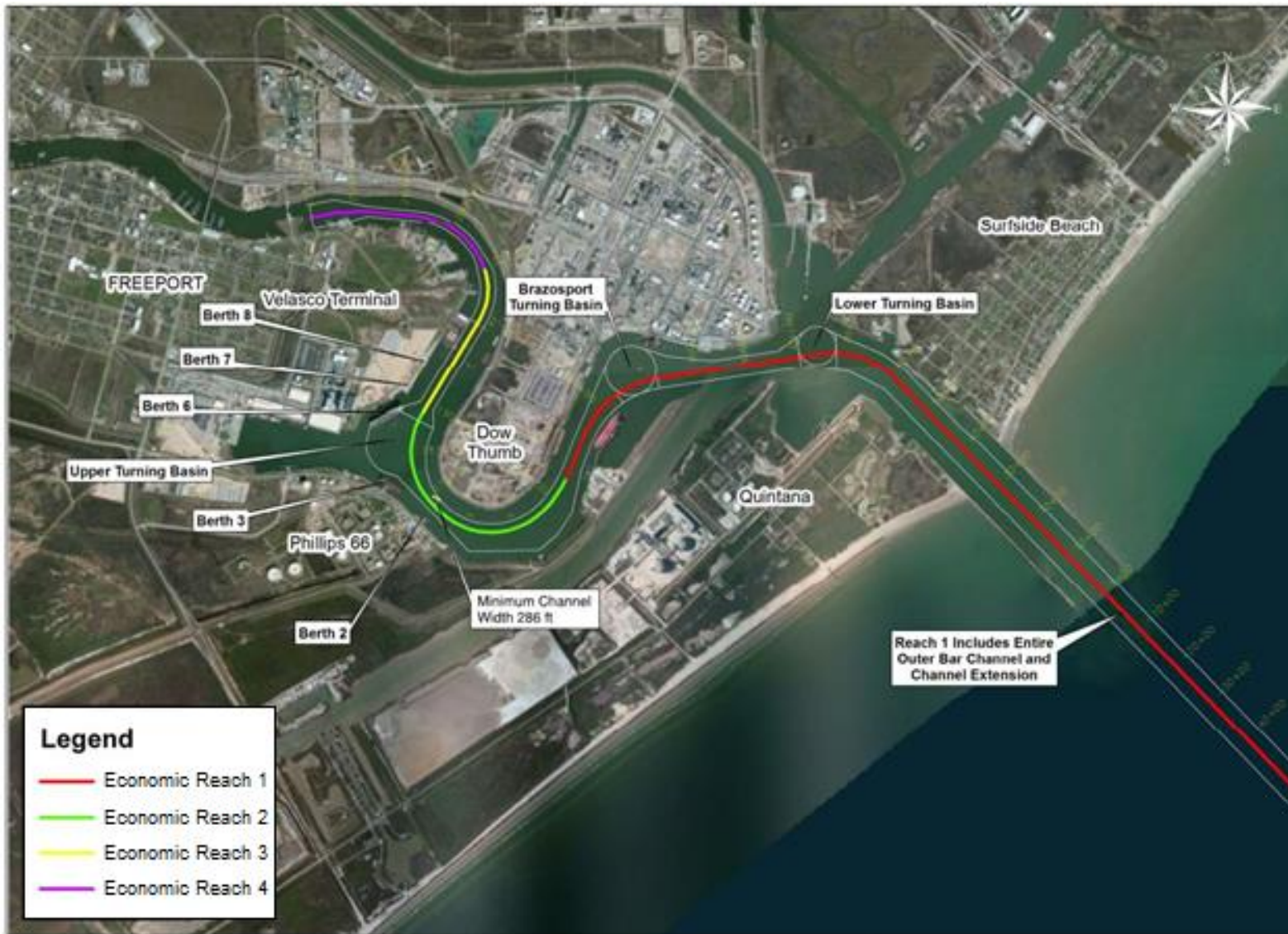


Figure 1-2 - Project Area (Reach 2 and Reach 3)

1.7 VERTICAL DATUM INFORMATION

As per Engineering Technical Letter (ETL) 1110-2-349 *Requirements and Procedures for Referencing Coastal Navigation Project to Mean Lower Low Water Datum*, dated April 1, 1993, and Engineering Manual (EM) 1110-2-1003 *Hydrographic Surveying*, dated April 1, 2002, all elevations referred to in this report, unless specifically noted otherwise, are based on mean lower low water (MLLW) tidal datum. Previous publications on this project were released utilizing Galveston District's mean low tide (MLT) datum. A conversion of zero MLLW = 1 foot MLT (rounded to the nearest whole foot) has been applied (**Engineering Appendix Section 3.2**).

1.8 FUNDING SINCE AUTHORIZATION

Table 1-2 shows the funding history through October 23, 2017, for the Freeport Harbor, by fiscal year (FY) and category. Note, this table only tracks funds received; therefore, WIK amounts for the feasibility study (\$456,735) or general reevaluation study (\$1,211,000) are not included.

Table 1-2 – Funding Since Authorization (through October 23, 2017)

Fiscal Year	Investigations – RECON		Investigations – Feasibility		Investigations – GRR		Investigations – PED		Total Funding	
	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal
FY 2002	\$46,000		\$130,000	\$ -					\$176,000	\$ -
FY 2003	\$79,000		\$406,900	\$570,000					\$485,900	\$570,000
FY 2004			\$418,000	\$397,000					\$418,000	\$397,000
FY 2005			\$495,000	\$500,000					\$495,000	\$500,000
FY 2006			\$500,000	\$482,900					\$500,000	\$482,900
FY 2007			\$709,000	\$709,000					\$709,000	\$709,000
FY 2008			\$382,000	\$400,000					\$382,000	\$400,000
FY 2009			\$574,000	\$556,000					\$574,000	\$556,000
FY 2010			\$248,549	\$199,549					\$248,549	\$199,549
FY 2011			\$412,000	\$49,000					\$412,000	\$49,000
FY 2012			\$48,000	\$ -					\$48,000	\$ -
FY 2013			\$ -	\$ -			\$1,000	\$ -	\$1,000	\$ -
FY 2014							\$1,452,400	\$ -	\$1,452,400	\$ -
FY 2015					\$1,211,000	\$ -	\$(11,000)	\$ -	\$1,200,000	\$ -
FY 2016									\$ -	\$ -
FY 2017			\$(3,602)	\$(337)	\$289,000	\$289,000	\$(335,405)	\$ -	\$(50,007)	\$289,337
FY 2018										
TOTAL	\$125,000	\$ -	\$4,319,847	\$3,863,786	\$1,500,000	\$289,000	\$1,106,995	\$ -	\$7,051,842	\$4,152,786
	\$125,000		\$8,183,633		\$1,789,000		\$1,106,995		\$11,204,628	

This table tracks funds received and does not include WIK (feasibility study \$456,735; \$1,211,000 general reevaluation study).

1.9 HISTORY OF THE INVESTIGATION

1.9.1 2012 Feasibility Report

The 2012 Feasibility Report evaluated navigation and environmental problems and opportunities for a 70-square mile study area. The study area included the cities of Freeport, Surfside Beach and Quintana, the FHC, the Brazos River Diversion Channel, a portion of the Gulf Intracoastal Waterway (GIWW), the Gulf of Mexico shoreline on both sides of the FHC, the offshore channel, and placement areas (PAs) 10 miles into the Gulf of Mexico. The entire study area was located within Brazoria County, Texas and adjacent state waters in the Gulf of Mexico.

The recommended navigation plan was not the National Economic Development (NED) plan. The recommended plan was a Locally Preferred Plan (LPP), which was shallower and less cost than the NED plan. The recommended plan met the requirements for a categorical exemption in accordance with Engineer Regulation (ER) 1105-2-100, Section 3-2.b.10. The LPP authorization recommended the following improvements referenced in MLLW datum:

- Deepen the Outer Bar Channel into the Gulf of Mexico to 58 feet;
- Deepen from the end of the Jetties in the Gulf of Mexico to the Lower Turning Basin to 56 feet;
- Deepen from the Lower Turning Basin to Station 132+66 near the Brazosport Turning Basin to 56 feet;
- Enlarge the Brazosport Turning Basin from 1,000 to 1,200 foot diameter;
- Deepen from Station 132+66, above the Brazosport Turning Basin, through the Upper Turning Basin to 51 feet;
- Deepen and widen the lower 3,700 feet of the Stauffer Channel to 51 feet and 300 feet wide;
- Dredge the remainder of the Stauffer Channel to 26 feet (previously authorized to 30 feet);

The dredged material management plan (DMMP) placement was developed during the feasibility study and documented in the 2012 Feasibility Report. Material from the Channel Extension, Outer Bar Channel and Jetty Channel was designated for offshore placement in the existing New Work and Maintenance Material Ocean Dredged Material Disposal Sites (ODMDS 1 and ODMDS 1A, respectively). Material from the inland FHC and basins would be placed in one existing confined upland PA (PA 1) and two new PAs (PA 8 and PA 9) to be constructed.

The following mitigation features were required as compensation for the impacts to fish and wildlife habitat from the future construction of the two new PAs:

- Preservation of approximately 131 acres of riparian forest under a permanent conservation easement and the improvement of its habitat value by establishing 11 acres of riparian forest in place of 11 acres of invasive tree species;
- The creation of three acres of wetlands and an associated one acre of riparian forest; and
- Required monitoring of mitigation performance and impacts to wetlands and riparian forest for corrective action, if needed

1.9.2 Chief’s Report and WRRDA 2014 Authorization – Project Costs

A Chief of Engineers Report was signed on January 7, 2013. A Record of Decision (ROD) was signed by the Assistant Secretary of the Army (Civil Works) or ASA (CW) on May 31, 2014. The Chief of Engineers Report recommended modification of the existing FHC that provides for a deep-draft waterway from the Gulf of Mexico to the City of Freeport through the original mouth of the Brazos River. A diversion dam about 7.5 miles above the original river mouth, and a diversion channel rerouting the Brazos River from the dam to an outlet into the Gulf about 6.5 miles southwest of the original mouth, now separate the FHC from the river system and make the harbor and channels a tidal system.

The 2012 Feasibility Report provides for a LPP (currently unconstructed) to modify the existing FHC. The Project First Cost breakdown based on the WRRDA 2014 price level of October 2013 is shown in **Table 1-3**.

Table 1-3 – WRRDA 2014 authorized Project First Cost (\$000)

Project Feature	Cost Share Percentages (Fed/NF)	Authorized Project First (Oct 2013 Price Level)		
		Federal Share	Non-Federal Share	Total Project First Cost
Upper Stauffer - Shallow Draft	90/10 (18-20 feet)	\$461	\$51	\$512
	75/25 (20-26 feet)	\$2,308	\$770	\$3,078
Lower Stauffer – Shallow / Deep Draft	90/10 (18-20 feet)	\$304	\$34	\$338
	75/25 (20-45 feet)	\$6,342	\$2,113	\$8,455
Contract 7 on Lower Stauffer Channel over 45 -feet	100% NF (over 45 feet) ¹	\$0	\$2,030	\$2,030
Freeport Harbor Channel	50/50 (over 45 feet)	\$111,533	\$111,533	\$223,066
Mitigation	50/50	\$67	\$67	\$134
Lands & Damages	100% Non-Federal	\$0	\$1,703	\$1,703
TOTALS²		\$121,015	\$118,301	\$239,316

¹ This should have been cost shared 50/50 or \$1,015,000 each.

² Does not include \$60,270,000 in Associated Costs (\$58,878,000 in NF berthing areas, and \$1,392,000 in Aids to Navigation costs (USCG Federal cost)).

The costs displayed in the Section 7002 of WRRDA 2014 authorized the Project for a total project first cost total cost of \$239,300,000 at October 2013 price levels. The estimated Federal and non-Federal shares of the project first cost are \$121,000,000 and \$118,300,000, respectively, as apportioned in accordance with the cost sharing provisions of Section 101 (a) of the Water Resources Development Act (WRDA) of 1986, as amended (33 U.S.C. 2211(a)).

1.9.3 General Reevaluation Trigger

Shortly after the study was concluded, the Port and the pilots expressed concerns regarding the ability of the Panamax design vessel to reach the Velasco Container Terminal in Reach 3. The channel narrows around the Dow Thumb in Reach 2 (**Figure 1-3**) and the Panamax design vessel has issues safely transiting around the Dow Thumb to allow travel to and from the Velasco Container Terminal.



Figure 1-3 – Channel Constriction

In late 2014, Port Freeport approached the Corps and requested a reevaluation of the previous study to determine the appropriate modifications to achieve the intent and purpose of the congressionally authorized project. The sponsor specifically requested evaluation of the modifications to Reach 2, required to allow the Panamax design vessel to reach the Velasco Container Terminal in Reach 3, and the work required to a depth of 46 feet. The sponsor's intention is to construct the necessary modifications to allow the Panamax transit and then later construct the remainder of the project to the authorized project depths.

Subsequent coordination with the Headquarters USACE (HQUSACE) resulted in a decision to proceed with a general reevaluation study. The study would examine ship passage under different scenarios around Dow Thumb, and formulate and evaluate alternative plans to determine a modification to the project authorized in WRRDA 2014 that would allow the Panamax design vessel to transit safely to and from the Velasco Container Terminal. Modifications were to be examined to evaluate impacts to the existing channel and to the existing HFPP, which includes features located adjacent to the channel. As necessary, the study would include an updated environmental review and hydrodynamic modeling and sediment sampling. A cost-benefit analysis of the recommended channel modifications would be conducted to determine whether the modifications are in the Federal Interest.

Additionally, an economic update must also be conducted on the project as a whole (2012 Feasibility Report and GRR modifications) to determine whether the project authorized under WRRDA 2014 is still in the Federal interest.

1.9.4 USACE Ship Simulations for 2012 Feasibility Study

Per the 2012 Feasibility Report Engineer Appendix, multiple ship simulations were conducted for the study. **Table 1-4** provides the ships that were modeled in the ship simulations.

Table 1-4 – Vessels Used in USACE Ship Simulations¹ for 2012 Feasibility Study

Name	Type	Beam	LOA	Draft	Simulation (Year)
		<i>(feet)</i>			
<i>Susan Maersk</i> ²	Containership	140	1140	47	2005
165k LNG Tanker	LNG Tanker	156	990	58	2005
VLCC	Crude Tanker	195	1120	58	2005
NA ³	Containership	106	915	46	2007
VLCC	Crude Tanker	195	1087	44	2010
Tanker	Crude Tanker	164	922	48	2010

¹This table was constructed from available records; however, not all records were available.

² Post Panamax Vessel Class

³ Vessel dimensions provided by ERDC/CHL

LOA=Length Overall, LNG=Liquefied Natural Gas, VLCC=Very Large Crude Carrier

Five channel alignments were initially evaluated in 2005, and then a revised plan was evaluated with a smaller container ship in 2007. In 2010, final runs to evaluate the Brazos Turning Basin were completed. The simulations in 2005 and 2007 showed the Post Panamax vessels could not navigate the channel but an assumption was made that Panamax and Sub Panamax could safely navigate the channel. The assumption; however, was not verified through a ship simulation during that feasibility study.

1.9.5 Implications of Widening Around the Dow Thumb

It was realized early in the study that widening at the Thumb would likely have an impact on portions of two HFPP features located in the study area. Additionally, another study, the Sabine to Galveston study (S2G), has been involved in evaluating alternatives in the study area and is approaching finalization. The project deliver teams (PDTs) for both studies have coordinated throughout this study and acknowledge there may be opportunities for cost savings between the two studies within the GRR project area. In this study, conservative geotechnical assumptions have been made and opportunity for cost savings will be further investigated during the pre-construction, engineering, and design (PED) phase.

1.9.5.1 Existing Hurricane Flood Protection Project Infrastructure

One of the requirements of the GRR study is to examine any impacts the modifications to the authorized project may have on the HFPP. **Figure 1-4** provides an overview of the aerial extent

of the HFPP features. The circle within the bottom right quadrant shows the location of the Dow Thumb and study area for this FIGRR-EA. Note the circle does not include the full 2012 Feasibility Report/FEIS project area.



Figure 1-4 - HFPP Features within the GRR Study Area

1.10 PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

See **Table 1-1**, presented earlier in this document for a complete list of Freeport Harbor, Texas work and authorizations.

Rivers and Harbors Act (RHA) of 1880 authorized the original project to construct jetties for controlling and improving the channel over the bar at the mouth of the Brazos River. Work was conducted from 1881-1886, then operations were suspended for lack of funds.

RHA of 1888 authorized the Brazos River Channel and Dock Company to provide a navigation channel at the mouth of Brazos River and thence inland between the banks of river. The company was unable to finance completion of the work.

RHA of 1899 transferred works, rights, and privileges for the project to the United States (U.S.). This constituted the initial authorization for the existing Freeport Harbor. Numerous authorizations have since been enacted but the majority of the changes have occurred since the 1950s.

RHA of 1925 (R&H Committee Doc. 10, 68th Cong., 2nd Session) authorized the construction of a diversion dam approximately 7.5 miles above the original river mouth and a diversion channel rerouting the Brazos River from the dam to an outlet in the Gulf about 6.5 miles southwest of the original mouth. Since this reroute, Freeport Harbor no longer receives freshwater input from the Brazos River, resulting in a tidal FHC.

RHA of 1950 (H. Doc. 195 81st Cong., 1st Session) deepened the outer bar channel to 38 feet, and 36 feet in the authorized channels to and including the Upper Turning Basin.

RHA of 1958 (H. Doc. 433, 84th Cong., 2nd Session) relocated the outer bar channel on a straight alignment with the jetty channel, and maintained the Brazos Harbor entrance channel and turning basin (constructed by local interests).

The FCA of 1962 (H. Doc. 495, 8th Cong.) authorized the Freeport Hurricane Flood Protection Project (Freeport HFPP) for Freeport and Vicinity, Texas, under P.L. 87-874. The HFPP (shown previously in **Figure 1-4**) provided for construction of improvements at Freeport and Vicinity, Texas for risk management against storm tides caused by tropical cyclones/hurricanes along the Gulf Coast of magnitudes up to and including the standard project hurricane. The HFPP consists of approximately 43 miles of levees and wave barriers and related pump stations, gates, and culverts. Many of the existing features that were determined to have an effect on the FHC system were adopted into the HFPP Federal project as is. Portions of two of those HFPP features are located within the GRR project area (**Figure 1-5**).

The Old River North Levee is the first of those features and is shown in the figure with a purple line. The levee follows along the perimeter of the channel; however, within Reach 2 of the project area, the north slope of the channel is the toe and underwater berm of the Old River North Levee. This underwater berm provides slope stability to the levee in the area of the Dow Thumb. The second feature, in the GRR project area, shown with a pink line, is the North Wave Barrier located across the channel from the Dow Thumb. The existing Freeport HFPP system is currently “unacceptable” in the Flood



Figure 1-5 – HFPP & GRR Study Area

Control and Coastal Emergency Act (P.L. 84-99) program and not certifiable for Federal Emergency Management Administration (FEMA) accreditation under the National Flood Insurance Program (NFIP) Code of Federal Regulations (44 CFR Section 65.10). Therefore, the local sponsor (Velasco Drainage District or VDD) has a System-Wide Improvement Framework (SWIF) plan in place to address the deferred maintenance issues and issues impeding 44 CFR Section 65.10 accreditation. The VDD submitted a SWIF letter of intent (LOI) to the USACE in November 2012, and this letter of intent was accepted and approved by USACE on 13 January 2013. As part of the formulation process, the final recommendation assumed all of the SWIF items would be addressed in accordance with the requirements therein, and would not impact implementation of the final recommendation.

RHA of 1970 (P.L. 91-611; 84 Stat.1818) authorized the Freeport Harbor Project commonly referred to as the “45-Foot Project” (at mean low tide or MLT). The project, which generally deepened and widened the 1950’s project, was completed in 1993. The *Freeport Harbor, Texas (45-foot Project), Final Environmental Statement*, was prepared by the USACE in 1978. Text in the Report of the Board of Engineers described the channel in Reach 2 of the GRR study area as “generally 350-375” feet wide. The channel in Reach 2 was reduced from the 1958 RHA authorization due to an approximately 75-foot shift of the channel away from the underwater berm of the HFPP. This shift was conducted to protect the underwater berm at the base of the Old River North Levee for stabilization. The area around the Dow Thumb where the channel was shifted away from the underwater berm is shown as “deauthorized” in a diagram from the House Document used in the 1970 RHA (**Figure 1-6**).

Two General Design Memorandums (GDM) were prepared for the existing 45-Foot Project, titled *Freeport Harbor, Texas General Design Memorandums No. 1, Phase I and Phase II*, dated 1978, and 1979, respectively. These GDMs provided the basis for preparation of all the dredging and construction plans and specifications for the authorized project. The GDM for Phase II presented additional concerns based on geotechnical data that was collected. The USACE determined the channel needed to be shifted yet further away (i.e. 90 feet) from the underwater berm. This

provided stability to the existing HFPP levee foundation around the Dow Thumb and helped provide an appropriate factor of safety (FOS) resulting in a channel in the Dow Thumb area measuring 285 feet wide. Plans and Specs were prepared for the 45-Foot Project in 1991 showing the channel in its current constructed condition of 285 feet and 279 feet widths in the constricted area of the channel at Dow Thumb. A cutout of the section from the 1991 Plans and Specs is provided in **Figure 1-7**.

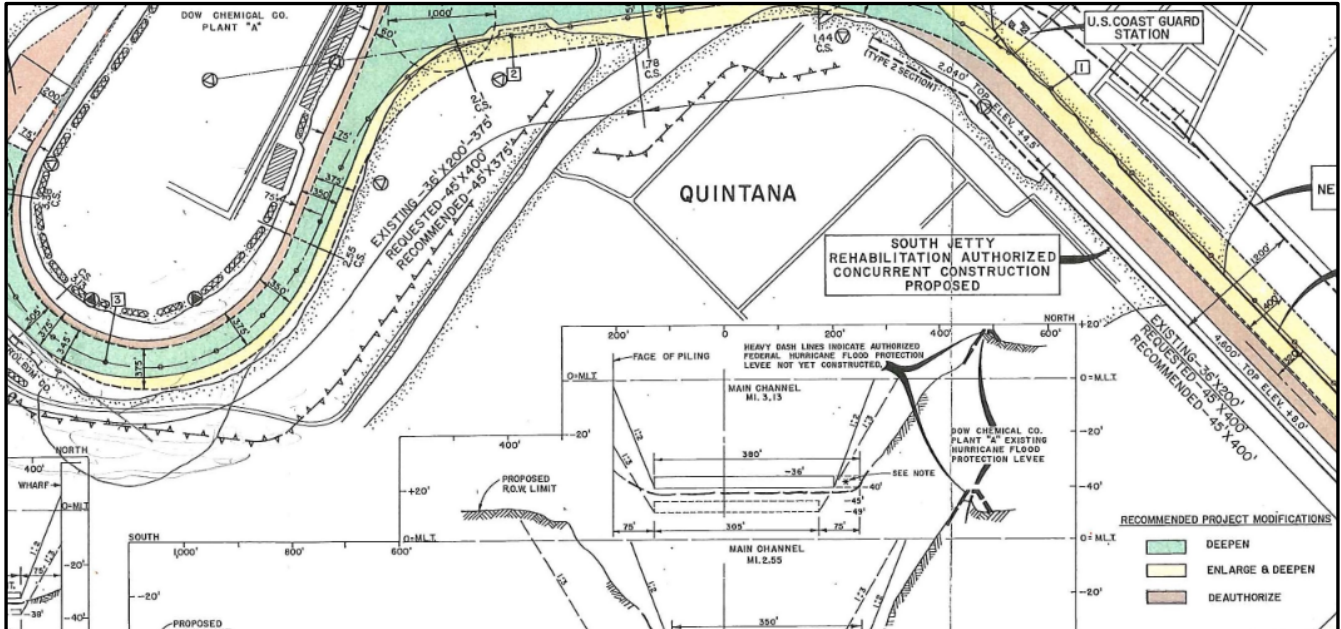


Figure 1-6 - RHA House Document Cutout - “Deauthorized” (Brown) Channel around HFPP Levee

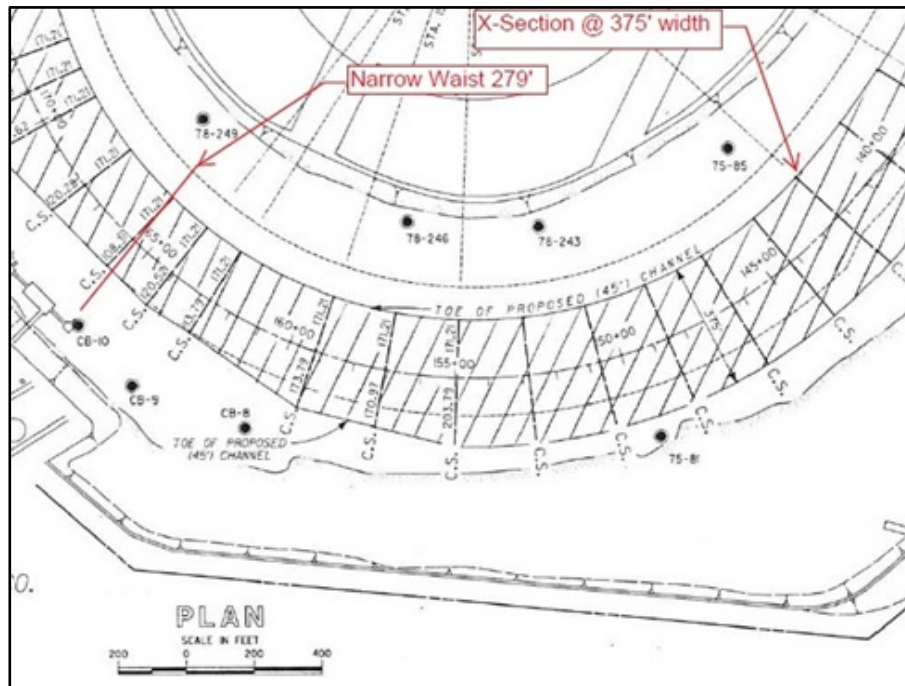


Figure 1-7 - Cutout of Channel from 1991 Plans & Specs for 45—Foot Project

Prior to the completion of the 45-Foot Project, the Brazos Pilots cited issues with negotiating the bends of the inner harbor. A ship simulation was conducted and the results demonstrated a need to widen the channel at three new locations to ensure safe navigation of vessels. Two of these widening's were located on each side of the channel in Reach 1, to ease the immediate approach to the Lower Turning Basin. The third location was within the GRR project area on the south side of Reach 2.

In 1997, the Galveston District issued a decision document determining the channel work, as recommended by the ship simulation, was “within the original authority for the construction of the project.”

The *Freeport Harbor, Texas (45-Foot Project) Channel Widening to Correct Navigation Problems, Brazoria County, Texas, Environmental Assessment (1997 EA)* described the adjustment as:

“...dredging an average of about 200-foot wide strip on the south side of the main channel from Station 134+00 to Station 164+00. The dredged materials from the proposed channel work will be discharged in an existing upland confined placement area (PA) No. 1 located south of State Highway 288 and east of the Brazos River Diversion Channel. The proposed work will also require the relocation of about 2,000 feet of an existing upland earthen wave barrier.”

The wave barrier that was moved was the western end of the HFPP North Wave Barrier that is situated in the GRR Study Area.

The FHC is currently maintained at the 1970 authorized depths shown in **Table 1-5**. The channel in Reach 2 is generally 350-375 feet wide except for the constrained “waist” in the area of the Dow Thumb, which is currently 279 feet wide (caused by the shifting of the channel away from the HFPP underwater berm). The segment referred to as the Lower Stauffer Channel was never deepened or dredged for the 45-Foot Project. This segment was de-authorized in 1974 under Section 12 of WRDA 1974 (P.L. 93-251). Lower Stauffer Channel currently has a depth of approximately 19-feet MLLW.

Table 1-5 – 45 Foot Project Authorized Depths and Widths (RHA 1970)

Channel Segment	Depth (MLLW) ¹	Width (Feet)
Outer Bar Channel		
Outer Bar Channel	48	400
Jetty Channel	46	400
Lower Turning Basin	46	750
Main Channel		
Channel to Brazosport Turning Basin	46	400
Brazosport Turning Basin	46	1,000
Channel to Upper Turning Basin	46	Generally 350-375 ²
Upper Turning Basin	46	1,200
Brazos Harbor		
Channel to Brazos Harbor	37	200
Brazos Harbor Turning Basin	37	750
Stauffer Channel		
Channel to Stauffer Turning Basin	Deauthorized	
Stauffer Turning Basin	Deauthorized	

¹ Does not include advance maintenance or allowable overdepth.

² Two GDMs subsequent to the 45-Foot project authorization (1970 RHA) resulted in shifting the channel in the area of the Dow Thumb to protect an underwater berm and thus the stability of the HFPP levee factor of safety. This resulted in a constriction of the channel measuring approximately 279 feet wide at the waist of the Dow Thumb.

WRRDA 2014 authorized the recommended plan from the 2012 Feasibility Report. The recommended navigation plan was the LPP, which was shallower and less costly than the NED plan. A Chief of Engineers Report was signed on January 7, 2013, and the ROD was signed by the ASA (CW) on May 31, 2014. The depths and widths of the plan authorized by WRRDA 2014 are presented in **Table 1-6**. The proposed deepening and widening required a DMMP, which included two new PA sites (PA 8 and PA 9) as well as offshore sites. For orientation purposes, the channel segments involved in this GRR evaluation for modifications are highlighted in the table.

The project authorized under WRRDA 2014 has not yet been constructed. Except for the widening of the Outer Bar Channel and Jetty Channel conducted by Port Freeport under Department of the Army (DA) Regulatory Permit SWG-2004-02311, the existing condition matches the dimensions of the 45-Foot Project authorized to 45-feet MLT (46-feet MLLW).

Table 1-6 – 2012 Feasibility Report Authorized Depths & Widths (Unconstructed)

Channel Segment	Depth (MLLW)	Width (Feet)
Outer Bar Channel		
(NEW) Future Channel Extension ¹	58	600
Outer Bar Channel	58	600 ²
Jetty Channel	56	600 ²
Lower Turning Basin	56	Existing (750)
Main Channel		
Channel to Brazosport Turning Basin	56	Existing (400)
(NEW) Brazosport Turning Basin	56	1,200
Channel to Upper Turning Basin	51	Existing (generally 350-375) ³
Upper Turning Basin	51	Existing (1,200)
Brazos Harbor (No Proposed Change)		
Channel to Brazos Harbor	N/A	N/A
Brazos Harbor Turning Basin	N/A	N/A
Stauffer Channel (Modified)		
Channel to Stauffer Turning Basin	51	300
Stauffer Turning Basin	26	200

¹ Not surveyed or constructed. Extension authorized from end of Outer Bar Channel to the -58 MLLW Contour.

² Widened from 400 to 600 feet per DA Regulatory Permit (SWG-2004-02311) by Port Freeport (not deepened).

³ Channel is constrained to a width of approximately 279-feet at the waist of the Dow Thumb.

Sabine Pass to Galveston Bay Study (S2G) developed recommendations to reduce the risk of coastal storm surge impacts in this study area. The S2G is proposing to modify the Old River North Levee, which is located in the GRR project area. The modifications to the HFPP levee would be configured to ensure there is no reduction in the existing FOS. The Chief's Report was signed on December 7, 2017.

Phillips 66 Berth 2 improvements were authorized under DA Permit SWG-2014-00116, issued to the Phillips 66 Company on December 23, 2014, under purview of Section 10 of the RHA of 1899 (33 U.S.C 403) and Section 404 of the Clean Water Act (33 U.S.C 1344). The DA Permit authorized the modification of the Phillips 66 (Phillips) Berth 2 as part of overall construction efforts by Phillips in the general area of the "waist" near the Dow Thumb. The stated purpose of the work was to increase production of Export Grade Liquid Petroleum Gas (LPG) to worldwide markets. This included upgrades to the terminal and dock facilities.

2 EXISTING CONDITIONS*

2.1 GENERAL

The FHC provides for deep-water access from the Gulf of Mexico to Port Freeport. **Table 2-1** presents the existing dimensions of the channels. The project authorized under WRRDA 2014 has not yet been constructed. Except for widening of the Outer Bar Channel and Jetty Channel conducted by Port Freeport, the existing condition matches the dimensions of the 45-Foot Project authorized to 45-foot MLT (46-foot MLLW). As addressed previously in **Section 1.7**, the FHC MLLW datum value is plus one foot above MLT. The Galveston District recently converted the FHC to the MLLW datum, and all dredging contracts now use the MLLW datum.

Table 2-1 – Existing Condition (Depths and Widths) of Freeport Harbor Channel

Channel Segment	Beginning Seaward		Depth (MLLW) feet	Bottom Width (feet)	Advance Maintenance (feet)	Allowable Overdepth (feet)
	Station Start	Station End				
Outer Bar Channel						
Future Channel Extension	Natural Bay Bottom	-300+00	Not surveyed or constructed. Extension is authorized from end of Outer Bar Channel to the -58 MLLW Contour.			
Outer Bar Channel	-300+00	0+00	48	600 ¹	2	2
Jetty Channel	0+00	71+52	48	600 ¹	2	2
Lower Turning Basin	71+52 ²	78+52 ²	46	750	2	2
Main Channel						
Channel to Brazosport Turning Basin	78+52	107+50	46	400-600	2	1
Brazosport Turning Basin	107+50 ²	115+00 ²	46	1,000	2	1
Channel from Brazosport Turning Basin	115+00	132+66	46	Generally 350-375	2	1
Channel to Upper Turning Basin	132+66	174+00	46	Generally 350-375	2	1
Upper Turning Basin	174+00 ²	184+20 ²	46	1,200	2	1
Brazos Harbor						
Brazos Harbor Approach Channel	28+00	20+00	37	200	-	-
Brazos Harbor Turning Basin	20+00 ²	0+00 ²	37	750	-	-
Stauffer Channel³						
Stauffer Channel, Lower Reach	184+20	222+00	19	200	2	1
Stauffer Channel, Upper Reach	222+00	255+00	19	200	2	1
Stauffer Turning Basin	255+00 ²	260+00 ²	19	500	2	1

¹ Widened only, per DA Regulatory Permit (SWG-2004-02311) by Port Freeport.

² Stations on Turning Basin indicate where the channel enters and exits from Turning Basin; channel does not necessarily enter or exit at the center of the Turning Basin.

³ Stauffer Channel was Deauthorized under the 45-Foot Project and Reauthorized and Modified under the WRRDA 2014.

The existing FHC dredged material PAs are shown in **Figure 2-1**. PA 1 was constructed in 1990 and modified in 1997. It is located approximately 0.5 mile south of State Highway (SH) 36, and approximately 1,000 feet east of the Brazos River Diversion Channel. PA 1 is approximately 320 acres with a perimeter of approximately 20,310 linear feet. The existing ground elevation is approximately 21 feet NAVD 88 (North American Vertical Datum of 1988) with a dike height of 25 feet NAVD 88. Currently, PA 1 has an existing capacity of approximately 0.8 million cubic yards (MCY).

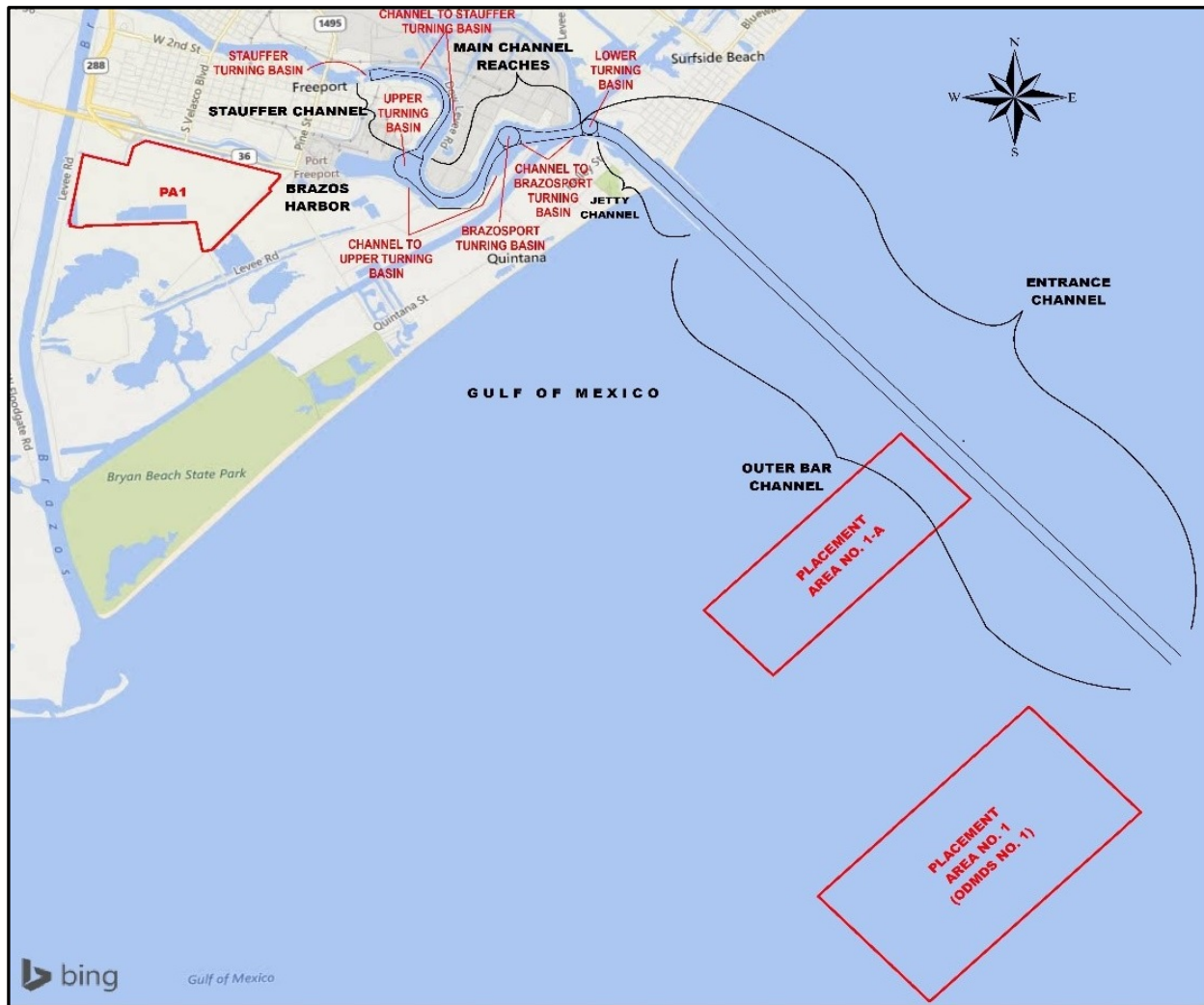


Figure 2-1 - Dredged Material Placement Areas at Freeport Harbor

Two ocean disposal sites located in the Gulf of Mexico exist for offshore placement. Both ODMDS sites are located in a dispersive offshore environment and assumed to have unlimited capacity due to longshore drift processes. The New Work ODMDS 1 is designed for an approximately 2,236-acre bottom area and is located approximately 5.5 miles southwest from the mouth of the Jetty Channel and approximately six miles from shore. The Maintenance ODMDS

1A is designed for an approximately 1,129-acre bottom area and is located approximately 2.5 miles southwest from the mouth of the Jetty Channel and approximately 3 miles from shore. A recent U.S. Environmental Protection Agency (EPA) change to the ODMDS designation allows maintenance material from the entire vicinity of the FHC to be placed offshore into ODMDS 1A. This is the current Operations and Maintenance (O&M) practice for the FHC and the assumption for this study is that the current O&M practice of the ODMDS 1A placement for all FHC maintenance material would continue in the future.

The currently authorized depth of the FHC does not allow fully loaded larger vessels to traverse the waterway so many vessels currently have to be light-loaded. To complete a lightering operation, large crude carriers remain offshore and transfer their cargo into smaller crude tankers, which transport the product for the remainder of the voyage.

2.2 PHYSICAL DESCRIPTION OF THE EXISTING PROJECT

One of the earlier ports on the Texas coast, Freeport Harbor was developed at the mouth of the Brazos River. The river was later diverted to an outlet in the Gulf of Mexico to the west of the original mouth, resulting in a ship channel that received no direct input from the Brazos River. Prior to development of the port, the area was comprised of habitats typical of the central Texas coast including coastal marsh and tidal flats, coastal prairie, tidal creeks and riparian habitats.

2.2.1 Tides

The FHC, which is formed from the natural outlet of the Brazos River, follows a winding course to the southeast before connecting to the GIWW and the Gulf of Mexico. The FHC receives no input from the Brazos River or any other major waterways. The mean tide range at National Oceanic and Atmospheric Administration (NOAA) Station 8772447 in Freeport, Texas is 1.39 feet, and the diurnal range is 1.8 feet (NOAA, 2016a).

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 passes through the Jetty Channel then flows northeast and southwest into the GIWW at the Lower Turning Basin, and northwest into the Main Channel. Tidal exchange within the FHC is limited because it is a dead-end channel with no connection to the Brazos River or other major waterways.

2.3 ENVIRONMENTAL AND HISTORIC RESOURCES

2.3.1 Description of the Ecological Region

The study area is in the Texas Gulf Prairies and Marshes ecological region (Gould, 1975). “This region is a nearly level, slowly drained plain less than 150 feet in elevation, dissected by streams and rivers flowing into the Gulf of Mexico. Soils are acidic sands and sandy loams, with clays occurring primarily in the river bottoms.” Native vegetation in this region once consisted of tallgrass prairies and some post oak savannah woodlands; however, almost all of the region’s historic native coastal tall grass prairie and its associated prairie wetlands have been lost through conversion to agricultural uses and urban development (U.S. Fish and Wildlife Service [USFWS], 2008). Although tall grass prairies, dominated by big blue stem (*Andropogon gerardi*), sea coast bluestem (*Andropogon littoralis*), indiangrass (*Sorghastrum nutans*), eastern gamagrass (*Tripsacum dactyloides*), gulf muhly (*Muhlenbergia capillaris*) and some *Panicum* species, still exist; today, most have been invaded by trees, brush and introduced grasses (Native Prairies Association of Texas [NPTA], 2016). Common examples of invading trees and brush include mesquite (*Prosopis glandulosa*), live oaks (*Quercus virginiana*), prickly pear (*Opuntia ficus-indica*) and *Acacias*. Non-native grasses such as Bermuda and carpet grass that are common in pastures have germinated in nearby uncultivated land. Barrier islands, estuaries, and marshes line the coast in this region. Coastal prairies and marshes are typically dominated by Amaranth (*Amaranthaceae*) and Goosefoot (*Chenopodiaceae*). Native wetland species such as sedges (*Carex* sp. and *Cyperus* sp.), spikerush (*Eleocharis* sp.), rushes (*Juncus* sp. and *Scirpus* sp.), several cordgrasses (*Spartina* spp.), and seashore saltgrass (*Distichlis spicata*) are found in the salt marshes. Although much of the native habitat has been lost to agriculture and urbanization the region still provides important habitat for migratory birds and spawning areas for fish and shrimp” (Texas Parks and Wildlife Department [TPWD], 2016c).

2.3.2 Protected/Managed Lands in the Study Area

Federal refuges, a state managed area, and local sanctuaries are located partially within or near the study area. Federal refuges include the Brazoria National Wildlife Refuge and the San Bernard Wildlife Refuge. The Justin Hurst State Wildlife Management Area is located about five miles west of Freeport. Local sanctuaries that are located within or near the study area include the Neotropical Bird Sanctuary, and the Xeriscape Park. Both sanctuaries are administered by the town of Quintana.

2.3.3 Physical and Hydrological Characteristics of the Study Area

The study area is located along the central Texas coast situated between the Matagorda and Galveston Bay systems. FHC is a dead end channel without input from the Brazos River or other

major waterways so water exchange occurs primarily at the intersection of the FHC and the GIWW and the main outlet into the Gulf of Mexico. Salinity in the FHC is measured at Station 11498, Old Brazos River Channel. With little watershed area and freshwater inflow, the average salinity at the station is almost the same as the coastal waters. The minimum salinity is over 18 parts per thousand (ppt) and the average is over 26 ppt (Texas Commission on Environmental Quality [TCEQ], 2016).

The study area is located within the Upper Coast division (Hatch et al., 1999) of the Gulf Coast Prairies and Marshes Ecoregion (Gould, 1975). This ecoregion is a nearly level plain less than 250 feet in elevation, covering approximately 10 million acres. The Gulf Coast Prairies include the coastal plain that extends approximately 30 to 80 miles inland, while the Gulf Marshes are located in a narrow strip of lowlands adjacent to the coast and barrier islands (Hatch et al., 1999). The study area is characterized as Quaternary (Recent and Holocene) Alluvium containing thick deposits of clay, silt, sand, and gravel, overlying the Pleistocene-aged Beaumont Formation. These formations consist mainly of stream channel, point bar, natural levee, and back-swamp deposits associated with former and current river channels and bayous. The Alluvium outcrops approximately 70 to 90 miles wide paralleling the Texas coastline. Beneath the surface deposits lies the Beaumont Formation, a massive and complex alluvial deposit of clay, silt, sand, and gravel deposited during the Pleistocene and estimated to be less than 1,000 feet thick. 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 (Texas Water Development Board, 1990).

The climate of the Freeport area is humid subtropical with warm to hot summers and mild winters. The dominant air mass in summer is marine tropical in which sea breezes moderate afternoon heat. Occasional showers or thunderstorms are common during this season. Winters are mild with considerable day-to-day variation between the marine tropical air mass a modified continental polar and marine polar air masses. Periods of freezing temperatures are infrequent and usually last no longer than 2 or 3 days.

Rainfall averages about 43 inches annually at Freeport. The annual rainfall distribution is greater for the early summer and fall periods and least for the winter and late summer. Two principal wind regimes dominate the area and include persistent southeasterly winds occurring from March through November and strong, short-lived northerly winds from December through February. Severe weather occurs periodically in the area in the form of thunderstorms, tornadoes, and tropical storms or hurricanes.

2.3.4 Biological Communities in the Study Area

The following describes biological communities and wildlife habitat occurring in the placement areas, uplands, open water, and wetlands in the study area.

2.3.4.1 Placement Areas

Based on aerial interpretation, the areas designated as inland PAs are characterized as disturbed developed land with pockets of open water, shrubs, and herbaceous species that thrive in disturbed areas. PA 1 has been used for placement and as a result, it consists of several large unvegetated areas containing dredged material. PAs are not considered high-quality wildlife habitat due to recurring disturbance and lack of established native vegetation. The sparse vegetation in PAs consists mainly of opportunistic species that thrive on disturbed soils. This vegetation in PAs do not contribute significantly as food or detritus sources or scrub habitat because they are physically and hydrologically isolated from the surrounding habitat by the containment dike. Fast growing species such as sea oxeye daisy (*Borrchia frutescens*), saltwart (*Salicornia bigelovii* and *Batis maritima*), Carolina wolfberry (*Lycium carolinianum*), false willow (*Baccharis halimifolia*), and narrow leaf marsh elder (*Iva angustifolia*) can be found in these PAs.

2.3.4.2 Terrestrial

Terrestrial uplands include developed areas, dunes and relict beach ridges, grasslands, and woodlands. The uplands found in the project area are primarily developed areas; however, dunes and relict beach ridges, grasslands, and woodlands are found within the study area.

Developed areas include the PAs described above, industrial development, residential development, transportation development (roads/railroads), and utility development (power lines/pipelines). There are industrial developments such as the Dow and Philips refineries adjacent to the project area.

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. Sand and coastal dunes are found outside the project area in Quintana Beach near the mouth of Freeport Channel at the jetty. Typical plant species of the primary dunes in the broader study area include sea oats (*Uniola paniculata*), bitter panicum (*Panicum amarum*), Gulf croton (*Croton punctatus*), beach morning glory (*Ipomea pes-caprae*), and fiddleleaf morning glory (*Ipomea stolonifera*). Secondary dune species include marshhay cordgrass (*Spartina patens*), seashore dropseed (*Sporobolus virginicus*), seacoast bluestem (*Schizachirium littorale*), seashore saltgrass (*Distichlis spicata*), pennywort (*Hydrocotyle bonariensis*), and partridge pea (*Chamaecrista fasciculata*). The secondary dune community, which is located in the hummocky area leeward of the higher and drier primary dunes, is often a wetland community or considered a transitional community between upland and wetland.

Based on aerial interpretation there appears to be shrub/scrub vegetation outside the project area south of PA 1 and around nearby Bryan Lake. Typical forest and shrub/scrub vegetation that may

occur in the study area include sugar hackberry (*Celtis laevigata*), cedar elm (*Ulmus crassifolia*), Chinese tallow (*Sapium sebiferum*), toothache tree (*Zanthoxylum clava-herculis*), pecan (*Carya illinoensis*), mulberry (*Morus rubra*), honey locust (*Gleditsia aquatica*), gum bumelia (*Sideroxylon lanuginosum*), Jerusalem tree (*Parkinsonia aculeata*), yaupon holly (*Ilex vomitoria*), saw palmetto (*Serenoa repens*), Macartney rose (*Rosa bracteata*), trumpet creeper (*Campsis radicans*), poison ivy (*Toxicodendron radicans*), and sumpweed (*Iva* sp.).

There are only small areas within the study area with upland grassland vegetation such as along roadways, inland of sand dunes in Quintana, and along electrical transmission corridors. Upland grassland vegetation that may occur in the study area likely supports a mix of introduced pasture grasses such as bermudagrass (*Cynodon dactylon*) and bahiagrass (*Paspalum notatum*) and native species. These native species, remnants of the original coastal prairie, likely form only a small percentage of the upland grassland. They include little bluestem (*Schizachyrium scoparium*), brownseed paspalum (*Paspalum plicatulum*), Indiangrass (*Sorghastrum nutans*), rosettegrass (*Panicum oligosanthos*), and thin paspalum (*Paspalum setaceum*).

These upland areas may provide habitat for mammals such as the Virginia opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), hispid cotton rat (*Sigmodon hispidus*), northern raccoon (*Procyon lotor*), and coyote (*Canis latrans*), and reptiles such as the eastern six-lined racerunner (*Aspidoscelis sexlineata sexlineata*), little brown skink (*Scincella lateralis*), and western diamond-backed rattlesnake (*Crotalus atrox*). According to the TPWD Diversity Database (TPWD, 2016b), there are no recent records of rookeries or other animal assemblages in the project area.

2.3.4.3 Aquatic

Coastal wetlands (saline to freshwater) are distinct areas between terrestrial and aquatic systems where the water table is at or near the surface, or the land is covered by shallow water with emergent vegetation. They are important natural resources that provide habitat for fish, shellfish, and other wildlife. Both estuarine and freshwater (palustrine) habitats occur in the study area. Estuarine areas include the open water channel within the project area and freshwater habitats occurring behind the HFPP levees. These are described briefly below; more detail can be found in the 2012 FEIS.

Estuarine and freshwater wetlands, tidal flats, and beaches provide habitat for a wide variety of bird species, including wading birds such as the great blue heron (*Ardea herodias*), great egret (*Ardea alba*), roseate spoonbill (*Platalea ajaja*), and black-necked stilt (*Himantopus mexicanus*); shorebirds such as the sanderling (*Calidris alba*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), and willet (*Catoptrophorus semipalmatus*); and gulls and terns such as the laughing gull (*Larus atricilla*), ring-billed gull (*Larus delawarensis*), Forster's tern (*Sterna*

forsteri), and royal tern (*Sterna maxima*); and migratory waterfowl such as the northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), and green-winged teal (*Anas crecca*). Several colonial waterbird rookeries are known to occur in and near the project area. Tidal flats also provide habitat for the piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*), both federally listed as threatened.

Apart from avian species, wetlands also provide habitat for amphibians such as Blanchard's cricket frog (*Acris blanchardi*), American bullfrog (*Lithobates catesbeianus*) and southern leopard frog (*Lithobates sphenoccephalus*), reptiles such as the western cottonmouth (*Agkistrodon piscivorus leucostoma*) and Gulf saltmarsh watersnake (*Nerodia clarkii clarkii*), and mammals such as the marsh rice rat (*Oryzomys palustris*).

Open water in the study area, as well as some of the wetlands, provide habitat for aquatic communities. In general, fish species found mainly in shallow areas include the Gulf killifish (*Fundulus grandis*), sheepshead minnow (*Cyprinodon variegatus*), and silversides (*Menidia spp.*). Inhabitants of marsh areas include the pinfish (*Lagodon rhomboides*), silver perch (*Bairdiella chrysoura*), and gizzard shad (*Dorosoma cepedianum*). Species often found in deeper areas include the Atlantic croaker (*Micropogonias undulatus*), Gulf menhaden (*Brevoortia patronus*), and hardhead catfish (*Arius felis*), while a number of fish are abundant in both marsh and deeper areas, including bay anchovy (*Anchoa mitchilli*), spot (*Leiostomus xanthurus*), and striped mullet (*Mugil cephalus*) (Pattillo et al., 1997).

2.3.4.3.1 Estuarine Habitats

Estuarine habitats occurring in the study area include emergent wetlands and shrub/scrub wetlands, and estuarine subtidal unconsolidated bottom. Estuarine wetlands are found in the study area along the Freeport Channel in areas with access to saline water such as those not protected by the wave barrier or levees. Subtidal estuarine habitat occurs within the Old Brazos River channel in the project area.

The dominant species in the frequently inundated low salt estuarine emergent wetlands is smooth cordgrass (*Spartina alterniflora*), followed by seashore saltgrass (*Distichlis spicata*). These are often interspersed with low brackish marshes dominated by saltmarsh bulrush (*Bolboschoenus robustus*) and glasswort (*Salicornia virginicus*). Common species in the high salt/brackish marshes, which occur at slightly higher elevations and are thus less frequently inundated, include the sea ox-eye daisy, saltwort, and shoregrass (*Monanthochloe littoralis*).

The estuarine intertidal shrub/scrub category includes coastal wetlands dominated by woody vegetation and periodically flooded by tidal waters. Species include big leaf sumpweed (*Iva frutescens*) and the exotic invasive tamarisk (*Tamarix sp.*).

2.3.4.3.2 Freshwater Habitats

Five freshwater wetland habitats have been identified as occurring in the study area: freshwater aquatic vegetation – submerged and floating (palustrine aquatic bed); freshwater marshes (palustrine emergent wetland); freshwater shrub/scrub wetlands; freshwater forested wetlands; and freshwater flats (unconsolidated shore).

Freshwater marshes occur in the study in swales near the Quintana and Surfside beach shorelines. Common species included spikerush (*Eleocharis* sp.), flatsedge (*Cyperus* sp.), rushes (*Juncus* spp.), smartweed (*Polygonum* sp.), seashore paspalum (*Paspalum vaginatum*), coastal cattail (*Typha domingensis*), and American bulrush (*Schoenoplectus pungens*). Artificially flooded areas are present in the project area, in placement areas and areas impounded by levees and roads.

Freshwater shrub/scrub wetlands, which may include woody species such as common buttonbush (*Cephalanthus occidentalis*), baccharis (*Baccharis* sp.), big leaf sumpweed, and tamarisk, occur in the study area. Similarly, freshwater forested wetlands likely dominated by black willow (*Salix nigra*), Chinese tallow, and other pioneer-type species occur within the study area. None of these wetlands has direct hydrologic connections to the Freeport Harbor Channel. Freshwater flats are unvegetated to sparsely vegetated areas with sand or mud substrate; common species are the same as for freshwater marshes.

More information on terrestrial and aquatic wildlife in the study area, including commercial and recreational species, can be found in the 2012 FEIS, and more information on threatened and endangered species in the study area is provided in the Biological Assessment (BA) (**Appendix H**) of this EA.

2.3.5 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 (MSFCMA) (PL 94-265) of 1996. The NOAA EFH Mapper has identified the study area as EFH for federally managed species such as the red drum (*Sciaenops ocellatus*), 43 species of reef fish, all of the coastal migratory pelagic species, and 4 species of shrimp (NOAA, 2016b). The categories of EFH that occur within the Project area include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine emergent wetlands, marine water column, and marine nonvegetated bottoms. EFH that occurs within the project footprint includes marine water column and marine nonvegetated bottoms. Marine water column and marine nonvegetated bottoms occur in abundance within the study area. Habitat Areas

of Particular Concern (HAPC) and EFH Areas Protected from Fishing were not identified in or near the 2012 Feasibility/FEIS Project area.

2.3.6 Threatened and Endangered Species

Federally listed species potentially occurring within the vicinity of the study area include five species of sea turtle – the green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp’s ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), and loggerhead sea turtle (*Caretta caretta*); three bird species – the piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), and whooping crane (*Grus americana*); the West Indian manatee (*Trichechus manatus*); four species of whales – fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaengliae*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*); and four coral species – lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), boulder star coral (*Orbicella franksi*), and elkhorn coral (*Acropora palmata*) (USFWS, 2016; National Marine Fisheries Service [NMFS], 2016a). The four whale species and West Indian manatee receive additional protection under the Marine Mammal Protection Act (MMPA).

Additional state protected species are listed by TPWD as potentially occurring in Brazoria County: Eskimo curlew (*Numenius borealis*), jaguarundi (*Herpailurus yaguarondi*), Louisiana black bear (*Ursus americanus luteolus*), ocelot (*Leopardus pardalis*), and red wolf (*Canis rufus*) (extirpated) (TPWD, 2016a). These additional species are not likely to occur in the study area. Additionally, they were not identified by the jurisdictional Federal agencies (NMFS and USFWS). Furthermore, the Louisiana black bear has recently been removed from the Federal list of threatened and endangered species (81 Federal Register [FR] 13124–13171; March 11, 2016). Birds recently removed from the Federal list of threatened and endangered species such as the American peregrine falcon, Arctic peregrine falcon, peregrine falcon, brown pelican, and bald eagle are protected under the Migratory Bird Treaty Act (MBTA). The bald eagle continues to receive additional protection under the Bald and Golden Eagle Protection Act (64 FR 46542–46558; 72 FR 37346–37372).

2.3.7 Water and Sediment Quality

The TCEQ has designated the old Brazos River Channel Tidal (Freeport Harbor) as Segment 1111. The designated uses for Segment 1111 are contact recreation (swimming) and high-quality aquatic habitat. Since April 2015, the salinity in the FHC ranged from 13.7 to 32.4 ppt and dissolved oxygen (DO) concentrations range from 1.2 to 8.6 milligrams per liter. The criterion for high-quality aquatic life use is 4 milligrams per liter for DO. Enterococci concentrations were below 10 Most Probable Number/milliliter, well below the criterion of 35 Most Probable Number/deciliter, indicating that the waters of the FHC support contact recreational use.

In its review of the 2012 FEIS, TCEQ concurred that there is reasonable certainty that the Freeport Harbor Channel Improvement Project (FHCIP) would not violate water quality standards, and provided water quality certification for the Preferred Alternative of the FHCIP.

Coring and testing of sediments from the submerged bench at Dow Thumb waist were conducted in April of 2016 (Terracon, 2016). The testing included the collection of sediment, water and modified elutriate samples within the dredge prism at the “Waist” of the Dow Thumb. No significant contaminants were identified during the survey. Additional information from the sampling conducted by Terracon (2016) is provided in **Section 2.3.10** below.

The USACE conducted monitoring of the ocean placement of construction material from dredging of the Outer Bar and Jetty channels for the 45-foot Project (USACE, 1978). No unacceptable water quality impacts were found. According to the 2012 FEIS, no water column, sediment, or benthos problems were noted during the monitoring. There was also monitoring of the water column before, during, and after dredging and placement in the New Work ODMDS in the early 1990s (EH&A, 1994). No causes for concern for the water column were found upon placement of this material in the New Work ODMDS.

2.3.8 Air Quality

Brazoria County is included in the eight-county Houston-Galveston-Brazoria (HGB) ozone nonattainment area, which is classified as “severe” in terms of its degree of compliance with the 1997 8-hour ozone standard. This classification affects facilities that generate the ozone precursors, nitrogen oxide (NO_x), and volatile organic compounds (VOC). As such, the project is subject to the General Conformity Rule, which applies to all nonattainment and maintenance areas. This project, as a Federal action, is subject to the General Conformity Rule promulgated by the EPA. The rule mandates that the Federal Government not engage in, support, or provide financial assistance for licensing or permitting, or approving any activity not conforming to an approved State Implementation Plan. In Texas, the applicable plan is the Texas State Implementation Plan, an EPA-approved plan for the regulation and enforcement of the National Ambient Air Quality Standards in each air quality region within the state.

2.3.9 Noise

Noise levels in the project area are elevated compared to undeveloped areas along the coast and are affected by petrochemical industry operations, vessel navigation, and vehicular traffic in the Freeport Harbor area.

The magnitude of noise is usually described by its sound pressure, usually in decibels (dB), and dB values are further defined in terms of frequency-weighted scales (A, B, C, or D). The A-weighted scale is most commonly used in environmental noise measurements because it places most emphasis on the frequency range detected by the human ear (1,000 to 6,000 hertz). Sound levels measured using A-weighting are often expressed as dBA. Although the vast majority of land use along the ship channel is dominated by commercial and industrial uses, noise-sensitive receivers such as single-family residences, recreational vehicle parks, and recreational areas do occur on both sides of the channel in the communities of Quintana, Surfside Beach, and Freeport, but do not occur in the project area.

2.3.10 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 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 for the 2012 FEIS 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 (ROW). Results of the 2012 FEIS HTRW assessment found no concerns with the ocean or upland placement of sediments. There were also no known HTRW sites within the 2012 FEIS footprint. The 2015 Sabine Pass to Galveston Bay Draft Integrated Feasibility Report and Environmental Impact Study also included an HTRW review area encompassing this project area (USACE, 2015). According to the **Appendix N** of that report, the project area was assigned a low general risk level.

A recent analysis of environmental media found within the study area at the Dow Thumb was conducted by the Engineer Research and Development Center (ERDC) (Montgomery and Bourne, 2017) to provide information for the Section 404(b)(1) water quality analysis. The material will be placed in an upland, confined placement area. The primary objectives of this sampling event were to evaluate soils in the underwater berm around the Dow thumb for potential contaminants. Samples of sediment, surface water and modified elutriates were collected at six representative locations within the project area, and a chemical and miscellaneous analysis of each sample was performed. Analytical results for sediment, surface water and modified elutriates were compared to at least three State and/or Federal screening benchmarks for each media to evaluate potential adverse impacts. Of the sediment samples collected, 59 constituents were detected in at least one

sample. Of the 59 constituents, only 4 constituents exceeded screening benchmarks for one or more samples (i.e., pesticides, polychlorinated biphenyls [PCBs], and arsenic). These exceedances were marginal; and are not expected to result in adverse effects during dredging or placement activities. In surface water samples, 29 constituents were detected as contaminants; however, there were no exceedances of screening benchmarks. Of the modified elutriate samples collected, 40 constituents were detected as contaminants. Similar to the surface water samples, none of the constituents detected in the modified elutriate samples exceeded screening benchmarks. An uncertainty analysis was also performed to verify data usability, and concluded that the results of this analysis are usable for dredging and placement decision-making.

2.3.11 Cultural Resources

Cultural resource investigations for both terrestrial and marine resources were performed for the project area in conjunction with the 2012 FEIS. This provided a well-developed cultural history for this portion of the Texas coast. The aboriginal inhabitants of this region seasonally exploited the Brazos River for its maritime and mainland resources; early European mariners utilized the mouth of the Brazos as a riverine passage to mercantile trade; and the nineteenth-century Austin colonists developed the mouth of the Brazos into commercial and social centers. Therefore, cultural resources characteristic of this area range from prehistoric shell middens to early European shipwrecks to historic period sites such as Fort Velasco and the towns of Quintana and Velasco. Historical research and investigations identified one previously recorded archeological site (41BO175) within the project area. This site was located on the south bank of the Old Brazos River channel south of the Dow Thumb. It is identified as Fort Bend, a Civil War Era fort that was occupied from 1861 to 1865. When the site was recorded in 1990, all that remained were sand walls of the fort facing the river; no artifacts were observed. The landform on which the site was located has been destroyed.

2.3.12 Energy and Mineral Resources

According to the Railroad Commission of Texas (RCT) public GIS viewer (2016) there is one pipeline that crosses the study area and one adjacent abandoned pipeline. ConocoPhillips has one active crude oil pipeline crossing the FHC between its two terminals. Enterprise products responded to the public notice notifying USACE that they own a pipeline within the project footprint. There is an abandoned volatile natural gas pipeline adjacent to the bend easing portion of the study area. There are no active wells in the study area.

2.3.13 Socioeconomic Considerations

A socioeconomic analysis was conducted for Brazoria County and the adjacent census tracts, block groups, and block within the study area. The project is located in an industrially developed port with few places for public access and no residential areas. Port Freeport provides access to one of

the largest petrochemical complexes in the world. Major petrochemical industries operating out of the port include ConocoPhillips Petroleum, Dow Chemical, and Badische Anilin und Soda Fabrik (BASF). Port activities contribute to the local and regional economy by generating business revenues to local and national firms providing vessel and cargo-handling services at several public and private marine terminals. Businesses, in turn, provide employment and income to individuals. According to the 2012 FEIS, marine cargo activity at Freeport’s public and private marine terminals in the navigation district is responsible for 11,131 direct jobs with local firms, 75 percent of which were held by residents of Brazoria County (USACE, 2012a). These direct jobs induce additional jobs within the local region. The current channel configuration is limiting to growth of the port, as the channel is not currently wide or deep enough to accommodate larger vessels.

The 2000, 2010, and preliminary 2015 Census population counts for Brazoria County are shown in **Table 2-2**. The population for Brazoria County had a 43 percent increase between 2000 and 2015.

Table 2-2 – Population Statistics for Brazoria County

Geographic Area	Population		
	2000	2010	2015
Brazoria County	241,763	313,166	346,321

U.S. Census, American Community Survey, 2014; U.S. Census Bureau 2016

There is a civilian labor force of 169,808 in Brazoria County, with an unemployment rate of 5.6 percent as of September 2016, according to the Texas Workforce Commission (2016). The 2010 to 2014 5-year American Community Survey median household income for Brazoria County was \$69,092. There are census tracts and block groups in the study area; however, the direct project area currently has no population due to the open water nature and a portion of an undeveloped parcel of the area. The demographic breakdown for Brazoria County is 51.4 percent White (Caucasian), 28.6 percent Hispanic, 12.6 percent Black or African American, 5.9 percent Asian, and 1.6 percent other (U.S. Census Bureau, 2016). Two census block groups (BG) encompass the project area (census tracts 6642, BG 2 and 6644, BG 2). Based on the most recently available demographic data, census tract 6642, BG 2 has 26.0 percent of the population below the poverty level which is more than twice the county average of 11.2 percent below the poverty level indicating this block group contains an environmental justice (EJ) population (U.S. Census Bureau, 2016). Additionally, 75.1 percent of the population in census tract 6644, BG 2 identifies as a minority, indicating this block group contains an EJ population. According to aerial photographs, the only residential areas are a few scattered residences near Quintana beach and a neighborhood on the corner of Brazosport Boulevard and Levee Road. These residential populations are located more than a half mile from the project area. There are no populations of children, or facilities geared towards children (e.g. schools, playgrounds) in the project area. Quintana Beach and

Jetty Park, both public parks, are located at the mouth of the FHC approximately one mile from the project area.

2.4 ECONOMIC REACHES

The Economic Reaches in this GRR mirror those utilized in the 2012 Feasibility Report. **Figure 2-2** displays the Economic Reaches.

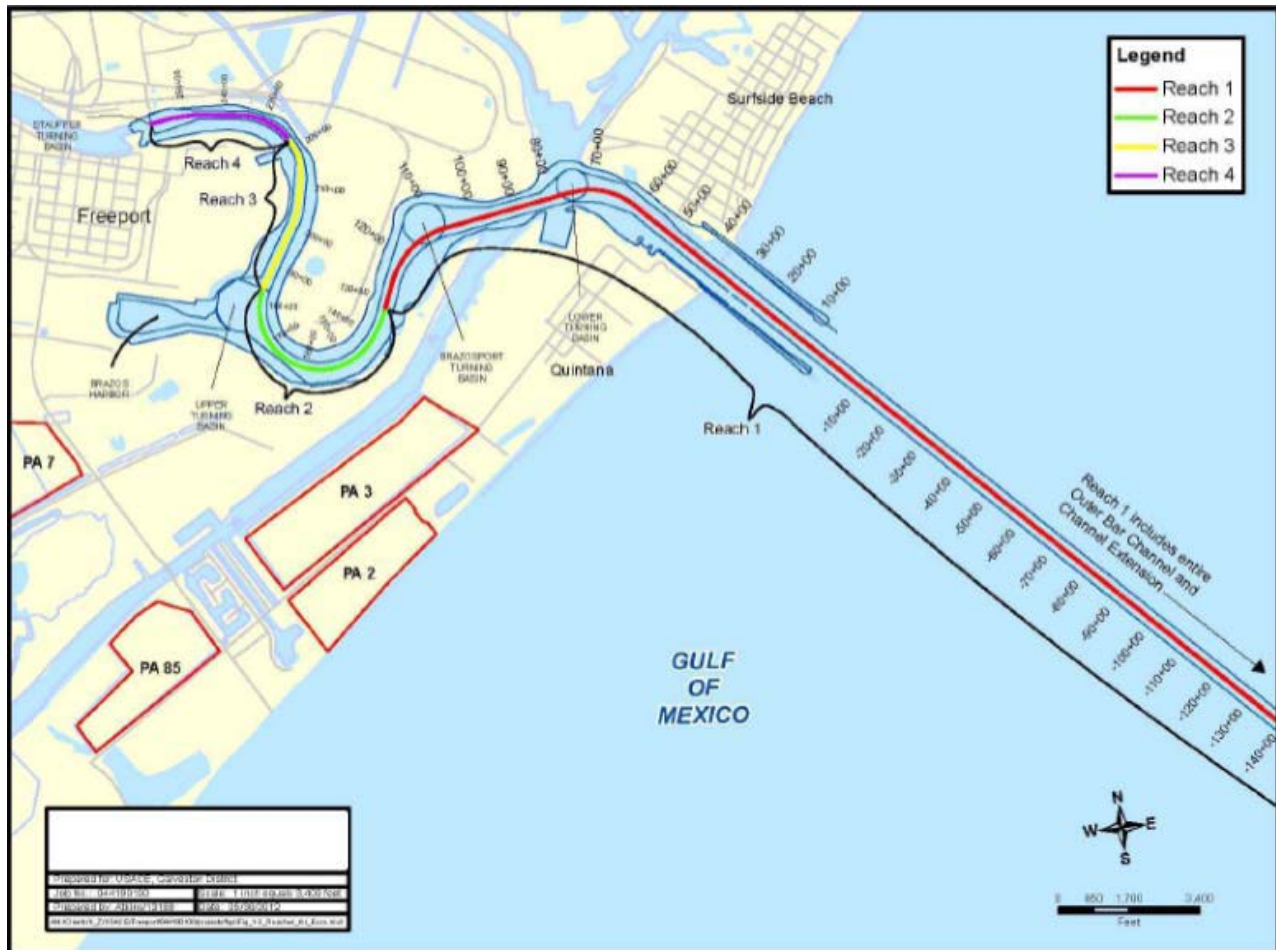


Figure 2-2 – GRR Economic Reaches

The current channel primarily serves the petrochemical industry, and the reaches at Freeport serve various commodities. Reach 1 is currently 48 feet MLLW (outside the jetties) and 46-foot MLLW (inside the jetties) and varies from 600 feet wide in the Entrance Channel to 400 feet wide as it crosses the GIWW. Freeport LNG (Liquefied Natural Gas), Seaway (crude oil, petroleum products), and some of Dow Chemical (chemicals) docks are in Reach 1. Reach 2 is 46-foot MLLW and 279-feet wide at the most constrained point, the waist of the Dow Thumb. Phillips (crude petroleum, petroleum products, chemicals, LPG) has Berths 2 and 3 in this reach. The Upper Turning Basin is also included in this reach, which is dredged to 46-foot MLLW and 1,200-

3 FUTURE WITHOUT-PROJECT CONDITIONS*

For purposes of this study, the Future Without-Project (FWOP) is considered pre-WRRDA 2014 to establish a baseline for economic analysis and is compared only to alternatives proposed for modification in this GRR. Where necessary, the incremental difference between the 2012 Feasibility Report features and the features being reformulated under the GRR will be explicitly quantified or described applicable to cost, benefit, and environmental analysis.

The USACE is required to consider the option of “No Action” as one of the alternatives in order to comply with ER 1105-2-100 and the requirements of NEPA. With the FWOP, it is assumed that no project would be implemented by the Federal Government or by local interests to achieve the planning objectives. The FWOP forms the basis against which all other alternative plans are measured.

With the FWOP condition, the Panamax vessel would not be able to transit around the Dow Thumb in Reach 2 to call on the Velasco Container Terminal. The Panamax was the design vessel for Reach 3 in the 2012 Feasibility Report.

3.1 Economic Conditions

Under the without-project conditions, the existing conditions will likely continue for both the Aframax tankers and sub-Panamax containerships. The channel will not be able to accommodate larger vessels than those that currently call. Existing pilot rules will likely continue. As demand for container imports and exports grow, it will take additional vessels to meet this demand. Since these vessels will not be able to utilize a deeper draft, the transportation costs will be higher. This higher cost could limit Port Freeport’s ability to grow, and limit capitalizing on opportunities to contribute benefits to the Nation.

In the future with-project condition, potential benefits include transportation cost savings. By utilizing larger vessels or being able to load more fully, it will require fewer vessels to transport the same amount of goods, thereby decreasing at-sea transit costs. Additional detail can be found in the **Economic Appendix**.

3.2 Dredged Material Base Plan Description

The FWOP Alternative is the existing 45-foot project, discussed previously in **Section 2.1**. The 45-foot project depth and existing width would be maintained throughout the project area. The Main Channel, turning basins, and Stauffer Channel dimensions would remain in their current condition. Maintenance material from the project area would continue to be placed in the existing

PA 1. This FWOP scenario assumes that the sponsor's Widening Project (Section 204(f)) is constructed.

PA 1 is located approximately 0.5 mile south of SH 36, and approximately 1,000 feet east of the Brazos River Diversion Channel. The PA is approximately 320 acres with a perimeter of approximately 20,310 linear feet. The existing ground elevation is approximately 21 feet NAVD 88 with a dike height of 25 feet NAVD 88. Currently, PA 1 has an existing capacity of approximately 0.8 MCY. Once the dikes are raised to 31.5 feet NAVD 88, the PA will have an estimated capacity of 3.4 MCY. The dikes will be raised under the FWOP.

Lastly, ODMDS 1 and ODMDS 1A, discussed previously in **Section 2.1**, exist for offshore placement. This is the current O&M practice and the assumption for this study is that the current O&M practice of the ODMDS 1A placement for all FHC maintenance material will likely continue in the future.

3.3 Environmental and Historic Resources

Without construction of the Recommended Plan, minor and temporary effects of the construction in Reach 2 would be avoided. Environmental effects of the existing project would continue as they do today. The largest impact of the existing project 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 or RPMs and implementing Terms and Conditions described in the Gulf Regional Biological Opinion for Hopper Dredging, Gulf of Mexico (NMFS, 2003 with 2005 and 2007 updates). Minor and temporary effects to air quality and noise levels would occur during maintenance dredging episodes. 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.

3.4 Engineering Considerations

Channel width constraints at Dow Thumb and other engineering considerations to the existing wave barrier (a feature of the Freeport HFPP), storm surge analysis, Regional Sea Level Change (RSLC), sedimentation analysis, and ship simulations are known issues in the project area for the GRR and described here.

The NFS provided a relative sea level rise (RSLR) analysis in December 2015, using the NOAA Technical memo, "*Global Sea Level Rise Scenarios for the US National Climate Assessment*" as the basis of their analysis (**Engineering Appendix, Attachment 2, Hydrology and Hydraulics Report, Section 3**). The Intermediate-High scenario for the NOAA estimate of RSLR was 2.4

feet for a 50-year period of analysis (2017-2067). That number has since been revised to 2.46 feet for a 50-year for a period of analysis of 2020-2070. The Intermediate-High scenario was recommended since the Freeport Harbor Channel Improvement Project supports a significant industrial complex and would impact an adjacent flood protection system (HFPP). ERDC was asked to provide surge modeling assuming 2.4 feet for a future sea level rise condition (**ERDC Risk Based Wave and Surge Modeling Report** provided in **Attachment 9 of the Engineering Appendix**).

During the preparation of the draft GRR, it was suggested that the RSLR used through the evaluation should match what was submitted with the S2G Feasibility Study. Since S2G relied upon the USACE sea level change calculation tool, the NFS included a RSLR analysis using the same tool. The RSLR value of 1.18 feet corresponding to the Intermediate curve was used for the GRR wave analysis and hydrodynamic analysis.

We believe that the higher sea level rise number is appropriate to use for the Surge Modeling because it is more conservative, leading to a greater area of inundation. The USACE Intermediate curve is otherwise suitable for a navigation project.

3.4.1 Storm Surge Modeling

An analysis of storm surge levels in Freeport Harbor was conducted for this GRR and showed no adverse impacts related to increases in storm surge for proposed modifications. The study took advantage of previous modeling conducted for the Federal Emergency Management Agency (FEMA) Region VI National Flood Insurance Program (NFIP) Risk MAP study and the existing model used in the S2G study for coastal storm risk management (CSRМ) to depict the existing harbor configuration. A new grid was created for the with-project condition to represent the removal of the wave barrier and to update the bathymetry where the bend easing and channel widening/deepening are to take place.

Since the FWOP alternative does not incorporate any structural changes to the project, the only change from an engineering perspective is sea level rise. Storm surge modeling was performed for the GRR to examine the effects of sea level rise for a future without project alternative. An initial set of simulations was run using a present sea level configuration and a second set of simulations was run incorporating a future sea level rise value of 2.4 feet. A comparison of the resulting water surfaces show that the resulting increase is nonlinear and often greater than the modeled sea level rise of 2.4 feet. Detailed information can be found in the **ERDC Risk Based Wave and Surge Modeling Report** provided in **Attachment 9 of the Engineering Appendix**.

3.4.2 Relative Sea Level Rise

Relative Sea Level Rise (RSLR) was calculated for the 50-year period of analysis starting in year 2020 as the sum of average global sea level rise, vertical land movement, and regional basin trends utilizing USACE curves. The sea level rise analysis revealed a 50-year RSLR of between 0.71 feet assuming the USACE Low curve, 1.18 feet assuming the USACE Intermediate curve, and 2.68 feet assuming the USACE High curve. To maintain consistency with previous USACE studies in the region, a 50-year RSLR value of 1.18 feet was selected for this study based on the USACE Intermediate curve (**Engineering Appendix, Section 6.3**).

3.4.3 Wave Barrier

The Freeport HFPP includes a wave barrier (North Wave Barrier) in the southwest portion of the project area, which is just one element of the HFPP. The wave barrier is an earthen barrier 9,447 foot (1.8 miles) long with a 20-foot crown width. It was installed to provide protection against the design hurricane. It is located on the south side of the existing Freeport Harbor Project and runs in front of the Phillips Petroleum facility. Over the last 40 years, USACE has constructed dredge disposal areas on Quintana Island, south and east of the wave barrier. The disposal areas are now at a higher elevation than the wave barrier. Based upon review of the previous analyses in the S2G study, the height of the dredge disposal areas on Quintana Island are higher than the subject wave barrier.

4 PROBLEMS AND OPPORTUNITIES

The authorized plan from the 2012 Feasibility Report included the following channel modifications shown in the bullets below. The economic reach for each modification is identified in brackets:

- Deepen the Outer Bar Channel into the Gulf of Mexico to 58 feet [**Reach 1**];
- Deepen from the end of the jetties in the Gulf of Mexico to the Lower Turning Basin to 56 feet [**Reach 1**];
- Deepen from the Lower Turning Basin to Station 132+66 near the Brazosport Turning Basin to 56 feet [**Reach 1**];
- Enlarge the Brazosport Turning Basin from 1,000 to 1,200 foot diameter [**Reach 1**];
- Deepen from Station 132+66, above the Brazosport Turning Basin, through the Upper Turning Basin to 51 feet [**Reach 2**];
- Deepen and widen the lower 3,700 feet of the Stauffer Channel to 51 feet and 300 feet wide [**Reach 3**]; and
- Dredge the remainder of the Stauffer Channel to 26 feet (its previously authorized depth was 30 feet) [**Reach 4**].

Subsequent to the authorization it was determined that the channel width in Reach 2 prevents the safe, efficient navigation of the Panamax design vessel around the Dow Thumb precluding transit to and from the Velasco Container Terminal in Reach 3 (**Section 1.10 History of the Investigation**). Thus, the problems addressed in the Freeport GRR generally align with the stated problems in the 2012 Feasibility Report.

4.1 PROBLEMS

Problems in the GRR study area include:

- Transportation inefficiency - The existing channel width and turning basin limit the size of the ship that can transit Reach 2 (channel near Dow Thumb) and thus terminals cannot take advantage of economies of scale of the larger vessels
- Safety/Maneuverability problem - Due to the small cross sectional area and tight bend of the channel near the Dow Thumb, large vessels must pass at a slow speed to prevent potential damage to moored vessels caused by pressure field effects generated by the passing vessel. The very slow speed is not sufficient for steerage and safe control of larger vessels.

4.2 OPPORTUNITIES

Opportunities in the GRR study area include the following:

- Identify significant transportation cost savings;
- Positively impact the regional economy;
- Positively impact life-safety risk; and
- Avoid or minimize impacts to the environment in the project area.

4.3 PLANNING GOALS

The goal of the study is to identify a plan that contributes to Federal objectives while protecting the Nation's environmental resources and complying with existing laws, regulations, and executive orders. All four accounts established to facilitate display of effects of alternative plans will be utilized including NED, environmental quality (EQ), regional economic development (RED) and other social effects (OSE) in the Freeport GRR. The RED and OSE accounts will be discussed qualitatively in the evaluation.

4.4 PLANNING OBJECTIVES

The objectives utilized in the Freeport GRR are the same as the objectives utilized for the 2012 Feasibility Report. The period of analysis for this study is 50 years. Those objectives were:

- Improve the navigational efficiency and safety of the deep-draft navigation system at Freeport Harbor within the period of analysis, and,
- Maintain or protect the quality of the Freeport Harbor area's aquatic, terrestrial, and cultural resources within the period of analysis.

However, in this reevaluation, the primary objective is:

- To allow for the safe and efficient movement of the Panamax design vessel around the Dow Thumb for transit to and from the Velasco Container Terminal, a Port Freeport facility.

This objective is necessary for the project to accrue the benefits for which Congress intended when the report was authorized under WRRDA 2014.

4.5 PLANNING CONSTRAINTS

The constraints of the study include:

- Modifications that cause unacceptable increases in risk to the Freeport HFPP will need to be mitigated; and
- Modifications to the Phillips Berth 2 will not be proposed to gain additional width at Dow Thumb.

4.6 RELATED DOCUMENTS

This FIGRR-EA contains an economic reanalysis of the 2012 Feasibility Report, inclusive of the proposed GRR modifications (Recommended Plan). The USACE evaluated environmental impacts of all elements of the authorized project in the 2012 FEIS for which a ROD was issued on May 31, 2013.

4.7 DECISIONS TO BE MADE

This FIGRR-EA will provide recommendations for modifications needed to address the safe and efficient transit of the Panamax design vessels around the Dow Thumb and to and from the Velasco Container Terminal to realize the benefits of the 2012 Feasibility Report, in addition to an economic update for the project. Various alternatives were evaluated and specific measures were suggested to minimize, or avoid adverse effects to local resources.

5 FORMULATION AND EVALUATION OF ALTERNATIVE PLANS*

5.1 PLAN FORMULATION RATIONALE

Formulation for the Freeport FIGRR-EA was limited to determining what modifications to the project authorized in WRRDA 2014 would allow the Panamax vessel to safely transit around the Dow Thumb (Reach 2) to and from the Velasco Container Terminal (Reach 3) and accrue the benefits intended by Congress. Formulation included avoiding, minimizing, and mitigating impacts to the environment and other Federal projects. Physical constraints have a significant bearing on the development of the final array in the project area. To address this, the PDT developed criteria for the development of the final array.

- Meet objectives and constraints: The alternative must contribute to the planning objective, which will be evaluated both quantitatively (NED and EQ) and qualitatively (other social effects or OSE and RED).
- Safety Requirements: The alternative will meet USACE design criteria for channels and levees, allow adequate space for tugs, and meet U.S. Coast Guard (USCG) safety requirements.
 - Pilot Input: Initial input to the alternatives considered in the GRR was provided by the pilots to gain their assessment of whether the plans were suitable for their use from a safety and navigation standpoint. Initial input was provided by the pilots in writing and confirmed in the GRR ship simulation.
 - Previous Ship Simulation Input: Previous ship simulations performed in the study area were reviewed to inform the final array of alternatives (**Section 1.9.4**).
- Sponsor Input: The sponsor indicated they were interested in the narrowest channel width that will be found to safely accommodate the design vessel and that the pilots will support.

An initial set of alternative plans was developed to determine what modifications would be required. These plans were screened and further refined to select the Recommended Plan. The plans were also examined and compared considering the Federal criteria of completeness, efficiency, effectiveness, acceptability, and constructability from the Principles and Guidelines (P&G), as well as for their potential impact to the environmental and other Federal project.

5.2 MANAGEMENT MEASURES

Individual measures (**Table 5-1**) that would allow the objective of safely and efficiently moving the Panamax design vessel around the Dow Thumb were considered in the process of formulating alternatives. Non-structural measures would not alleviate the issue around the Dow Thumb. Using the criteria listed earlier in **Section 5.1**, the three combined measures of bend easing, widening at Dow Thumb and a turning notch in the Upper Turning Basin would be necessary to reach the objective. Specifically, pilot input and information from previous simulations required the addition of the bend easing and turning notch. As such, these measures were not carried forward and analyzed as individual measures because that violated “Pilot Input” and “Previous Ship Simulation Input” criteria listed above. Smaller variations (footprint) of the final array were considered, but eliminated because they did not meet Pilot Input criteria. Non-structural measures would not alleviate the issue around the Dow Thumb; therefore, they were not considered further.

Table 5-1 – Freeport GRR Measures Considered

Measure	Description	Considered in Final Array (Yes/No)
Non-Structural Measures		
Adjust Vessel Speed	Vessels already operate at the slowest speed possible without affecting maneuverability.	No
Increase Tugboat Assistance	Current tug operations alone will not allow the Panamax to transit around Dow Thumb to reach the Velasco Container Terminal.	No
Structural Measures		
Deepening Only	Constraints on vessel classes are not benefited by deepening only.	No
Bend Easing/Widening Only	Pilots indicated the measures considered individually would not improve maneuverability.	No
Relocation of Phillips Berth 2	This was screened out because it would be cost prohibitive.	No
Widening, Bend Easing, and Turning Notch combined	As determined through ship simulations, all three measures combined will be necessary at some width to allow safe transit of Panamax Vessel to the Velasco Container Terminal.	Yes

No Action Alternative (FWOP Condition) – The USACE is required to consider the option of “No Action” as one of the study alternatives in order to comply with the requirements of the NEPA. With the No Action Plan (i.e., the FWOP Condition), it is assumed that no project would be implemented by the Federal Government or by local interests to achieve these particular planning objectives. However, it is assumed that normal operation and maintenance activities, along with other probable channel improvements, would be performed over the period of analysis. The No Action Plan, therefore, forms the basis to which all other alternative plans are measured. Details of the “No Action” plan are included in **Section 5.3**.

5.3 SUMMARY OF ALTERNATIVES ANALYSES

Alternatives - This study evaluated modifications in Reaches 2 and 3 to allow the Panamax design vessel to transit safely around the Dow Thumb to and from the Velasco Container Terminal. As shown in the introduction to **Section 4 Problems and Opportunities**, Reach 2 falls within the channel from approximately Station 132+66 to the Upper Turning Basin and Reach 3 includes the Upper Turning Basin and the lower reach of the Stauffer Channel. The “final array” for this reevaluation is comprised of alternatives that are not significantly different from one another since they are similar in alignment. However, due to potential significant differences in implementation costs and potential impacts, they are presented here as the focused array of alternatives the PDT has evaluated to identify the Recommended Plan. These alternatives, considered to a depth of 46-feet, are listed in **Table 5-2**.

Table 5-2 – Alternatives to 46 feet MLLW

Alternative	Description
No Action Alternative	No Action or Future Without-Project Condition
Alternative 1	Widening at Dow Thumb (375 feet) + Bend Easing + Notch at Upper Turning Basin (required for incremental justification)
Alternative 2	Widening at Dow Thumb (400 feet) + Bend Easing + Notch at Upper Turning Basin
Alternative 3	Widening at Dow Thumb (425 feet) + Bend Easing + Notch at Upper Turning Basin (required for incremental justification and if the ship simulation does not pass the design vessel with 400-foot at Dow Thumb)

Alternatives 1 through 3 include the bend easing and turning notch features based on results from previous ship simulations, and October 7 and October 29, 2016 meetings held with the Brazos Pilots. The bend easing and turning notch are considered critical components to the alternatives to enable the Panamax vessel to navigate to and from Berth 7 at the Velasco Container Terminal. The turn radius-to-ship length ratio for the channel near the Dow Thumb is approximately one. Since it is not possible to substantially increase the channel width to accommodate the navigation turn, a bend easing and turning notch are necessary to allow the pilots to align the ship prior to traversing the waist.

Due to the small cross sectional area and tight bend of the channel near the Dow Thumb, large vessels must pass at a slow speed to prevent potential damage to moored vessels caused by pressure field effects generated by the passing vessel. The very slow speed is not sufficient for steerage and safe control of the vessel. To facilitate safe maneuvering, a bend easing at the wave barrier (Station (Sta.) 147+00 to Sta. 160+00)) was incorporated into the alternatives. This feature would also serve as a safety overrun when situated away from Berth 2 where the LPG vessels dock.

The turning notch was added to each alternative based on the 2014 ship simulation conducted with the Super-Panamax and the Post-Panamax vessels (Ever Ultra at 935x106x44 feet and the Maersk Kendal at 982.6x131x44 feet). That simulation indicated that the existing 1,200-foot turning diameter of the Upper Turning Basin was not sufficient for the maneuvering of the longer vessels. Per EM 1110-2-1613, *Hydraulic Design of Deep Draft Navigation Projects* (page 9-2),

“Recent ERDC/WES simulator studies have shown that turning basins should provide minimum turning diameters of 1.5 times the length of the design setup where tidal currents are less than 1.5 knots.”

The design vessel for Reach 3 (2012 Feasibility Report and GRR) has a length overall (LOA) of 965 feet and requires a turning basin diameter of 1,447 feet. The pilots expressed the need for the Upper Turning Basin turning notch to allow for the rotation of the vessel, to conduct a three-point turn, and dock the Panamax vessel at Dock 7, and eventually Dock 8. For these reasons it was determined that all alternatives would include the bend easing and the turning notch at the Upper Turning Basin.

5.3.1 No Action Alternative (FWOP Condition)

The No Action Alternative (**Figure 5-1**), is the existing depths and widths in the FHC as shown in **Table 5-3**. This alternative assumes the construction of the project authorized under WRRDA 2014 has not occurred and the GRR modifications and the Lower Stauffer Channel WIK have not been implemented in Reach 2 and Reach 3, respectively. The Outer Bar Channel and Jetty Channel (not shown) have been widened from 400 feet to 600 feet by the NFS under DA Permit SWG-2004-02311, and maintenance has been assumed by USACE. The existing channel depths and widths are shown in text boxes within the figure. In the No Action Alternative, there are no impacts to the HFPP underwater berm or wave barrier. Conversely, the benefits for which the project was authorized would not be accrued. The limits of the economic reaches are drawn in a bold red line (Refer back to **Figure 2-2** for the defined reaches).



Figure 5-1 –No Action Alternative (FWOP Condition)

Table 5-3 – Alternative 1 – No Action (FWOP) Depths and Widths of FHC

Reach	Approx. Station Start	Approx. Station End	Depth (MLLW)	Width (feet)	Turning Basin (TB) Diameter (feet)
Reach 1 ¹	-300+00	132+66	46	Varies 350-600 ¹	Lower TB (750); Brazosport TB (1,000)
Reach 2	132+66	1184+20	46	350-375 (waist 279 ²)	Upper TB (1,200)
Reach 3	184+20	222+00	19	200	N/A
Reach 4	222+00	260+00	19	200	Stauffer TB (500)

¹ Reach 1 in the 2012 Feasibility Report includes a future channel extension, which has not been surveyed or constructed and is not included as part of the Existing Condition. Port Freeport widened the Outer Bar and Jetty Channel (Station -300+00 to Station 71+52) to 600 foot width per DA Permit SWG-2004-02311; deepening is not authorized under the Permit.

² The minimum width at Dow Thumb is included in this alternative.

5.3.2 Alternatives 1-3: Widening at Dow Thumb (375 feet, 400 feet, 425 feet) + Bend Easing + Notch at Upper Turning Basin

Figure 5-2 provides a graphical representation of Alternatives 1, 2, and 3. The difference between these alternatives is the width of the channel (375, 400, or 425) in Reach 2 around the Dow Thumb. The footprint of the bend easing, and turning notch features would be the same for all three

alternatives. The stability wall (or similar mitigation feature) would provide levee stability to offset removal of the underwater berm around the Dow Thumb. This is necessary to widen the channel. The yellow rectangle shown in Reach 3 corresponds to work in the Lower Stauffer Channel that Port Freeport intends to construct as WIK under an MOU. This WIK effort is discussed later under **Implementation Requirements in Section 8.4**.

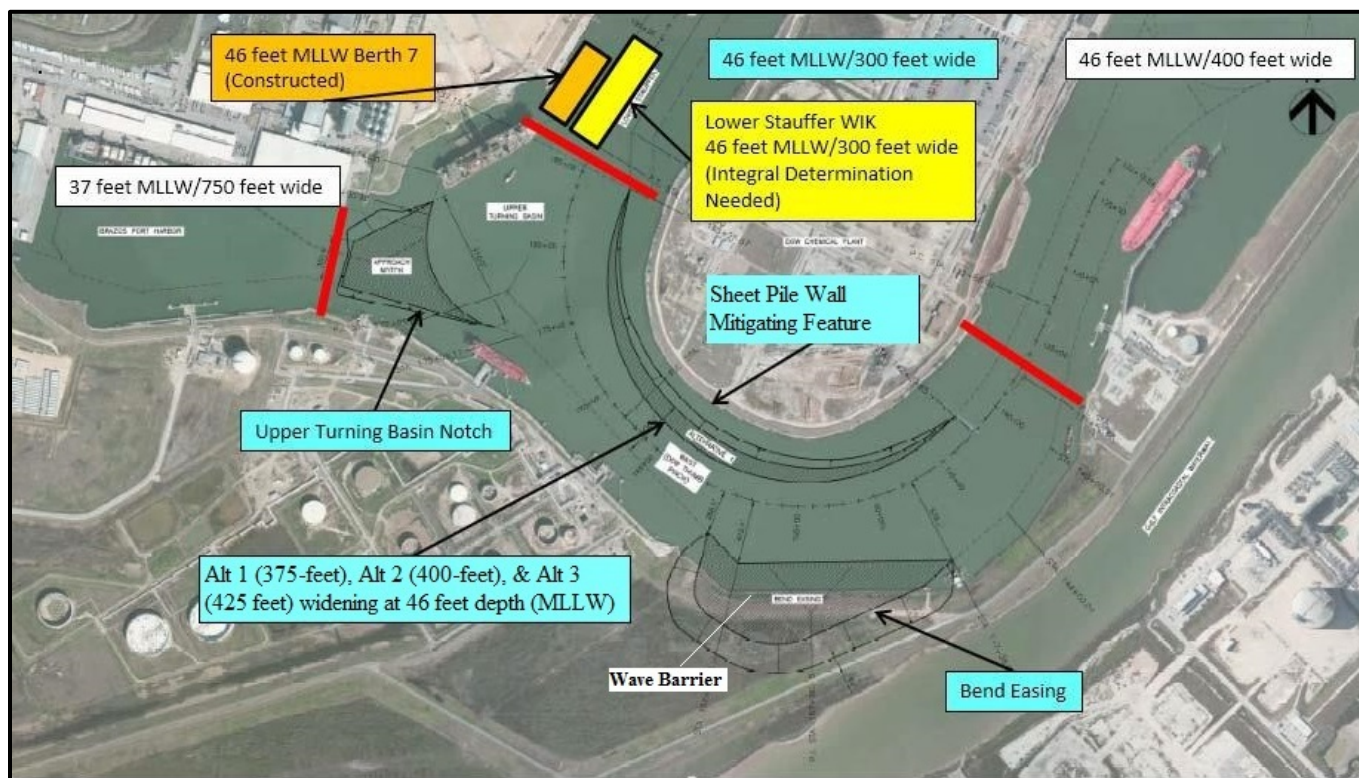


Figure 5-2 –Alternatives 1, 2, and 3 to 46 Feet MLLW Depth

Table 5-4 presents the depths and widths of Alternatives 1 through 3. All major features (widening at Dow Thumb, bend easing and the notch in the Upper Turning Basin) are required together.

Table 5-4 – Alternative 1, 2, and 3 to 46 Feet Depth and Widths

Reach	Depth (MLLW)	Width (feet)
Reach 1	46	600
Reach 2	46	375, 400, 425
Reach 3	19, portion dredged to 46 as WIK	300
Reach 4	19	200

5.4 First Screening of Final Array Based on 2016 Ship Simulation Results

The Pilot input and previous ship simulations resulted in the inclusion of both the bend easing and the turning notch into the final array of alternatives. However, a ship simulation was deemed

necessary to determine which alternative provided for the safe, efficient transit of the Panamax vessel around the Dow Thumb to the Velasco Container Terminal.

A limited ship simulation study (**Engineering Appendix, Attachment 3**) was performed at the STAR Center based in Dania Beach, Florida to examine the proposed modifications required to allow safe transit around the Dow Thumb to the Upper Turning Basin. Participants included two Pilots from the Brazos Pilots Association, ERDC technical oversight, and observers including commissioners and staff from Port Freeport, HDR Engineering, Inc., and Galveston District.

It is important to note the 2016 ship simulation did not dock the vessel at the Velasco Container Terminal at Berth 7. The intent of the 2016 ship simulation was to determine what modifications would be necessary to enable the design vessel to make it around the Dow Thumb. The 2014 ship simulation used vessels of comparable length. **Figure 5-3** shows the vessel tracks from the 2014 ship simulation and the maneuvering of the vessel outside the existing 1,200-foot Upper Turning Basin. An approximate representation of the existing diameter of the Upper Turning Basin has been added to the figures to demonstrate where the diameter is inadequate for the safe maneuvering of the vessel.

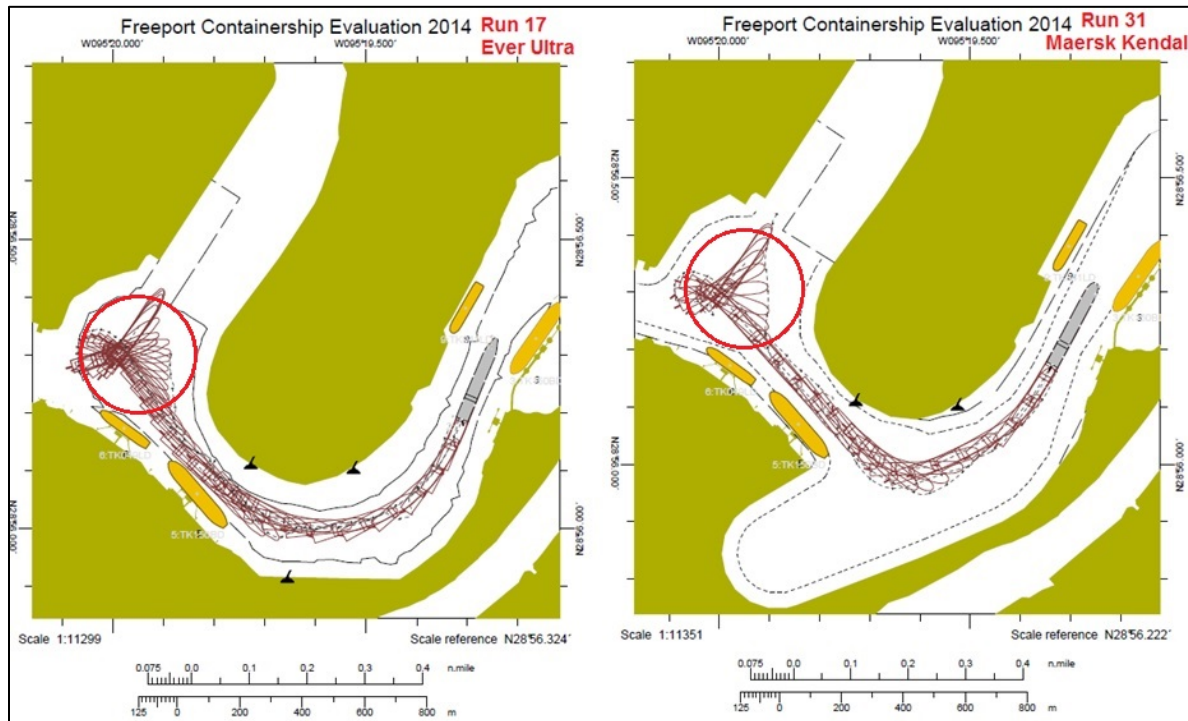


Figure 5-3 – 2014 Ship Simulation with Vessel Tracks at Upper Turning Basin

The 2016 simulation used the hydrodynamic model of a Panamax sized container vessel, the CMA CGM Virginia for the study (964.6 feet LOA, 105.6 feet Beam, and 42.6 feet draft). The recommendations of the 2016 Ship Simulation concluded that:

- Safe inbound and outbound transits with the Panamax sized vessel are possible with the 400-foot channel width;
- Three assist tugboats are critical for both inbound and outbound transits.

Based on the results of the 2016 ship simulation an initial screening of the Final Array of Alternatives was conducted (**Table 5-5**). If an alternative would not provide for the transit of the Panamax vessel around the Dow Thumb, it was screened out of the Final Array. Therefore, based on the results of the 2016 Ship Simulation, the remaining alternatives carried forward for the final screening process were Alternative 2 (Widening at Dow Thumb (400 feet) + Bend Easing + Notch) and Alternative 3 (Widening at Dow Thumb (425 feet) + Bend Easing + Notch).

Table 5-5 – Screening of Alternatives Based on 2016 Ship Simulation Results

Screening Criteria	No Action Alternative (FWOP Condition)	Alternative 1 Widening at Dow Thumb (375 feet) + Bend Easing + Notch to 46 feet	Alternative 2 Widening at Dow Thumb (400 feet) + Bend Easing + Notch to 46 feet	Alternative 3 Widening at Dow Thumb (425 feet) + Bend Easing + Notch to 46 feet
Ship Simulation Confirmed Panamax Can Transit around Dow Thumb (Yes/No)	No	No	Yes	Yes
Forwarded for Evaluation	No	No	Yes	Yes

5.5 Final Comparison of Alternative Plans / Decision Criteria

Criteria used to evaluate the remaining two alternatives included an evaluation of costs and benefits of the proposed modification as a separable element (**Table 5-6**). Benefits were calculated utilizing the HarborSym model. The HFPP Mitigation Feature (stability wall) is included as an associated cost. This feature is needed prior to removal of the underwater berm, and widening of the channel, constructing the bend easing, and dredging of a turning notch, all to 46 feet MLLW. However, the costs to re-designate the west end of the North Wave Barrier to the elevated Old Quintana Road to allow for construction of the bend easing were not included in the calculations for screening costs; however, the costs would be identical across Alternatives 1 through 3 and therefore, would not change the selection of the Recommended Plan.

Environmental impacts were considered in the screening by including estimated fish and wildlife/wetland mitigation costs. However, none of these alternatives would result in

environmental impacts requiring mitigation. Therefore, no environmental mitigation or monitoring costs are included in the estimated Project First Cost.

The First Cost of Construction for deepening to 46 feet MLLW, O&M, environmental mitigation, and monitoring costs (\$0), and the HFPP mitigation feature (stability wall) cost were included in the Average Annual Costs. The cost to re-designate the west end of the North Wave Barrier to the elevated Old Quintana Road is not included. The PDT has reviewed the existing conditions of the wave barrier and Old Quintana Road. Old Quintana Road has a higher elevation than the existing wave barrier and additional limited hydrological analysis has also occurred. Current, Port Freeport (NFS) and Velasco Drainage District (NFS for HFPP) are pursuing a Section 408 modification to relocate the existing wave barrier to the Old Quintana Road. Additional engineering review and analysis to be conducted under the Section 408 review could result in the Old Quintana Road being designated as a HFPP feature “the new wave barrier” and protected via real estate protection easement.

Table 5-6 – Benefit¹ Analysis for GRR Alternatives to 46 foot depth (\$000)

Screening Criteria		Alternative 2	Alternative 3
		Widening at Dow Thumb (400 feet) + Bend Easing + Notch	Widening at Dow Thumb (425 feet) + Bend Easing + Notch
<i>Oct 2016 Price Levels and 2.875% Interest Rate</i>			
Total Costs	Project First Cost ²	\$41,664	Greater than \$41,664
	O&M Cost	\$100,646	\$100,646 or Greater
	Environmental Mitigation / Monitoring	\$0	\$0
	HFPP Modifications (Associated Cost) ²	\$15,342	\$15,342
Average Annual	Average Annual Costs	\$4,374	Greater than \$4,374
	Average Annual Benefits	\$6,452	\$6,452
	Benefit-to-Cost Ratio (BCR)	1.47	Less than 1.47
	Net Excess Benefits ¹	\$2,078	Less than \$2.078

¹ First cost of construction, O&M, and associated costs of HFPP modifications (implementation expected under Section 408) are included in this cost; cost for reassignment of wave barrier was not included but is the same across the structural alternatives.

² During the screening process costs were included in each alternative for the Lower Stauffer WIK.

³ Associated financial cost; not part of the recommended Federal project but a necessary non-Federal responsibility.

Alternative 3 was not evaluated quantitatively because it could be removed through logical deduction. It is obvious that costs to widen to 425 feet would be more than the costs widening to 400 feet. Additional soil needs to be removed, and potentially additional engineering for levee stability analyses. Additional dredging would also be needed since the footprint is larger than at

400 feet. Hence, the average annual costs are higher at 425 feet width than at 400 feet width. Meanwhile, the benefits are unchanged. With a 425-foot wide channel, there may be an increased safety margin, but quantifiable benefits are negligible. Vessel speeds would remain the same. Vessel classes, loading patterns, routes, and commodities all remain the same with both alternatives. Average annual benefits do not change. Therefore, Alternative 3 is deemed to have lower net excess benefits than Alternative 2.

Table 5-7 provides a comparison of the remaining two alternatives against the four criteria in the P&G: completeness, effectiveness, efficiency, and acceptability. Both alternatives in the final array are considered acceptable. While both alternatives would allow the transit of the Panamax design vessel around the Dow Thumb 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 2 (Widening at Dow Thumb (400 feet) + Bend Easing + Notch) is the plan which best meets the four P&G criteria.

Table 5-7 – Comparison of P&G Criteria for Remaining Alternatives

Alternative Comparison to P&G Criteria	Alternative 2 Widening at Dow Thumb (400 feet) + Bend Easing + Notch, all to 46 feet	Alternative 3 Widening at Dow Thumb (>400 feet) + Bend Easing + Notch, all to 46 feet
Acceptability <i>meets all laws, regulations, and guidance. Note this is also a safety issue.</i>	Acceptable; addresses safety issue.	Acceptable; addresses safety issue.
Completeness <i>provides and accounts for all necessary investments or other actions to ensure the realization of the planning objective.</i>	Plan is a complete solution to all planning objectives.	Plan is a complete solution to all planning objectives.
Efficiency <i>is the extent to which an alternative plan is the most cost effective means of achieving the objective.</i>	<ul style="list-style-type: none"> • Least cost alternative; • Most cost effective means of achieving the objective. 	<ul style="list-style-type: none"> • Most expensive alternative; • Achieves same objective as least cost alternative; • This alternative not most cost effective alternative.
Effectiveness <i>is the extent to which the alternative plan contributes to achieve the planning objective.</i>	This alternative is effective for the Panamax transit around Dow Thumb and to and from the Velasco Container Terminal.	This alternative is effective for the Panamax transit around Dow Thumb and to and from the Velasco Container Terminal.

5.6 COMPARISON OF ENVIRONMENTAL IMPACTS OF FINAL ARRAY OF ALTERNATIVES

Environmental effects of the two alternatives would be very similar. Neither of these alternatives would affect the existing salinity, long-term water quality, EFH, protected species, wetlands, submerged aquatic vegetation (SAV), or prime farmlands, or have negative socio-economic effects. All of the channel modifications would be dredged to the existing depth of 46 feet MLLW. The only difference in impacts would be associated with temporary and minor impacts of channel widening on the east bank of the Old Brazos River at the Dow Thumb. The channel would be widened from 279 to 400 feet under Alternative 2 and from 279 to 425 feet under Alternative 3. Channel widening with Alternative 2 would affect about 9.9 acres of submerged bottom, while widening to 425 feet would increase the channel widening impacts to submerged bottom by about 10 percent. Widening would result in the removal of part of the submerged berm around the Dow Thumb, deepening it from a current average depth of 30 to 40 feet MLLW to about 46 feet MLLW. Benthic organisms in the dredged area would be removed by the dredging, but recolonization is expected. No SAV would be affected. Alternative 3 would also require a slightly longer construction period, resulting in slightly longer duration turbidity and slightly greater air emissions and noise impacts. A stability wall at the Dow Thumb would be required for both alternatives prior to channel widening; but it would be approximately the same size for both alternatives. This wall would be constructed between the existing HFPP's Old River North levee and the river's edge, on the existing levee slope. No wetlands would be affected by this construction and sediment barriers would be used to minimize the amount of sediment entering the river during construction. Turbidity impacts from construction would be minor and temporary.

Both Alternative 2 and Alternative 3 would include the following features, resulting in the same effects. Each would:

- dredge about 7.5 acres of submerged bottom and excavate 16.4 acres of emergent land to ease a bend on the west side of the channel south of the Dow Thumb;
- require the relocation of a portion of the HFPP wave barrier by re-designating a segment of the Old Quintana Highway to serve as the wave barrier; and
- dredge about 8.3 acres of submerged bottom to create a "Notch" at the Upper Turning Basin northwest of the Dow Thumb.

Dredging of submerged lands for the bend easing and notch would result in the deepening of a total of about 15.8 acres of subtidal bottom to 50 feet deep (includes advance maintenance and overdepth). The current water depth at the bend easing location is essentially the same as the deep draft channel; current depth in the notch area averages about 20 feet deep. Benthic organisms in the dredged area would be removed by the dredging, but recolonization is expected. No SAV

would be affected. Excavation of 16.4 acres of emergent land for bend easing would result in no wetland impacts. The area has been disturbed by construction of the wave barrier, and is impounded by the barrier, Old Quintana Road and upland development. It is comprised primarily of the wave barrier and slope, and vegetated with Bermuda grass and other common grasses.

New work dredging for both alternatives would be conducted primarily with a hydraulic cutterhead dredge, although mechanical excavation would be utilized for a portion of the bend easing area. All new work material would be placed in the existing upland confined PA 1. Maintenance dredging for both alternatives would be conducted with a hopper dredge and the material would be placed in existing ODMDS 1A. Potential impacts to threatened and endangered sea turtles, which are associated with hopper dredge use, would be the same for both alternatives. All potential takes are covered by the existing Gulf of Mexico Regional Biological Opinion (NMFS 2003, 2005, 2007).

Based upon the comparison of effects, there are only minor different potential impacts related to implementation of either of the action alternatives. Although long-term impacts for both projects would be expected to be roughly equivalent, construction-related impacts would be slightly less for Alternative 2. Thus, Alternative 2 was identified as the environmentally preferable alternative. The No Action Alternative would not provide the socioeconomic benefits of improved navigation efficiency.

5.7 PLAN SELECTION

Alternative 2 is the most cost effective of the final array of alternatives. This plan involves widening the channel at the Dow Thumb to 400 feet, and constructing the bend easing and turning notch, all to 46 feet MLLW (**Figure 5-4**). The pilots concurred that the Recommended Plan would allow for the efficient, safe transit of the Panamax design vessel around the Dow Thumb and to and from the Velasco Container Terminal. No environmental mitigation would be required for Alternative 2. New work material for the Recommended Plan would be placed in PA 1.

5.7.1 NED Benefits

The economic analysis for the GRR Recommended Plan shows a benefit cost ratio of 1.74 at a channel depth of 46 feet, as shown in **Table 5-8**.

Table 5-8 - Summary of Benefits and Costs for Recommended Plan at 46 Feet (\$000)
(October 2017 Price Level, 50 Year Period of Analysis, 2.75 Percent Discount Rate)

Investment Costs	
Total Project Construction Cost	\$52,500
Interest During Construction	\$1,450
Total Investment Cost	\$53,950
Average Annual Cost	
Construction Average Annual Cost	\$1,998
OMRR&R	\$2,157
Total Average Annual Cost	\$4,155
Average Annual Benefits	\$7,237
Net Annual Benefits	\$3,082
Benefit-Cost Ratio	1.74

See Section 9 of this report for information concerning the Economic Update, focusing on the authorized project features from the 2012 Feasibility Report.

An incremental analysis was conducted to determine the optimal depth for the Recommended Plan. The costs were calculated at 46 feet and 40 feet. Intermediate depths were interpolated based on a linear trend. HarborSym was used to calculate benefits, and individual model runs were conducted for the channel depths of 42 feet, 43 feet, 44 feet, 45 feet, and 46 feet. Depths for 41 feet and 40 feet were interpolated. The assumptions used at 46 feet were also used for each of the other depths. The only changing factor was the vessel’s ability to load to its draft-constrained depth. The results showed that a channel depth for the GRR features showed the highest net benefits at an increment of 46 feet (**Table 5-9**).

Table 5-9 – Incremental Analysis Summary (\$000)

Channel Depth	40	41	42	43	44	45	46
	<i>(2016 Price Levels at 2.875 % Interest Rate)</i>						
Average Annual Benefits	\$3,123	\$3,789	\$4,455	\$5,111	\$5,598	\$6,010	\$6,452
Average Annual Costs	\$4,270	\$4,287	\$4,305	\$4,322	\$4,340	\$4,357	\$4,374
Net Excess Benefits	(\$1,147)	(\$499)	\$150	\$788	\$1,259	\$1,653	\$2,078
BCR	0.73	0.88	1.03	1.18	1.29	1.38	1.47

It is not known if Alternative 2 is the NED plan that maximizes the net excess benefits because the net excess benefits were still increasing at 46 feet and the analysis did not consider depths beyond the 46-foot increment at the request of the NFS. However, Alternative 2 at 46 feet was the most cost effective of the Final Array of alternatives considered. Therefore, Alternative 2 is considered the Recommended Plan.

At the 46 foot depth, the benefit-cost ratio (BCR) is 1.47 with net excess benefits of \$2,078,000. The break-even point on the investment, using only transportation cost savings as the source of benefits, is the year 2049 at 46 feet given current interest rates. Generally, a longer duration to the break-even year has a greater level of risk associated with the investment because of the uncertainty surrounding the assumptions. Simply stated, it is easier to predict what will happen next year versus 30 years from now.

5.7.2 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 NFS 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 plan and become a federally supportable plan. The sponsor intends to construct the WRRDA 2014 authorized depths in the future; however, the Recommended Plan for the GRR modifications would only be to 46 feet deep.

5.7.3 Least Cost Disposal Alternative

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

5.7.3.1 Beneficial Use Opportunities

In accordance with existing Federal policy and guidance, the potential for BU of the limited quantity of new work material that would be generated by construction of the Recommended Plan was given additional consideration beyond the previous USACE (2012c) study. The BU analysis is focused on the limited amount of new work material from the Recommended Plan features (1,730,000 cubic yards – primarily soft sandy clay). Potentially viable options in the project

vicinity for BU could include either beach nourishment or marsh nourishment. However, due to low sand content of the dredged material, only marsh nourishment projects appear feasible.

Based on a review of aerial photography, the nearest potential marsh restoration area is a small degraded marsh area in the southern Oyster Creek watershed, adjacent to the GIWW and just east of the project area (**Figure 5-5**).

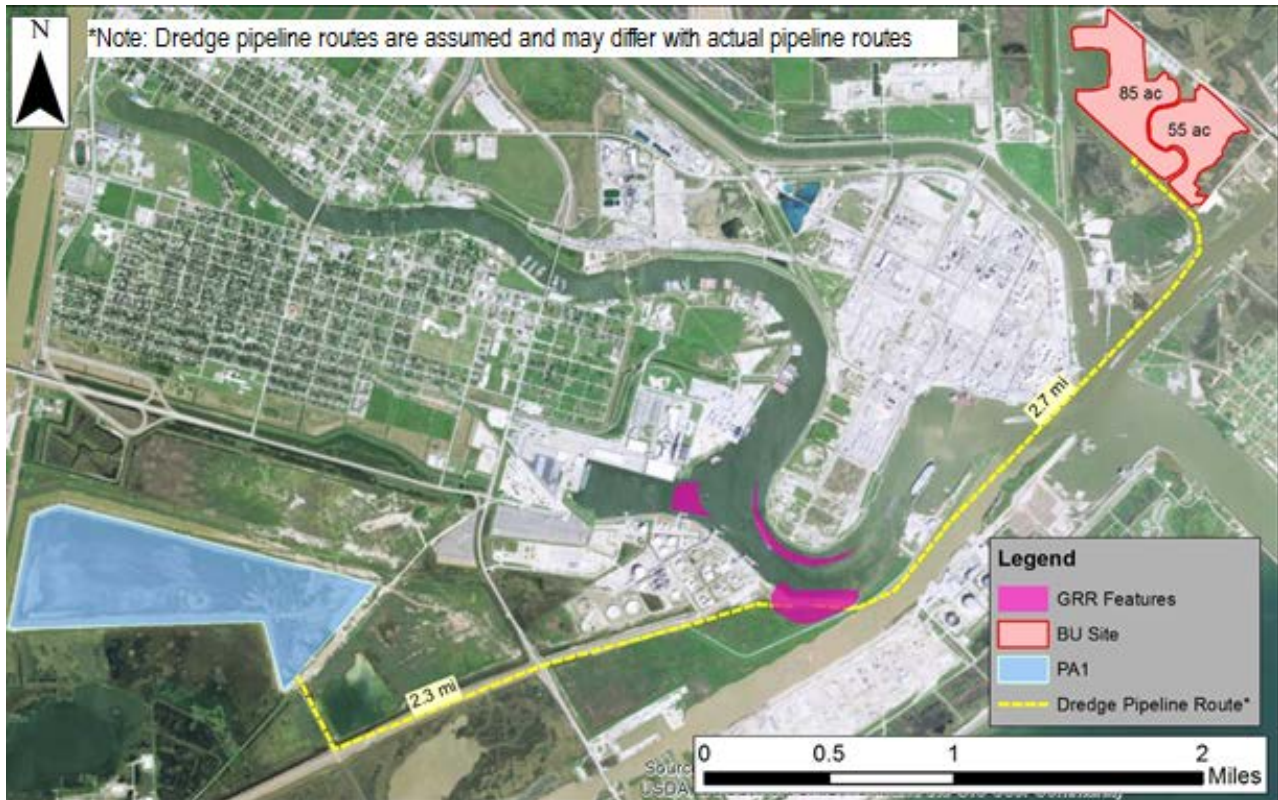


Figure 5-5 – Project Features, Placement Area, and Potential BU Site

The pumping distance to this area from the Bend Easing feature is about 2.7 miles. The Bend Easing is the feature closest to the BU area and contains the largest amount of new work material. It is possible that approximately 8 acres of marsh could be constructed with the available material. The pumping distance from the Bend Easing feature to PA 1 (the upland, confined placement area identified for material from this area) is about 2.3 miles. The PAs or BU areas selected in the DMMP are those which provide the needed capacity at the lowest cost per cubic yard. Based solely on pumping distance, the least-cost disposal option would be PA 1 since the closest potential BU site is about 30 percent farther away. The placement area selection is based upon the least-cost, environmentally acceptable alternative. However, the BU plan could be recommended if the NFS or other interested entity were willing to fund the difference (increase) in placement and construction costs over the least cost placement plan for the Recommended Plan.

5.7.3.2 Screening for Recommended Plan Least Cost Plan (DMMP)

The BU Opportunities discussion in **Section 5.7.2.1** indicates that the closest potential BU site is approximately 30 percent farther pumping distance than the upland confined PA 1. Physical characteristics (bathymetry, geotechnical etc.) of this potential BU site are not known. A comparison of the placement using existing PA 1 and a combination of BU/PA1 is provided in **Table 5-10**. The BU site does not have sufficient area to contain all 1.7 MCYs of new work material; therefore, the BU site and PA 1 would be required. No other nearby BU sites have been identified.

Because the existing elevation within the BU site is unknown an average fill height of 3 feet was assumed for this comparison. Based on this fill height the potential BU site can contain roughly 0.7 MCY of dredged material. The remaining 1.0 MCY of new work material would be placed at PA 1. It was assumed that a containment dike with 3 feet of freeboard would be needed during dredged material placement at the BU site. To retain the existing natural meandering channel that currently passes through the site, the BU site was split into 2 parcels.

Table 5-10 – Screening for Least Cost Placement Plan

Metric	PA 1	BU Placement + PA 1	Least Cost
Sufficient Capacity	Yes	No, identified BU site can only hold ~ 0.7 MCY. PDT was unable to identify another BU site in the proximity. Therefore, PA 1 would still be required.	N/A
Construction Surveys	One	Two	PA 1
PA/BU Construction Mobilization (Mob) and Demobilization (DeMob)	Once	Twice (for BU and again for PA 1)	PA 1
Dredge Mob/DeMob	Once	Once	Same
Pipeline Mob/DeMob	Once	Twice (for BU and again for PA 1)	PA 1
Pumping Distance	2.3 mi	0.7 MCY for 2.7 mi to BU site and 1 MCY PA 1 for 2.3 miles to PA 1 = (2.5 mi weighed average)	PA 1
New Decant Structures	No, existing	Yes, five (5) for BU Site	PA 1
Geotechnical Surveys	Conducted and Completed	None existing on BU Site, will require investigation	PA 1
Real Estate Easement	Existing Easement owned by NFS	No easement on BU Site, underlying land owned by multiple owned by multiple non-NFS entities	PA 1
PA 1 Levee Raising (CYs)	170,000	165,000	BU
Marsh Levee Raising (CYs)	0	90,000	PA 1
Bankline Stabilization	No		PA 1
Least Cost Placement Alternative	YES	NO	***

5.7.4 Interrelation between the S2G and GRR Recommended Plans

The GRR study proposes modification to the FHC in the area of the Dow Thumb. Earlier in **Section 1.9.6** and **Section 1.10**, it was mentioned that the S2G study was developing recommendations to modify the Old River North Levee as part of their recommended plan. The S2G study has proposed modifications on the terrestrial portion of the Dow Thumb as part of their recommended plan. The Freeport GRR and S2G are independent studies being conducted under separate business lines (navigation vs flood risk management or FRM). The PDTs for the Freeport GRR and S2G studies have coordinated and considered the potential effect that one project would have on the other.

The S2G study evaluated alternatives that would provide flood reduction for multiple areas along the upper Texas coast. One of the areas the S2G study focused on was the Freeport area. The S2G PDT evaluated improvements that could to be implemented to the existing Freeport HFPP (**Figure 5-6**). The S2G PDT determined that the levee required an elevation raise in the area around the Dow Thumb. Currently the levee is an earthen embankment and the S2G's Recommended Plan proposes to replace the earthen embankment with a pile founded T-wall. With the area currently at a questionable FOS for global stability, placing additional earthen material on the levee would further lower the FOS. Therefore, the earthen embankment around the Dow Thumb would be degraded to an elevation, which provides an acceptable FOS (per current guidance) for global stability of the level section. Then a T-wall would be placed on the earthen levee section (**Figure 5-7**). Upon completion of the S2G construction, the levee would meet current acceptable FOS.

The Freeport GRR Recommended Plan considered the existing FOS of the levee as the FWOP condition since the S2G Recommended Plan has not yet been authorized. Although these features of the two studies (S2G and Freeport GRR) are located immediately adjacent to each other, the studies are not proposing alternatives that would limit the ability to implement either proposed project or FOS correcting mitigation feature. The S2G study is proposing a solution that would affect the earthen levee itself and replace the feature with a T-Wall that is supported by deep-driven piles. Prior to constructing the Freeport GRR Recommended Plan, modifications to the HFPP would be required. The NFS intends to modify the HFPP Old River North Levee (stability wall) and North Wave Barrier (re-designation of wave barrier) under Section 408 at 100 percent NFS cost. The proposed modification to the HFPP Old River North Levee involves the insertion of a stability feature (i.e. A-Z Wall) into the terrestrial portion of the Dow Thumb at the waterside toe of the HFPP levee.

Each of the proposed solutions would be implementable on their own or could be implemented together. There is an opportunity for cost savings if the design of the S2G and GRR Recommended Plans are coordinated. The GRR study made some conservative geotechnical assumptions that

will be further evaluated during the Section 408 approval process for the HFPP modifications. If the two studies work together during PED phase, there will be an opportunity to benefit both projects and save costs.



Figure 5-6 - Map displaying location of the HFPP levee on Dow Thumb

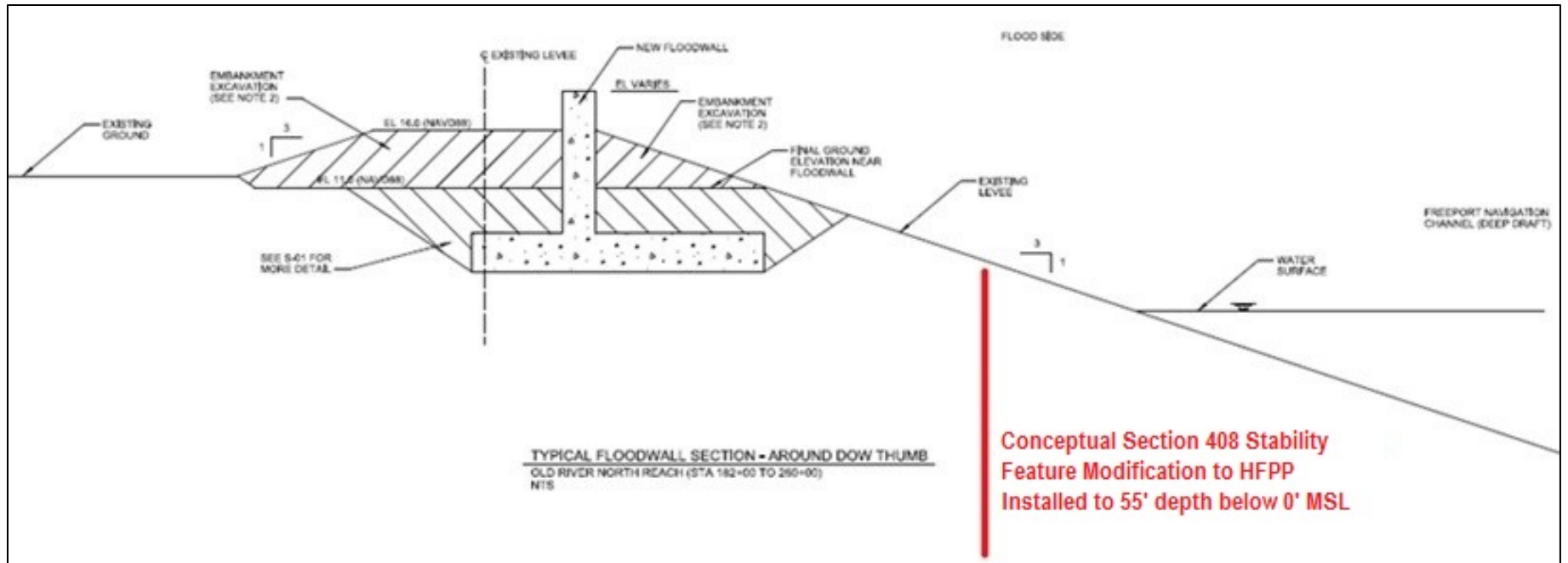


Figure 5-7 - S2G Typical Floodwall Section and Section 408 Modifications required for GRR Recommended Plan

6 RECOMMENDED PLAN

The Recommended Plan for the modification of the project authorized in WRRDA 2014 is identified as Alternative 2. This alternative addresses the safe, efficient navigation of the Panamax vessel around the Dow Thumb, for transit to and from the Velasco Container Terminal. This alternative is considered the most cost effective alternative of the final array of alternatives.

6.1 PLAN COMPONENTS

The Recommended Plan consists of the following features:

- Channel widening to 400 feet from approximately Sta. 142+28 to Sta. 184+20. This would include removal of the underwater berm around the perimeter of the Dow Thumb;
- Dredging a new bend easing at the wave barrier from Sta. 147+00 to Sta. 159+85 (requiring the re-designating of the west end of wave barrier to Old Quintana Road); and
- Dredging a new turning notch at the Upper Turning Basin (Sta. 175+77 to 181+41) situated adjacent to the Brazos Port Harbor.

Modifications to the HFPP Old River North Levee (stability wall) and North Wave Barrier (re-designation of wave barrier) are expected to be conducted under Section 408 of Title 33 of the U.S. Code (33 U.S.C. 408).

6.1.1 New Work Construction

Alternative 2, the Recommended Plan, consists of widening the channel around the Dow Thumb to 400 feet between Station 142+28 and Station 184+20. The HFPP levee was constructed immediately adjacent to the existing FHC. The north slope of the navigation channel in this area acts as the toe of the HFPP levee. It consists of naturally deposited sediments (not a constructed feature) comprising what is referred to in this study as the underwater berm. Widening of the channel to 400 feet will require removal of the underwater berm. A slope stability analysis was conducted to determine what effect the removal of the underwater berm would have on the HFPP Old River North Levee situated around Dow Thumb.

6.1.1.1 Stability Wall Prior to Removal of Underwater Berm and Channel Widening

A slope stability analysis was conducted on the levee in the Dow Thumb area. Based on available foundation strength information from 1978 investigations, the computed FOS once the underwater berm is removed was calculated to be about 1. This would be non-compliant with the national levee safety guidance specified in EM 1110-2-1902 and EM 1110-2-1913, which recommend a FOS value of 1.3. Discussions with the District Levee Safety Program indicated the navigation

project must implement engineering solutions to make the FRM project (the FHPP) whole by bringing the levee up to an acceptable FOS (>1.3), which based on existing data, would be above the current FOS of the levee in this area.

To increase the FOS for the HFPP levee in the project area to allow for the removal of the underwater berm, two design alternatives are proposed. Both of the designs would meet current levee safety guidance and facilitate the removal of the underwater berm and widening of the channel for the Recommended Plan. One design alternative is to construct a sheet pile wall out of commercially available steel Pipe-PZ or Pipe-AZ systems; the other design alternative is to use deep soil mixing to strengthen the critical foundation soil stratum. Preliminary slope stability analysis demonstrates a possibility of increasing the factor of safety to 1.697 by using this combined system to 55 feet below zero elevation. The deep soil mixing would provide a slightly lower FOS (1.681) for higher cost. Implementation of the stability features is expected to occur under Section 408.

6.1.1.1.1 Discussion of Low Soil Shear Strength Concern

It must be noted that no new geotechnical data was gathered for this study. All stability and design analysis was done using existing information. The current slope stability analyses are based upon the historical foundation information obtained in 1970s. The latest foundation investigation was conducted by Professional Service Industries (PSI); however, the strength information provided a similar strength data as the District 1970's subsurface investigation. Therefore, PSI data was not used for the slope stability analyses for the GRR. The District concluded the existing strength data is questionable due to the very low strength; however, this is the only information with field logs and lab report available for the GRR study. Therefore, the District recommends collection of additional foundation soil information during PED to validate the existing critical foundation strata and validate the current conceptual design. Implementation is expected to occur under Section 408 with reviews of design performed by USACE. For information concerning existing geotechnical data see **Engineering Appendix, Attachment 7**.

6.1.1.2 Channel Widening, Bend Easing, and Turning Notch Construction

Construction of the Recommended Plan would result in approximately 1.734 MCY of new work dredged material. New work dredged material for the Recommended Plan is assumed to have consistent composition with the classification provided in the 2012 Feasibility Report. The new work is expected to consist of 10-20 percent sand and 80-90 percent clay (**Engineering Appendix, Section 4.6.3**). All new work material is designated for placement at PA 1 by transfer through pipeline.

The dredging of the bend easing would cut into the west end of the existing HFPP North Wave Barrier at this location. Therefore, the elevated Old Quintana Road, located immediately south of the existing wave barrier, would be re-designated as the wave barrier (**Figure 6-1**). A new flood-protection levee easement would be conveyed to the Velasco Drainage District (VDD) for the right to operate and maintain the re-designated wave barrier. Designating this portion of the North Wave Barrier to the road would situate this portion of the wave barrier contiguous with the remainder of the barrier running eastward along Old Quintana Road. Implementation of this modification to the HFPP wave barrier is expected to be conducted by the NFS under Section 408.

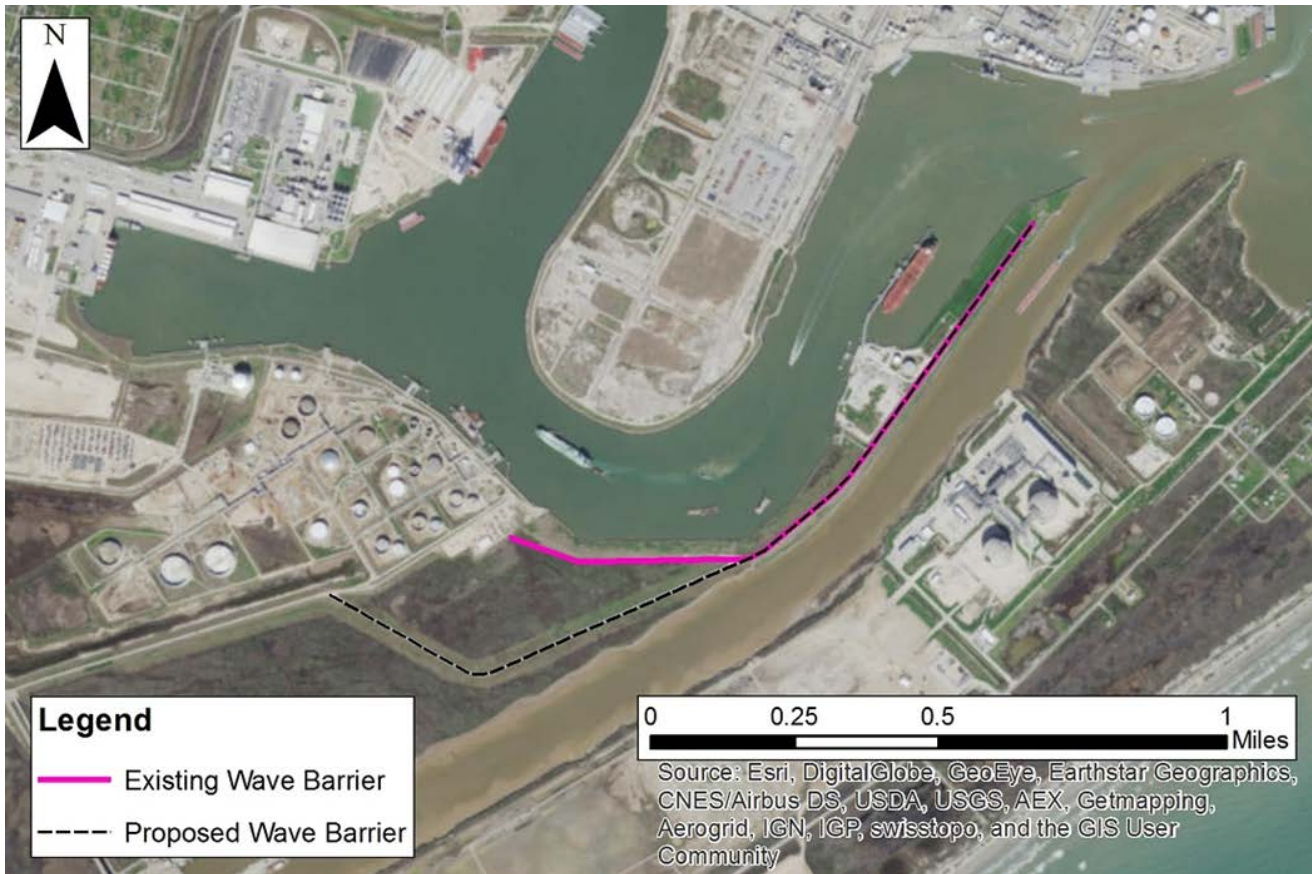


Figure 6-1 – Relocate/Redesignate Wave Barrier Portion to Old Quintana Road

6.1.2 Dredged Material Management Plan

A summary of dredged material placement is presented below. For more detail see **Appendix K, Dredged Material Management Plan**.

6.1.2.1 New Work Placement for Recommended Plan

The construction of the Recommended Plan would result in approximately 1.73 MCY of new work dredged material. Additionally, although not part of Recommended Plan, the NFS WIK on the Lower Stauffer Channel, conducted under the WRRDA 2014 authorization, would result in new

work dredging quantities of approximately 270,000 CY to be placed in PA 1. Therefore, those quantities are also included in the table to confirm adequate capacity is available in PA 1 for the Recommended Plan and WIK new work material. In total, all new-work dredged material, totaling approximately 2.0 MCY, would be transferred through pipeline to PA 1 (**Table 6-1**). For additional information pertaining to dredged material placement, see **Engineering Appendix Section 4.6.5**

Table 6-1 – New Work Dredging and Placement Plan for Recommended Plan

Feature	Stations		In-place Vol. (cy)	Average Bulk Factor	Bulk Vol. (cy)	Placement Location
	From	To				
Channel Widening	142+28	184+20	150,000	1.425	213,750	PA1
Bend Easing	147+00	159+85	1,478,000	1.425	2,106,150	PA1
Turning Notch	175+77	181+41	106,000	1.425	151,050	PA1
Recommended Plan Total New Work			1,734,000	1.425	2,470,950	PA1
Lower Stauffer WIK ¹	184+20	198+50	270,000	1.425	384,750	PA 1
Total Including WIK Volumes			2,004,000	1.425	2,855,700	PA1

¹ Not part of the Recommended Plan, provided for PA capacity assessment purposes only

PA 1 is located in Freeport roughly 0.5 mile south of SH 36 and approximately 1,000 feet east of the Brazos River Diversion Channel (USACE 2012a). The PA is approximately 320 acres in size with a perimeter length of approximately 20,310 linear feet. Existing ground elevation is approximately 21 feet NAVD with a dike height of 25 feet NAVD. According to an analysis conducted in the 1990's by PSI, PA 1 can have a maximum dike elevation of 31.5 feet NAVD. While the existing capacity of PA 1 is approximately 0.8 MCY, the PA is estimated to provide up to 3.4 MCY of capacity if the dikes are raised to 31.5 feet NAVD. This DMMP proposes a dike elevation increase to 31.5 feet NAVD for PA 1. This height includes 3 feet for ponding and freeboard above the targeted bulk dredged fill height. The footprint of the existing PA will not be expanded outside of the existing ROW for PA 1. For additional information pertaining to dredge material placement see **Engineering Appendix, Section 4.6**.

6.1.2.2 Maintenance Material Placement for Recommended Plan

As noted previously, the Sponsor's WIK quantities are included in the calculations for the Recommended Plan Placement Plan to ensure adequate capacity is available for the Federal project. After the completion of new work dredging for the Recommended Plan and the Sponsor's WIK at Lower Stauffer Channel, the components of the Recommended Plan would result in the additional increment of periodic maintenance dredging estimated at (Stations 142+28 to 198+50) would receive an annual shoaling volume of approximately 54,600 CY. Additionally, it is

estimated that the Lower Stauffer Channel would receive an annual shoaling rate of approximately 2,500 CY. This would result in an annual shoaling rate of approximately 57,100 CY.

The DMMP for the Recommended Plan is based on maintenance dredging in 3-year cycles for the widening, bend easing, and turning notch and 12-year cycles for the WIK in the Lower Stauffer Channel. Sixteen (16) dredging cycles are expected to occur within the 50-year timeframe covered by the DMMP, with a total dredged volume of approximately 2.7 MCY. All maintenance-dredged volume is designated for placement at the Maintenance ODMDS. **Table 6-2** contains the 50-year placement plan for the maintenance-dredged material from the Recommended Plan (**Engineering Appendix, Section 4.6.5.2**).

Table 6-2 – 50-Year Placement Plan for Maintenance Dredged Material for Recommended Plan

Reach	Stations		Annual Volume (cy)	Cycle Length (year)	Volume per Cycle (cy)	No. of Cycles	Total Volume (cy)	PAs
	Start	End						
Channel Widening	142+28	184+20	12,900	3	38,700	16	619,200	ODMDS 1A
Bend Easing	147+00	159+85	30,900	3	92,700	16	1,483,200	ODMDS 1A
Turning Notch	175+77	181+41	10,800	3	32,400	16	518,400	ODMDS 1A
Total Maintenance GRR	142+28	181+41	54,600	varies			2,160,800	ODMDS 1A
Lower Stauffer Channel ¹	184+20	198+50	2,500	12	30,000	4	120,000	ODMDS 1A
Total Maintenance	142+28	198+50	57,100	varies			2,740,800	ODMDS 1A

¹ Not part of the Recommended Plan, provided for capacity assessment purposes.

Comparison of the 2012 Feasibility Report DMMP and the revised DMMP for the entire project (WRRDA 2014 authorized project and Recommended Plan) will be discussed in **Section 8.12**.

6.1.3 Environmental Mitigation

The Recommended Plan would result in no significant environmental or historic property impacts and therefore no mitigation is required.

6.1.4 Detailed Cost Estimate (MCACES) for Recommended Plan (Alternative 2)

A detailed cost estimate for the Recommended Plan has been developed utilizing Micro Computer Aided Cost Estimating System (MCACES) software tools. These costs (**Table 6-3**) include the associated non-Federal cost to construct modifications to the HFPP that must be conducted prior to channel widening or construction of the bend easing. The NFS intends to implement these modifications to HFPP under Section 408 at 100 percent NFS cost. For information concerning the cost estimate see **Section 9 in the Engineering Appendix**.

Table 6-3 – Costs for Recommended Plan to 46 feet (\$000)

Cost Account and Feature	Project First Cost <i>(Oct 2017 Price level, 2.75 % interest)</i>	Fully Funded Cost
General Navigation Features (GNF)		
12 Navigation, Ports & Harbors	\$26,561	\$28,203
16 Bank Stabilization	\$1,389	\$1,483
30 Preconstruction Engineering & Design (PED)	\$3,923	\$4,301
31 Construction Management (E&D, S&A)	\$2,097	\$2,363
GNF Total	\$33,970	\$36,350
LERR (100% Non-Federal Cost)		
01 Lands & Damages (100% non-Federal)	\$4,529	\$4,833
LERR Total	\$4,529	\$4,833
Project First Cost	\$38,499	\$41,183
Non-Federal (LERRs/Associated) Costs (100%)		
11 Levees & Floodwalls (HFPP Modifications) ¹	\$14,000	\$14,794
12 Berth 7 Improvements (dock & dredging)	\$20,462	\$21,621
Associated Costs Total	\$34,462	\$36,415
Project Cost plus Associated Costs	\$72,961	\$77,598

¹Implementation of HFPP Modifications expected to occur under Section 408

6.1.5 Project Schedule and Interest During Construction

Interest during construction (IDC) accounts for the opportunity cost of expended funds before the benefits of the project are available and is included among the economic costs that comprise the 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 PED durations are included in the IDC as well as the construction durations. The current construction schedule assumes benefits starting in the base year 2022 for the proposed project. Total construction duration is assumed to be 24 months. The IDC was computed to be \$1,450,000 using October 2017 interest rate of 2.75 percent.

6.2 DESIGN AND CONSTRUCTION CONSIDERATIONS

6.2.1 Value Engineering

A Value Engineering (VE) study was performed to determine alternatives that would improve ship navigation efficiency and safety, and possibly identify potential savings of project costs. The VE study was performed subsequent to the 2016 ship simulation so it was based on the preliminary results from those studies and limited to a plan for widening the channel to 400 feet wide, bend easing, and a turning notch. The VE study resulted in seven VE alternatives (**Table 6-4**). The PDT reviewed each of the VE alternatives and the VE teams projected values for the initial cost savings and the life cycle cost savings. Then a determination was made as to whether the VE alternative would be accepted, rejected, or deferred. For additional information, refer to the **Value Engineering Report**, provided as **Attachment 4** to the **Engineering Appendix**.

Table 6-4 - Recommended VE Alternatives and Evaluation

VE Alt	Description	Cost Savings • Initial, • Life Cycle	Accepted/Rejected/Deferred
1.1	Increase channel widening from 400 feet to 600 feet at DOW Thumb	•\$3,242,000 •\$42,459,000	Not Accepted; outside scope, defer to future study
1.2	Consult with HFPP to authorize design waiver to remove existing underwater berm without mitigation	•\$11,746,000 •\$0	Rejected, removing the underwater berm with the HFPP levee in the current location would leave an unacceptable Factor of Safety for the levee.
2.0	Reduce bend easing footprint by 20 percent and reconfigure optimally	•\$3,591,000 •\$0	Rejected, the pilots, being the experts of the Freeport Harbor Channel and large vessel operation, considered what would be needed and realistic to facilitate safe transit.
3.0	Use a combination of mechanical excavation and hydraulic dredging in lieu of only hydraulic dredging	•\$1,263,000 •\$0	Accepted, excavated material from terrestrial portion of bend easing would be reasonably dry allowing immediate use to raise levees, etc. However, contractor determines least cost method.
4.0	Sell above-ground excavated material to local developers or back to Port Freeport	•\$300,000 •\$0	Rejected, at this level of design in the feasibility state a high variability of uncertainty exists in regards to availability of potential buyers of the material. Additionally this requires additional contract and legal aspects.
5.0	Reduce advanced maintenance dredging from 2 feet to 1 foot across the footprint of the dredging	•\$1,771,000 •\$7,867,000	Rejected, PDT does not agree with the VE team recommendation that lessening the advanced maintenance would result in an overall cost savings. In addition, cost of O&M would have to increase the frequency of the dredging cycles, as the channel would shoal past the authorized depth more often.
6.0	Pre-purchase steel sheet piling through USACE to reduce timing and save sales tax costs	•\$393,000 •\$7,867,000	Rejected, while the Corps purchasing steel sheet pile may save the sales tax, the Corps would have to accept the risk for material quality and delivery. Additionally, the Corps would then need to store the material adding additional cost. The PDT also states the Corps as a Federal entity does not pay sales taxes, neither does the contractor working on behalf of the Corps. Risks outweigh the relatively low cost savings.

6.2.2 With-Project Sea Level Rise

RSLR was calculated for 50 years starting in year 2020 as the sum of average global sea level rise, vertical land movement, and regional basin trends utilizing USACE curves. The sea level rise analysis revealed a 50-year RSLR of between 0.71 feet assuming USACE Low curve, 1.18 feet assuming USACE Intermediate curve, and 2.68 feet assuming USACE High curve. To maintain consistency with previous USACE studies in the region, a 50-year RSLR value of 1.18 feet was selected for this project based on the USACE Intermediate curve (**Engineering Appendix, Section 6.3**).

6.2.3 Storm Surge

The channel's wave climate was modeled in ERDC's Steady State Wave model (STWAVE) under the No Action Alternative and the with-project condition, assuming an extreme storm event consisting of 100-year wind speed and 100-year still water level. Wave modeling was repeated with RSLR added to investigate possible effects of RSLR. Wave modeling shows little change (<0.1 feet) in wave height between the Recommended Plan and the No-Action Alternative. Due to minor increase of wave heights imposed by the Recommended Plan, it was concluded that the Recommended Plan would have minimal effect on the overtopping of levees and seawalls protecting the Dow and Stauffer plants.

Using the wave characteristics obtained from the wave analysis, the levees, and floodwalls protecting the Dow and Stauffer plants were analyzed for overtopping. Construction of the Recommended Plan requires partial removal of the wave barrier on the south side of the channel. The original intent of the wave barrier was to limit wave attack on the flood protection structures leeward of the barrier and to impede storm surges to the navigation channel. As confirmed thorough numerical modeling performed as part of the current investigation, the increased land elevations at Quintana greatly reduce the wave impacts on the wave barrier, with emergent land expected to remain even during the design storm. Furthermore, a roadway (Old Quintana Road) which passes along the south side of the FHC, separating it from the GIWW before turning northwest to Phillips, is both seaward of the wave barrier and at a higher elevation than the existing wave barrier.

Analyses suggest that implementation of the Recommended Plan would have minimal effect on the channel's hydrodynamics. For detailed information concerning hydrodynamic analyses conducted for the general reevaluation study see **Engineering Appendix, Attachment 2, Final Hydrology and Hydraulics Report, Freeport Harbor Channel Improvement Project, General Reevaluation Report, Brazoria County, Texas**, dated November 28, 2016 (Final Hydrology and Hydraulics Report) and **Engineering Appendix, Attachment 9**, provides the *ERDC Risk Based Wave and Surge Modeling Report*, dated August 2016.

6.3 REAL ESTATE CONSIDERATIONS

The existing HFPP includes a levee and an underwater berm situated along the perimeter of the Dow Thumb and parallel to the proposed widening in Reach 2 of the FHC. Widening at Dow Thumb would require removal of the underwater berm (exercised under navigation servitude), necessitating the incorporation of a stabilizing structure along the waterside of the HFPP levee prior to removal of the underwater berm. The structure would be inserted into the soil on the land portion of the Dow Thumb along the waterside of the HFPP levee most likely within the ROW of the existing HFPP. VDD holds a perpetual easement from Dow Chemical for the current levee

structure. The easement grants an estate with subordination of all rights to the drainage district, which are not specifically constrained except by reference to the overall purpose of the HFPP. Based on this easement the sponsor would be able to conduct the work within the described footprint of the easement. As such, there are no anticipated real estate issues with this feature.

The bend easing feature on the southern bank of the channel located across from the Dow Thumb would require Port Freeport to provide the necessary real property interests to facilitate construction. There are no anticipated real estate issues with this feature and Port Freeport is aware of the real estate requirement and stated that it will provide the necessary real property interest. The addition of a turning notch situated adjacent to the current Upper Turning Basin would not require additional real property acquisition and would be constructed under Navigation Servitude.

Assumption is that a new flood protection easement can be conveyed from the non-Federal sponsor to the VDD for the re-designation of the west end of the North Wave Barrier prior to construction of the bend easing. The VDD currently has an existing flood-protection levee easement. For the proposed feature, the current flood-protection levee easement would need to be released and a new easement issued. If terms cannot be agreed upon between the non-Federal sponsor and the VDD, delays in the project schedule prior to construction and increase in project costs would be incurred.

6.3.1 Lands, Easements, and Rights-of-Way

The Project Sponsor is required to furnish the lands, easements, and rights of way (LERRD) for the proposed cost-shared project. The real estate requirements must support construction as well as O&M of the project after completion.

The DMMP of the 2012 Feasibility Report included the use of the existing PA 1, and future use of PAs 8 and 9, once constructed. The tract on which PA 9 was to be constructed is no longer owned in fee by Port Freeport. Therefore, a new maintenance plan has been developed. It has been demonstrated that placing all maintenance material from the FHC into the ODMDS 1A is the least cost placement; therefore, PA 9 is no longer necessary for placement of dredged material from the authorized project or the Recommended Plan.

All new work material from the Recommended Plan is designated for placement into PA 1, for which the sponsor owns the land in fee. A 20-year temporary disposal easement for PA 1 was conveyed by the sponsor to the Government for the period from December 16, 2004 to December 2024. The subject term easement will need to be converted to a non-standard perpetual dredge material easement to the Government.

The bend easing will require an estimated 10 acres of land to be cut away from two tracts owned by the NFS in fee. The NFS will be required to convey a perpetual channel improvement easement to the Government. The material from the construction of the bend easing would be placed into PA 1. Construction of the bend easing would also require cutting into the portion of the North Wave Barrier not running along the Old Quintana Road. The wave barrier would be re-designated from its current location to the Old Quintana Road and contiguous with the remainder of the North Wave Barrier.

The Future PA 8 is part of the 2012 Feasibility Report DMMP. The NFS owns the land in fee for PA 8. As such, a non-standard perpetual dredge material easement and a dredged material pipeline easement to the Government will still be required.

6.3.2 Facility Removals/Deep-Draft Utility Relocations

The bend easing project feature will impact the existing North Wave Barrier of the HFPP. This structure will need to be relocated and a new flood protection levee easement will need to be conveyed to VDD for the right to operate and maintain the relocated levee. The cost for the relocation/re-designation of the wave barrier is expected to be implemented under Section 408 in which the NSF will be responsible for all cost as work-in-kind and will be available for LERRD crediting to the NFS.

The USACE has identified multiple pipeline and utility structures identified to be located around the project area. USACE Engineering Division confirmed these structures would not be impacted by the bend easing feature. The bend easing design will be offset so the multiple pipeline and utility structures will be avoided during PED.

6.4 OPERATIONS AND MAINTENANCE CONSIDERATIONS

The sedimentation analysis presented in the **Final Hydrology and Hydraulics Report** provided in the **Engineering Appendix, Attachment 2**, concluded that based on a review of historical dredging data the Recommended Plan would increase the annual dredging rate in the inner harbor channel (i.e., Stations 71+52 to 184+20) from approximately 281,000 CY/year for the No Action Alternative to approximately 315,000 CY/year; an increase of approximately 12 percent. See **Engineering Appendix Attachment 1, Drawings**, Sheet 00C-01 for Channel Alignment Data.

6.4.1 Environmental Quality

Adverse EQ effects of the Recommended Plan are negligible and there is no required fish and wildlife or historic property mitigation. All factors that would be relevant to the Recommended Plan were considered, including impacts on wetlands, effects on EFH and listed species, air quality, water and sediment quality, hazardous materials, historic properties, and socioeconomic,

and EJ impacts. Potential effects were evaluated under the EQ account; these are detailed in **Section 7**.

6.4.2 Regional Economic Development Benefits

At the aggregate level, U.S. demand for imported containerized goods is recognized as a function of domestic income, population, and other factors influencing demand, such as exchange rates. Demand for containerized exports depends upon economic activity in other countries, exchange rates, and other factors. The geographic pattern of U.S. demand for container port services depends upon (1) the location of domestic consumers with respect to foreign sources for imports, (2) the location of manufacturers, farms, resource industries, and other exporting businesses relative to foreign markets for their goods, and (3) the availability and relative costs of intermodal transport from sources to markets. Correlation between population and container volume, particularly imports, is cited by several analysts. While population is one of several variables affecting traffic growth, it is recognizably a key variable. Particularly for this study region, where over 90 percent of the existing container tonnage is served by trucks. Population growth for the counties within the Freeport and Houston port areas is presented in **Table 6-5**. While the population forecast shows fairly high growth for the region included in the HGB Statistical Metropolitan Area, regional population has increased at higher rates than expected (**Table 6-6**).

Table 6-5 – Metropolitan Statistical Area Population Project Texas Counties Adjacent to Freeport, Texas

County	2000	2010	2020	2030	2040	2050	2060	Average Annual Growth Rate (%) 2000–2060
Brazoria County	241,767	313,166	331,731	375,664	416,157	459,078	503,894	1.2
Harris County	3,321,660	4,092,459	4,416,793	4,964,463	5,512,168	6,059,895	6,607,635	1.2
Fort Bend	354,452	585,375	630,624	802,486	979,196	1,210,945	1,475,761	2.4
Wharton County	41,188	41,280	46,045	47,647	48,567	48,590	48,074	0.3
Galveston	250,158	291,309	284,731	294,218	298,057	300,915	302,774	0.3
Matagorda	37,957	36,702	43,295	44,991	45,925	45,793	45,377	0.3

Source: Texas Water Development Board, 2006 Regional Water Plan, County Population Projections 2000–2060.

Table 6-6 - Houston-Galveston Statistical Metropolitan Area 2000-2010 Population Estimates, Select Counties

County	2000	2010	2000–2010 Growth Rate (%)
Brazoria County	241,767	313,166	2.6

Harris County	3,321,660	4,92,459	2.1
Fort Bend	354,452	585,375	5.1
Wharton County	41,188	41,280	0.0
Galveston	250,158	291,309	1.5
Matagorda	37,957	36,702	-0.3
Total	4,247,182	5,360,291	2.4

Source: U.S. Bureau of Census

The distance from Freeport to towns and cities within and adjacent to Freeport was examined to determine the immediate market area. **Table 6-7** displays mileages from Freeport to towns and cities within and adjacent to Brazoria County. In addition to relative distances from Freeport, the location of “distribution centers” (DCs), also referred to as “inland ports,” was examined. It is noted that the inland ports of Alliance (Forth Worth), Wilmer (Dallas), and Kelly (San Antonio) are part of the Texas freight distribution network. The inland ports are noted to complement the overland border ports of entry, where consolidation of North American Free Trade Agreement–related trade transfers can take place. It is recognized that DCs previously functioned primarily as warehouses but currently are involved in repackaging cargo for retailers and adding value to commodities. These centers are established along supply chains to service retail outlets such as Wal-Mart, Target, Home Depot, and Lowes. While Houston has clear mileage advantages over Freeport for cargo traveling to Dallas/Fort Worth, the comparative one-way distance to San Antonio is less than 5 miles. Plans to widen the Panama Canal to accommodate larger container vessels will increase Texas container traffic. Over the next 20 years, Texas ports, waterways, highways, and rail facilities will handle between 50 and 85 percent more freight, depending on the mode of transportation, according to “Texas Ports 2007–2008 Capital Program,” a report by the Texas Department of Transportation.

Table 6-7 – Mileage Comparison to Cities Within or Adjacent to Brazoria County

City	Freeport miles	La Porte miles	Freeport Advantage Plus (+)	County
Lake Jackson	10	64	54	Brazoria
Rosenberg	58	58	0	Ft. Bend
Bay City	49	90	41	Matagorda
Angleton	27	54	27	Brazoria
Freeport	0	74	74	Brazoria
El Campo	101	102	1	Wharton
Clute	8	69	61	Brazoria
Wharton	60	82	22	Wharton
Palacios	72	128	56	Matagorda
West Colombia	26	66	40	Brazoria
Sweeny	27	75	48	Brazoria
Brazoria	18	66	48	Brazoria
Jones Creek	8	72	64	Brazoria
Danbury	25	41	16	Brazoria

6.4.3 Other Social Effects

As previously stated, the Recommended Plan would help alleviate safety concerns expressed by the pilots as they traverse the Dow Thumb. This increase of safety would help reduce the risk of allisions and collisions. The alternative selected is the safest alternative for the projected traffic. Hence, public safety may be increased by addressing safety concerns expressed by the pilots.

6.5 RISK AND UNCERTAINTY

Risk and uncertainty is an important part of the USACE planning process and is emphasized in Goal 2 of the USACE Campaign Plan, addressed later in **Section 8.12.1**.

6.5.1 Engineering Data and Models

Baseline storm surges used for the analysis were composed of the suite of storm surges produced from the FEMA Texas Joint Storm Surge Study (JSS). The FEMA Texas JSS used the Advanced Circulation (ADCIRC) model together with ERDC's STWAVE to perform storm surge and wave simulations.

In the Freeport region, without-project storm model results were applied for both with- and without-project conditions. This approach includes uncertainty associated with still water level overtopping and potential adjacent impacts.

Ship simulation modeling reproduced real-time vessel responses to various interacting forces including wind force, bank forces, tug and bow thruster forces, and ship-to-ship interaction. The final results for the optimized channel were based on simulation runs for the existing and proposed conditions, and analyses of vessel tracks and pilot evaluations. Although there is a degree of uncertainty involved in the accuracy of visual and environmental data, the real-time simulation by ship pilots determined the optimal channel widths required for safe navigation. The real-time runs are guided by the personal experience and knowledge of the pilots, and their testing is subjective. As such, the risk-based analysis is somewhat inappropriate for ship simulation.

6.5.1.1 Relative Sea Level Rise

This study uses current USACE sea level change guidance as required for USACE studies. Total RSLR at Port Freeport is slightly greater than the average global sea level rise primarily due to land subsidence and regional oceanographic behavior of the Gulf of Mexico. Based on NOAA scenarios, the RSLR is estimated to be between 0.96 feet and 3.66 feet for the period of 2020-2070. Similarly, USACE scenarios predict a RSLR of between 0.71 feet and 2.68 feet for the same period.

An intermediate-high 50-year rate of RSLR (2.4 feet) was used for the storm surge modeling. An intermediate 50-year rate of RSLR (1.18 feet), as calculated with the corps climate tool, was used as the “most likely” estimate of RSLR in the other analyses for this project, in accordance with the USACE planning guidance. The functioning of the navigation features would not be significantly affected by the full range of potential sea level change. Construction dredging would not be affected by future rates of RSLR. While shoaling rates toward the end of the period of analysis could increase due to an enlarged cross section and greater saltwater penetration, this small effect would probably be offset by increased overall water depths.

6.5.1.2 Geotechnical Data used for Levee Stability Feature Design

The current slope stability analyses are based upon the historical foundation information obtained in the 1970s. The latest foundation investigation was conducted by PSI; however, the strength information provided a similar strength data as Galveston District’s 1970’s subsurface investigation, so PSI data was not used for the slope stability analyses for the GRR study. The District concluded that the existing strength data is questionable due to the very low strength. Nonetheless, this is the only information with field logs and lab report available for the GRR study. For that reason, the District recommends collection of additional foundation soil information to

validate the existing critical foundational strata and to validate the current conceptual design of the stability wall during the Section 408 process.

6.5.1.3 Re-designating the Wave Barrier to Old Quintana Road

All of the evaluated alternatives, except the No-Action Alternative require the bend easing feature to facilitate transport of the Panamax vessel to and from the Velasco Container Terminal located in Reach 3. Construction of the bend easing requires the re-designation of a wave barrier associated with the HFPP. Since the wave barrier is part of another Federal project, if the feature cannot be re-designated to the elevated Old Quintana Road or something comparable, the GRR study does not have a valid alternative.

Feedback provided by the Pilots was used to design the GRR components and a ship simulation was conducted to verify the Panamax design vessel would be able to transit efficiently, safely around the Dow Thumb to the Upper Turning Basin. ERDC conducted storm surge modeling and the Sponsor conducted hydrodynamic wave overtopping analysis to show that the wave barrier is no longer needed for its intended function due to changes in geography (area was elevated sustainably) on Quintana Island.

6.5.1.4 Sediment Sampling on the Dow Thumb

The Recommended Plan would require modifications to the HFPP Old River North Levee prior to widening of the channel. Geotechnical analysis of existing information indicates the need to insert a stability structure on land located along the HFPP levee toe waterside prior to removal of the underwater berm. The Dow Chemical Company has been operating in this general area since World War II and there are rumors that releases of HTRW may have occurred in this area. If contaminated sediments were identified in a study/analysis during PED, there would likely be a delay in the project schedule and increased costs would be incurred for proper disposal of any material that would be disturbed by construction.

The PDT conducted a review of the available records and contacted the owners requesting information. For the last 20 years, the general area has been used as a rail storage yard with no plant facilities situated immediately adjacent to the levee. Prior to that time, one area near the north end of the proposed location for the stability feature may have been used as a plant facility. An HTRW records search indicates no open violations or remediation orders in this area. No sediment testing/quality information was received from Dow Corporation. Additionally, the PDT sampled sediment from the underwater berm for contaminants and found that the material is suitable for upland placement. Since sampling of the sediment from the underwater berm did not show contaminants, it is reasonable to assume the immediately adjacent terrestrial soils would also not be contaminated.

6.5.2 Economic Data and Models Analysis

As with most deep-draft navigation studies, key uncertainties exist that could affect the investment decision. The primary uncertainties pertain to growth rates of the associated commodities, loading patterns of those commodities, routes of the vessels, size and distribution of those vessels, fuel costs, market shifts, and exchange rates. Further explanation is given in the **Appendix A, Economic Appendix**.

6.5.3 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 was conducted by the Project Delivery Team. Cost risk analysis methods were applied to develop contingencies for the estimated total project costs (**Engineering Appendix, Section 9**).

6.5.4 Environmental Data and Analyses

The most current available data was used for the environmental analyses of the study area and assessment of impacts of the Recommended Plan. No significant environmental impacts were identified, and therefore no ecological modeling was required to quantify impacts or mitigation. No significant risks to environmental resources are expected with construction of the Recommended Plan. No significant uncertainties have been identified in the environmental data used to evaluate the with-project impacts. However, a low risk to the construction cost and schedule has been identified due to the deferment to the PED phase for sediment testing of the construction area for the stability feature located outside of the HFPP levee on the Dow Thumb. This has been determined to be low-based risk based upon the results of contaminant analyses of in-situ sediments of the underwater berm immediately adjacent to this area, and from information from the HTRW records search.

6.6 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 EA.

6.6.1 Clean Air Act

The General Conformity Rule is applicable only to nonattainment and maintenance areas. The proposed structural alternatives associated with the Recommended Plan would be located in Brazoria County, Texas. Brazoria County is included in the eight-county HGB ozone nonattainment area, which is classified as “severe” in terms of its degree of compliance with the 1997 8-hour ozone standard. This classification affects facilities that generate the ozone precursors, NO_x, and VOC. As such, the Recommended Plan is subject to the General Conformity Rule, which applies to all nonattainment and maintenance areas.

The GRR structural features (widening, bend easing, and turning notch) have been evaluated in terms of the relevant direct and indirect emissions associated with construction of the Recommended Plan. This analysis and the determination reports are presented in **Appendix J**. Based on this evaluation, the TCEQ has provided a General Conformity Determination for NO_x emissions for the Recommended Plan as emissions of NO_x are estimated to exceed the 25 tons per year applicability threshold. Emissions of VOC for the construction activities for the Recommended Plan are exempt from a General Conformity Determination because they are below the 25 tons per year applicability threshold. This determination is provided in **Appendix G**.

The following paragraph has been included in the FIGGR-EA, based upon TCEQ review and approval:

Based on the evaluation of the proposed project description, estimated air quality emissions, and with consideration of the General Conformity concurrence letter from the TCEQ, the USACE has determined that its approval of the proposed GRR Structural Features will meet the General Conformity requirements of 40 CFR 51 Subpart W and 40 CFR 93 Subpart B.

6.6.2 Clean Water Act

Waters of the U.S. are protected under Sections 401 and 404 of the Clean Water Act (CWA). The stated objective of the CWA is “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.” 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 F**.

The CWA 404(b)(1) Evaluation concludes that construction of the project is not expected to have any substantial adverse impacts to water quality; thus no violation of water quality standards is anticipated. The TCEQ provided State water quality certification by letter dated August 25, 2017.

6.6.3 Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA)

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. Section 102/103 of MPRSA authorizes USACE to place dredged material within an EPA-designated ODMDS, subject to EPA concurrence and the use of EPA dumping criteria. Both of Freeport's ODMDS are EPA-designated sites.

The annual shoaling rate from the Recommended Plan is expected to increase from approximately 281,000 CY per year to 315,000 CY per year, an increase of approximately 12 percent for this reach. The net increase of 34,000 CY represents less than a one percent increase in the total quantity of maintenance material forecast for ODMDS placement by the 2014 authorized project. **ODMDS analysis and modeling** is presented in **Appendix A of the 2012 EIS**. This modeling indicates the existing Maintenance ODMDS is large enough to accommodate maintenance 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 the ODMDS. The EPA reviewed the DIGRR-EA but provided no written comments. Subsequent informal coordination with EPA confirmed that EPA has no concern with the addition of this minor amount of material to the maintenance ODMDS. 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.

6.6.4 Section 7 of the Endangered Species Act

Informal interagency consultation under Section 7 of the Endangered Species Act (ESA) has been undertaken. A 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 project on these protected species (**Appendix H**). USACE has determined that the Recommended Plan would have no effect on any listed species. The Draft BA was submitted to USFWS and NMFS for review on December 1, 2016. Neither agency generally provides concurrence when a "no effect" call is made by the action agency.

6.6.5 Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)

The MSFCMA (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 DIGGR-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. The NFMS concurred that the project would have negligible impacts to EFH and federally managed fisheries. This determination is provided in **Appendix G**.

6.6.6 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 Area of Potential Effect 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. A thorough file review did not identify any National Register of Historic Places-listed or eligible sites or State Antiquities Landmarks within the project's area of potential effect. Therefore, coordination with the SHPO is not required.

6.6.7 Coastal Zone Management Act

Under the Texas Coastal Management Program (TCMP), enacted under the Coastal Zone Management Act in 1972, the Texas General Land Office (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. The GLO has confirmed that the project is consistent with the Texas Coastal Management Plan. This determination is provided in **Appendix G**.

6.6.8 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 I**. The CAR recognizes that the Recommended Plan avoids significant impacts to fish and wildlife resources, including federally listed, threatened, and endangered species. The CAR included eight recommendations including recommendations. These recommendations included using the BU of the dredge material, creating a nesting bird island, incorporating specific Best Management Practices (BMPs) to avoid inadvertent impacts to wildlife during construction, coordinating with NMFS, testing all new work and maintenance material for contaminants, and reevaluating the need for mitigation and ESA consultation if the project changes in the future. To the greatest extent possible, the USFWS recommendations have been integrated into the Recommended Plan. USACE has agreed to fully adopt four recommendations, and partially adopt

two recommendations. Two recommendations cannot be adopted due to USACE policy. Recommendations and all partial or non-adopts are fully explained in **Section 7.6**.

6.6.9 Marine Mammal Protection Act (MMPA) of 1972

The MMPA 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. A draft BA for the TSP (now the Recommended Plan) was prepared in October 2016 that concluded that the project would have no effect on marine mammals, as they are highly unlikely to occur in the project area. The draft BA was submitted to NMFS for ESA coordination on December 1, 2016. NMFS acknowledged receipt of the BA but will not review or provide a concurrence on projects where a “no effect” call has been made by the action agency.

Per a USFWS request, USACE would implement USFWS recommendations that avoidance measures specific to the manatee be implemented during construction of the project. Although sightings of manatees are rare along the Texas coast, they may occur. To avoid potential impacts to the West Indian manatee, USACE would advise all contractors and staff that manatees may be found in the project area. USACE would also incorporate specified education measures into construction and maintenance contracts for the Recommended Plan. These included preparation and distribution of identification materials, boat operation guidance, response measures such as avoiding feeding, watering, or other physical contact with a manatee, and contact instruction in the event of a sighting.

6.6.10 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.

6.6.11 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). There are no Coastal Barrier Improvement Act (CBRA) units within the project area. Because the Recommended Plan would have no effect on a CBRA unit, no coordination in association with the CBRA is necessary.

6.6.12 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 1981 Farmland Protection Policy Act requires Federal agencies to evaluate the impacts of federally funded projects that may convert farmlands to nonagricultural uses and to consider alternative actions that would reduce adverse effects of the conversion. None of the soils impacted by the Recommended Plan are classified as prime or unique farmlands. Therefore, there is no potential for impacts to prime or unique farmlands.

6.6.13 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 floodplain development unless there is no practicable alternative. The entire project area is mapped as Zone VE (coastal flood zone with wave velocity hazard) including the existing waterway. Approximately 16.4 acres of emergent land within Zone VE would be impacted for the bend easing portion of the Recommended Plan. However, this impact would not change the floodplain designation or increase flooding in the project area. Port Freeport has not reported any potential or new tenants that are planning to develop because of the project. The project is needed to allow ships to call on existing terminals and is not expected to induce development.

6.6.14 Executive Order 11990, Protection of Wetlands

This EO, amended by EO 12608, directs Federal agencies to avoid undertaking or assisting in new construction located in wetlands, unless no practicable alternative is available. No wetlands would be impacted by the Recommended Plan.

6.6.15 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 Recommended Plan project area. An evaluation of potential EJ impacts based on a review of the U.S. Census information has been conducted. There are two census block groups within the Recommended Plan area; one (census tract 6642, BG 2) contains a low-income population and the other (census tract 6644, BG 2) contains a minority population. Channel improvements would be confined to industrial areas or those within the existing waterway and are not located in or adjacent to the residential portions of the census tracts identified above. The Recommended Plan would

not be expected to adversely affect any low-income or minority populations. Local benefits would include the creation of temporary construction jobs and the maintenance or growth in the economy of the Port.

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

The Migratory Birds and the MBTA of 1918 (as amended) extends Federal protection to migratory bird species. Among other activities, non-regulated “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.

6.6.17 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 Recommended Plan area would not likely experience any adverse effects 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 5.6** 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, the existing FHC would continue in operation at its current depth and length. The improvements described for the 2012 Feasibility Report would be carried forward. The existing PAs and maintenance ODMDS would continue to be used. RSLR over the 50-year period of analysis would be expected to result in small increases in inundation and tidal circulation in the study area.

The Recommended Plan involves widening existing portions of the channel that is volumetrically minor compared to the water volume of FHC and the conversion of about 16.4 acres of upland to deep water. The proposed action also does not involve bathymetric changes to the channel that would interfere with or increase tidal exchange, increase shoreline currents, or change the littoral sediment transport. The Recommended Plan does not change the freshwater input or wind driven circulation within the project area. Therefore, no impacts to tides, currents, and associated processes, are anticipated.

Although the size of the proposed modifications are negligible compared to the volume or the tidal prism of the channel and would have negligible influence on water level, the proposed activities would widen, but not fill portions of the current FHC System. As such, it would not impact storm surge and/or coastal flooding adversely. Because the FHC is not a part of a riverine channel, it has no potential to alter riverine flow or floodplains. Therefore, no impacts to flooding from altering water levels in the FHC during storm conditions are expected.

7.3 Storm Surge Effects on the Study Area

The improvements proposed in the 2014 authorized project would increase storm surge elevations by about 0.16 foot locally, inside the jetties. However, this increase was considered small given

the general inundation of the greater Freeport area during a significant storm surge, and will not have a substantial effect on the level of protection offered by the current levee system. A majority of the study area is protected by existing wave barriers and the levee system. This study is recommending that the west end of the North Wave Barrier located south of the proposed bend easing be re-designated to the elevated Old Quintana Road. The effect of this change on coastal storm risk management has been evaluated, and no increase in surge risk was found.

7.4 Impacts to Biological Communities

Under the No Action Alternative, no effects would occur to the sensitive biological communities found in the study area. Impacts to biological communities as a result of the Recommended Plan are as follows.

7.4.1 Terrestrial

The Recommended Plan would result in impacts to approximately 16.4 acres of uplands to accommodate the bend easing. Terrestrial vegetation in this area would be converted to the navigation channel, which also serves as open water habitat. Equipment staging areas and dredge pipelines used for construction of the Recommended Plan would result in temporary minor effects to uplands in the project area; however, appropriate BMPs would be implemented where necessary to avoid and minimize potential effects. Placement of new work material would be confined to the existing approved PA1. Hydraulic pipelines would access the PA through existing waterways and across surface soils. BMP's would be utilized to minimize impacts. Construction to raise the levee heights of PA 1 would be conducted entirely within the existing PA ROW.

Equipment staging areas and dredged pipelines may result in temporary direct and indirect minor impacts to wildlife and habitats during construction. These will be minimized and appropriate BMPs would be implemented where necessary. Dredged material placement into existing PA 1 would not impact native habitat, or wildlife.

7.4.2 Aquatic

Aquatic communities would be temporarily affected by construction of the Recommended Plan. Approximately 25.7 acres of existing aquatic habitat would be disturbed during construction for the bend easing, channel widening, and turning notch. Benthic organisms would be removed by construction, but recolonization is expected. Aquatic organisms in the area would be impacted by short-term increases in turbidity as a result of excavation of the channel bottom. Short-term turbidity increases may also be associated with construction of the stability wall at the Dow Thumb for which implementation is expected to occur under Section 408. Sediment barriers would be used to minimize the amount of sediment entering the river during construction. Elevated turbidities during construction and maintenance dredging may affect some aquatic organisms near

the dredging activity; however, turbidities can be expected to return to near ambient conditions within a few hours after dredging or construction ceases. No special aquatic sites regulated under 40 CFR 230 are present within the Recommended Plan footprint.

Additionally, placement of material at the ODMDS would result in temporary local impacts to aquatic communities (primarily benthos) from increased sedimentation and turbidity. The additional amount of dredged material that would result from construction of the Recommended Plan is negligible. The maintenance ODMDS is currently used for placement of dredged material from maintenance cycles, and, therefore, continued placement of maintenance material at the site would not be expected to change current conditions. Generally, motile organisms are mobile enough to avoid highly turbid areas – under most conditions, fish and other motile organisms are only exposed to localized suspended-sediment plumes for short durations (minutes to hours) (Clarke and Wilber, 2000). No significant impacts to fishes or other pelagic fauna are anticipated from project construction or maintenance dredging.

7.5 Essential Fish Habitat Impacts

Under the No Action Alternative (FWOP condition), the impacts to EFH 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. 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.

EFH within the project area is discussed in **Section 2.3.5**. The project area includes EFH for red drum, reef fish, coastal migratory pelagic fish, and shrimp. The majority of impacts to managed species and their associated EFH would be limited to the estuarine benthic environment where the actual dredging would take place, as well as temporary impacts to the water column as a result of increased turbidity. The life stages anticipated to be impacted the most are the egg and larval stages, with those utilizing benthic habitats within the dredged footprint expected to experience the most impact (DiMarzio et al, 2016). The majority of the juvenile and adult life stages present in the project footprint are primarily forage and pelagic species capable of detection and avoidance behavior when exposed to unfavorable conditions. It is expected that construction of the Recommended Plan would not have any direct impacts to juvenile and adult fish other than a temporary displacement, and individuals would re-inhabit temporarily affected areas upon dredging completion. No aquatic vegetation has been identified in the dredged or adjacent buffer zone areas, therefore no impacts to seagrass or the nursery habitat it provides to juvenile fish would occur from the Recommended Plan. Therefore, only minimal impacts to benthic EFH are expected

to occur. Turbidity generated by the Recommended Plan could affect the foraging behavior of certain predators and the efficiency of filter feeders. Turbidity would be expected to affect only a small area surrounding the project area relative to the total habitat available to managed species, and dissipate quickly. Impacts from maintenance dredging would include short-term increases in water column turbidity and benthic impacts, although no long-term effects would be expected.

The Recommended Plan project area is not in or near any of the areas identified as HAPC, as these areas are located offshore. Therefore, no impacts to HAPC are expected from construction or maintenance of the Recommended Plan. Additionally, the project area is not in or near any of the areas identified as EFH Protected from Fishing.

7.6 Threatened and Endangered Species Impacts

Potential impacts to federally listed species are similar for both the No Action Alternative and Recommended Plan. The project area was evaluated for habitat and potential occurrence of each listed protected species. Both the FWOP and the Recommended Plan would have no effect on the listed animal and plant species.

As described in the BA (**Attachment H**), the Recommended Plan would not affect the following federally listed species potentially occurring within the vicinity of the study area: five species of sea turtle (green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle), the piping plover, red knot, and whooping crane, the West Indian manatee, four species of whales (fin whale, humpback whale, sei whale, and sperm whale) and four coral species (lobed star coral, mountainous star coral, boulder star coral, and elkhorn coral) (USFWS, 2016; NMFS, 2016a)).

Birds recently removed from the Federal list of threatened and endangered species such as the American peregrine falcon, Arctic peregrine falcon, peregrine falcon, brown pelican, and bald eagle are protected under the MBTA, and the bald eagle continues to receive additional protection under the Bald and Golden Eagle Protection Act (64 FR 46542–46558; 72 FR 37346–37372).

7.7 Fish and Wildlife Coordination Act Recommendation

The USFWS has provided a CAR which recognizes that the Recommended Plan avoids all significant impacts to fish and wildlife resources, including federally listed, threatened, and endangered species, and that no mitigation is required for the Recommended Plan (**Appendix I**). To the greatest extent possible, the USFWS recommendations have been integrated into the Recommended Plan. USACE has agreed to fully adopt four recommendations and partially adopt two recommendations, but cannot adopt two recommendations due to USACE policy. All partial or non-adopted recommendations are fully explained in **Appendix I**.

- USACE has agreed to utilize specific BMPs to avoid impacting wildlife during construction, coordinate with NMFS about EFH impacts of the Recommended Plan, and reevaluate project and ESA impacts if the Recommended Plan plans change. A detailed description of the BMPs is presented in **Appendix B, Section 5**.
- USFWS recommended that USACE work with Freeport Harbor Channel tenants and operators to BU dredged material. USACE has no direct relationship with the Port Freeport tenants or operators, and thus cannot fully adopt this recommendation. However, USACE will encourage Port Freeport to work with tenants and operators to beneficially use dredged material where feasible. USFWS recommended that USACE test all new work and maintenance material for contaminants, and to properly dispose of contaminated sediments should they be identified. This recommendation will be partially adopted by USACE. Testing of Dow Thumb bench sediments has found no significant contamination and the HTRW assessment of the project area has determined that the Recommended Plan project area is unlikely to contain contaminated sediments. Therefore, further sediment testing of dredged material is not currently planned. Further testing would be conducted if determined necessary during PED. Should contaminated materials be identified during PED or construction, those materials would be placed in an approved landfill site in accordance with applicable regulations. Maintenance material is tested for contaminants, and results are coordinated with EPA.
- USACE could not adopt USFWS' two recommendations.
 - USFWS recommends that USACE adopt a standard policy to use 75 percent of maintenance and new work material beneficially, and to include the BU of the dredge material in the Recommended Plan. Adoption of a standard policy regarding the BU of new work and maintenance material is beyond the purview of this study. However, in accordance with existing policy and guidance, USACE has reviewed the potential for BU of the limited quantity of new work material that will be generated by construction of the Recommended Plan; the amount of additional maintenance material associated with the Recommended Plan is negligible. Limited opportunities for BU exist in close proximity to the project area. Evaluation of the nearest potential BU area, a degraded marsh that could be restored with new work material from the Recommended Plan, determined that the least-cost disposal option would be the proposed upland site, PA1. Therefore, the BU option was not included in the Recommended Plan.
 - USFWS recommended that USACE create a nesting bird island at a suitable site, located in bays several miles from the project area. Construction of a bird island as part of this project could only be accomplished as mitigation as the study authorization does not include ecosystem restoration. The USACE environmental

impact analysis has determined that the project would result in no wildlife impacts requiring mitigation, and USFWS has concurred in this determination. Thus, construction of a bird island in conjunction with the Recommended Plan is not required nor is it authorized.

7.8 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 FHC. Inflow from the Gulf of Mexico would continue to dominate water quality in the study area.

Water Quality

No new construction or maintenance would occur in the project area under the No Action Alternative. Only the periodic maintenance dredging and dredged material placement already performed for the FHC System occurring over the next 50 years, and the temporary and localized effects due to increases in turbidity associated with those actions, would continue. Therefore no new temporary or localized effects would occur.

Dredging activities proposed in the Recommended Plan would result in minimal impacts and are not expected to significantly degrade the short-term or long-term water quality in the FHC. These effects would be consistent with those that are occurring during the normal maintenance dredging operations discussed previously under the FWOP. Temperature, salinity, turbidity, and density distribution patterns would temporarily be affected as a result of water column mixing during dredging and placement activities. These patterns would return to their previous baseline condition following completion of dredging. Any impacts to the distribution patterns for these water quality parameters from dredging would be minimal.

Short-term changes in DO, nutrients, and contaminant levels could occur due to mixing and disturbance of sediments into the water column during dredging and dredged material placement. Temporary decreases in DO concentration could occur during and immediately after dredging activities due to the movement of anoxic water and sediments through the water column. Temporary DO decreases could occur due to short-term increases in organic material in the water column, and the associated aerobic decomposition. These minimal impacts would be expected to be limited to the immediate vicinity of dredging and dredged material placement activities. Once the dredging activities stop, disturbed material would settle, and DO, nutrient, and contaminant concentrations would return to pre-disturbance levels. These impacts would be minimal and similar to impacts occurring during the periodic maintenance dredge activity and placement that

currently takes place in FHC. Therefore, temporary effects are expected from dredging due to short-term changes in DO, nutrients, and contaminant levels.

Dredging could cause short-term increases in turbidity. However, numerous studies indicate that dredge-induced turbidity plumes are typically localized, and spread less than a thousand meters from their sources and dissipate to ambient water quality within several hours after dredging is completed (Higgins et al., 2004). The vast majority of re-suspended sediments resettle close to the dredge within an hour (Anchor Environmental CA L.P., 2003). The anticipated dredging technique for the Recommended Plan would be hydraulic cutterhead dredging, which generally produces small plumes that rapidly decay (Reine et al, 2002). Atkins conducted baseline, 1-month post-disposal, and 6-month post disposal monitoring and testing at the ODMDS in 2015. The results of the monitoring surveys performed at 1 month (Atkins, 2016a) and 6 months following the disposal of the Freeport Harbor new work material at the offshore new work ODMDS did not indicate any adverse effects of the material on the benthic habitat in comparison with the baseline survey performed in October 2014 (Atkins, 2016b) prior to placement of dredged material (Atkins, 2016c). Properly operated dredges can confine elevated suspended bottom sediments to several hundred meters from the cutterhead with levels dissipating exponentially towards the surface with little turbidity actually reaching surface waters, and in many cases, at concentrations no greater than those generated by commercial shipping operations or during severe storms (Higgins et al., 2004). Therefore, only temporary, minor effects are expected from dredging activities due to increased turbidity.

Sediment Quality

Under the No Action Alternative, no new construction or maintenance would occur within the project area. Therefore, sediment quality would remain as described in **Section 2.3.7** of this GRR and the 2012 FEIS.

According to the 2012 FEIS, sediment within the project area in the FHC is not contaminated. Therefore, material dredged as a result of the Recommended Plan and normal FHC maintenance is safe for placement in existing upland placement area, PA 1 and the maintenance ODMDS. Impacts to sediment quality as a result of the Recommended Plan are anticipated to be temporary and negligible.

7.9 Air Quality Impacts

No new dredging construction emission sources are associated with the No Action Alternative. However, it is anticipated that air contaminants in the project area would increase due to 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.

The emission sources for the Recommended Plan would consist of marine and land-based mobile sources that would be utilized as scheduled for construction. Marine emission sources would likely include a 30-inch hydraulic cutterhead dredge, a 250-ton crane with a vibratory driver for setting sheet piles, and support equipment such as tugboats, a spill barge, and crew boats. The land based emission sources would include off-road equipment utilized for constructing levees and placing dredged material in the placement sites, and on-road vehicles for employees commuting to and from the work site. The marine emission sources and off-road equipment would consist primarily of diesel-powered engines. The on-road employee vehicles would consist primarily of gas-powered vehicles.

The Recommended Plan has been evaluated in terms of the relevant direct and indirect emissions associated with emissions from dredging, setting sheet pile walls for the stability wall (expected to be implemented under Section 408), support equipment, land-based construction equipment used in the placement of dredged material, and employee vehicles used to commute to and from the work sites. More information on the methods used for estimating air contaminant emissions and calculations is included in the report Draft General Conformity Determination, Freeport Harbor Channel Bend Easing Project, dated July 2016 (Appendix J).

The schedule for construction of the Recommended Plan is currently projected to commence early in 2019, and is projected to be completed within that calendar year. A summary of estimated NO_x and VOC emissions resulting from the activities associated with the Recommended Plan is shown in **Table 7-1**.

Table 7-1 - Summary of Estimated NO_x and VOC Emissions

Activity	NO _x Emissions ^a	Recommended Plan VOC Emissions ^a
Sheet Pile Placement ^b and Dredging	106.83	1.41
Land Side Dredged Material Placement	8.07	0.76
Employee Commuter Vehicles	0.42	0.43
Total	115.31	2.61

^a Emissions in tons per year

^b Implementation of sheet pile placement is expected to occur under Section 408

Based on the evaluation, it was determined that a General Conformity Determination for NO_x emissions would be required for the Recommended Plan as emissions of NO_x are estimated to exceed the 25 tons per year applicability threshold. Emissions of VOC for the construction activities for the Recommended Plan are exempt from a General Conformity Determination because they are below the 25 tons per year applicability threshold. The General Conformity Determination was conducted pursuant to the Clean Air Act, Section 176(c)(1), to document that emissions that would result from construction of the Recommended Plan are in conformity with the State Implementation Plan for the HGB ozone nonattainment area.

There would be temporary impacts to air quality during construction of the Recommended Plan. Dredge barges and construction equipment would temporarily increase emissions as described in **Table 7-1**. These emissions might impact recreational and commercial boaters in the project area during construction. Therefore, impacts to air quality as a result of the Recommended Plan are anticipated to be temporary and negligible. Estimated GHG emissions from construction activities during a portion of 2019 for the Recommended Plan were estimated as shown in the project emission-calculation tables associated with the **General Conformity Determination in Appendix I**. The total greenhouse gas emissions from the bend-easing marine and land-based construction activities are estimated to be 9,163 metric tons per year of CO₂e.

7.10 Noise

Potential noise impacts would be similar for both the No Action Alternative and Recommended Plan. Noise sensitive receptors would be limited to recreational boaters in the project area. No permanent noise sources would be installed as part of the Recommended Plan. The Recommended Plan would create short-term noise level increases similar to increases during maintenance dredging for the existing project. Therefore, impacts to noise as a result of the Recommended Plan are anticipated to be temporary and negligible. The noise of equipment and increased human activity during dredging activities may disturb some local wildlife, particularly birds, especially during the breeding season. Such impacts would be temporary and not likely have significant long-term implications. Furthermore, noise and artificial lighting impacts related to proposed activities would have minimal additive effects, given the current environment is affected by a number of transportation-related (e.g., barges, railway, roadway) and heavy industrial activities.

7.11 Hazardous, Toxic and Radioactive Waste Impacts

Potential HTRW impacts would be similar for both the No Action Alternative and Recommended Plan. According to a review of reasonably accessible regulatory database findings conducted for the 2012 FEIS and the 2015 draft report for the S2G feasibility study (USACE 2015), there are no concerns with the placement of sediments within PA 1 and the maintenance ODMDS. Therefore, no adverse impacts from HTRW are anticipated under the No Action or as a result of the

Recommended Plan. In addition, based on recent sediment and surface water chemical analysis (USACE, 2016a), constituents exceeding regulatory thresholds in the FHC channel at the Dow Thumb are considered to be negligible and would result in no adverse environmental impacts during routine maintenance or during the dredging and upland confined placement described in the Recommended Plan.

7.12 Cultural Resources Impacts

Impacts to cultural resources would be similar for both the No Action Alternative and the Recommended Plan. The activities associated with the Recommended Plan are limited to the channel widening, bend easing, and construction of the turning notch at the Dow Thumb, construction of the stability wall (expected to be implemented under Section 408), and the placement of dredged material from construction within existing PA1 and from maintenance in ODMDS 1A. Investigations for both terrestrial and marine cultural resources were performed for the project area as part of the 2012 FEIS. Information from this investigation has been compiled and evaluated to determine potential impacts to historic properties. All areas to be impacted by the Recommended Plan have been covered by these surveys. Based on the disturbed nature of the terrestrial and marine portions of the project area and the absence of historic properties within the project area, no impacts are anticipated to historic properties as a result of the No Action Alternative or the Recommended Plan. As a result, no coordination with the SHPO is necessary.

7.13 Energy and Mineral Resources Impacts

Impacts to energy and mineral resources would be similar for both the No Action Alternative and the Recommended Plan. According to the RCT's public GIS viewer (2016), energy resources identified within the project area include one active pipeline and one abandoned pipeline located adjacent to the bend easing. Enterprise Products identified a pipeline corridor that may be affected by the Recommended Plan. Preliminary determinations indicate that the Recommended Plan would not affect these pipelines. However, potential impacts will be reevaluated during PED to ensure that impacts are avoided or minimized to the greatest extent possible. Maintenance dredging of the existing FHC and the placement of dredged materials at the ODMDS would continue under the No Action Alternative and Recommended Plan, which would not impact any known energy and/or mineral resources other than impacts from the current status quo.

7.14 Socioeconomic Impacts

Under the No Action Alternative, the proposed corrective actions would not be implemented; therefore, improvements to vessel safety and mobility within the channel would not be improved. The FHCIP would still be constructed; however, it would not improve the FHC enough to allow the larger containment vessels to reach the Velasco Terminal. Brazoria County would continue to

have similar population and socioeconomic trends; however, if the dimensions of the channel are not enlarged to accommodate larger vessels then potential economic benefits of increased container traffic may not be realized.

Minimal negative impacts are expected to the human environment because all work would be located in the existing channel except for a small, uninhabited portion for the bend easing which would impact the undeveloped shoreline. Population increases in Brazoria County are driven primarily by the development of the petrochemical industry. The Recommended Plan would likely have a negligible effect on population growth trends within surrounding cities, and counties, which are located near the project area. As a result of the Recommended Plan, a small temporary increase in jobs in the region and therefore an economic benefit, associated with construction would be expected, and a small permanent increase associated with container ships and terminal traffic would be expected. No impacts would be expected as a result of maintenance dredging events over the 50-year period of analysis.

7.14.1 Environmental Justice

Under the No-Action Alternative, there would be no direct impact to EJ populations. The Recommended Plan would not be expected to adversely affect any EJ communities because there are none located in the project area. Potential benefits would include the creation of jobs in the regional economy.

7.14.2 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. 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 Recommended Plan. Therefore, children in the project area would not likely experience any adverse effects from the Recommended Plan.

7.15 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.

7.15.1 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. The 2012 EIS Cumulative Impact analysis included the past, present and reasonably foreseeable actions in the project area. Only actions not covered by the 2012 EIS are described in this analysis, but the cumulative analysis includes all projects described by the 2012 EIS and this document. In addition to the previous work in the FHC there are three specific actions and various state highway improvements that are considered in this cumulative impacts analysis: recent construction of the Freeport LPG Export Terminal, and potential improvements to the Freeport HFPP and Port Freeport Velasco Terminal.

7.15.1.1 Past and Present Actions

Freeport Harbor Channel Project

The existing Freeport Harbor Project was authorized by the 1950, 1958, and 1970 RHAs. The 1950 and 1958 RHA provided for an Entrance Channel (comprised of the Outer Bar and Jetty channels) of 38-foot depth and 300-foot width from the Gulf to inside the jetties, and for interior channels of 36-foot depth and 200-foot width up to and including the Upper Turning Basin. The 1970 RHA authorized the relocation and deepening of the Jetty Channel to a 45-foot depth (MLT) and 400-foot width and the Outer Bar Channel to a 47-foot depth (MLT) and 400-foot width, with an extension of approximately 4.6 miles into the Gulf. Construction of the project was completed in 1993, which generally deepened and widened the previously authorized project from the 1950s. The project authorized under WRRDA 2014 would modify the 45-Foot Project; however, it has not yet been constructed. It is anticipated that construction would occur after construction of the GRR Modifications. A Chief of Engineers Report was signed on January 7, 2013. A ROD was signed by the ASA (CW) on May 31, 2014.

Freeport Liquefied Petroleum Gas Export Terminal

Improvements to the Phillips 66 Berth 2 have recently been completed in the project area, between the proposed bend easing, and notch locations on the west side of the channel. Improvements to this berth are related to the Freeport LPG Export Terminal that started operations in December 2016 (Butane-Propane News, 2016; Phillips66, 2016). The facility is located on the site of the existing Phillips crude import marine terminal in Freeport and utilizes existing Phillips midstream,

transportation, and storage infrastructure. Export terminal infrastructure includes a 550,000-bbl refrigerated propane tank, LPG salt dome storage, and four refrigeration trains. There are two new LPG-ship-capable loading docks and two loading arms per dock.

7.15.1.2 Reasonably Foreseeable Actions

Improvements to the Freeport HFPP

Improvements to the Freeport HFPP have been recommended by USACE in the S2G Draft Integrated Feasibility Report and Environmental Impact Statement, which was submitted for concurrent public, policy, ATR, and independent external peer review in September 2015. The Chief's Report is in process. The study proposes overall modifications to the Freeport HFPP, including modifications to the Old River North Levee located in Reach 2, adjacent to channel widening at the Dow Thumb and the associated stability wall. The existing levee in the project area would be raised to provide an increased level of flood risk management.

Port Freeport Velasco Terminal Improvements

The 2012 EIS described Phase I improvements at the Velasco Terminal. Freeport has overall plans for improvements at Velasco Terminal that are being implemented in phases. Phase I is complete and includes deepening at Berth 7. Port Freeport has also recently installed two new container cranes. Currently, 26 acres are concrete paved at this terminal, but with the planned development the developed area will increase to about 90 operational acres. Port Freeport has plans to install an additional 5 Post-Panamax Gantry Cranes to expedite the cargo operations for the larger ships that will be arriving (Port Freeport, 2016).

Various Roadway Improvement Projects

Several roadway improvement projects are planned for the area including the SH 36 expansion to four lanes from U.S. Highway (US) 59 to farm-to-market road (FM) 1495 in Freeport planned for letting in FY 2018. The Texas Department of Transportation (TxDOT) is also proposing to replace the FM 1495 bridge and approaches over the FHC and construct a bridge on SH 332 over FM 1495 both to let by FY 2018. There is also a proposed project letting in 2018 to replace the concrete pavement on SH 288 to begin the first quarter of 2017 (TxDOT, 2016a).

7.15.2 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:

- air quality;
- water quality;
- biological communities; and
- EFH

7.15.2.1 Air Quality

The study area is located within a severe nonattainment area for ozone. As described in the 2012 FEIS, new work dredging activities associated with the Recommended Plan are expected to exceed the NO_x conformity threshold of 25 tons per year. A General Conformity Determination was prepared by the USACE (**Appendix J**). The NO_x 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 Panamax fleet is projected to result in a small decrease in vessel trips, which would result in a small decrease in air contaminant emissions. The reasonably foreseeable projects identified may also impact air quality. The improvements to Port Freeport and the Velasco Terminal may increase vessel traffic in the FHC. However, the vessels would be larger, more efficient vessels as part of the Recommended Plan; therefore, no cumulative impacts to air quality are anticipated.

7.15.2.2 Greenhouse Gas

Air emissions from the operation of internal combustion engines that produce exhaust result in GHG emissions that could contribute to global climate change. The CEQ published "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews", August 1, 2016 (CEQ, 2016). The CEQ guidance was rescinded in Executive Order 13783 on March 28, 2017. However, greenhouse gas emission estimates are provided in this document for information. All emissions would come from individual mobile internal combustion engines in on-road and non-road equipment, and it is likely that the total GHG emissions from mobile sources for all the present and reasonably foreseeable projects would exceed 25,000 metric tons per year of CO₂e when considered cumulatively. Estimated GHG emissions from construction activities during a portion of 2019 for the Recommended Plan were estimated as shown in the project emission-calculation tables associated with the **General Conformity Determination in Appendix J**. The total greenhouse gas emissions from the bend-easing marine and land-based construction activities are estimated to be 9,163 metric tons per year of CO₂e.

7.15.2.3 Water Quality

The historical and most recent testing data for the Recommended Plan project 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 due to turbidity, 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.

7.15.2.4 Biological Communities

7.15.2.4.1 Terrestrial

Approximately 16.4 acres up upland would be removed to create the bend easing that is part of the Recommended Plan. An additional 130 acres of uplands would be developed as part of the Velasco terminal expansion plans. Approximately 795 acres of additional ROW would be required for the SH 36 project (TxDOT, 2016b) and minor ROW additions would be required for the other road projects. The TxDOT and Velasco Terminal projects would occur without the proposed project. Therefore, the Recommended Plan would convert 16.4 acres of uplands into open water habitat. The Recommended Plan impacts to upland would not be significantly cumulative when considered with the other past, present, and reasonably foreseeable projects.

7.15.2.4.2 Aquatic

Approximately 25.7 acres of existing aquatic habitat in the FHC would be directly impacted during construction for the bend easing, channel widening, and turning notch. Aquatic organisms in the area would be impacted by short-term increases in turbidity, excavation of the channel bottom, and dredged material placement. Direct aquatic impacts to jurisdictional streams, wetlands, and ponds by the Velasco Terminal expansion, and TxDOT roadway projects would be covered by Section 404 nationwide or individual permits. No wetland or other aquatic habitat impacts have been identified for improvements to the Freeport HFPP (USACE, 2015).

The primary effects to bays and deep-water habitats in the Recommended Plan project area would be to benthos. Organisms present on water bottoms are affected by dredging and placement of dredged materials. Past and present actions and reasonably foreseeable future actions in the study area would result in 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 the ODMDs buries and temporarily smothers benthic organisms within those areas. With the exception of the existing FHC project, none of the other past or present projects evaluated here utilize the ODMDs. Recommended Plan impacts associated with use of PA 1 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 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.

7.15.2.5 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 and potential projects 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.

7.15.3 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 FHC, including the Recommended Plan impacts, are part of the continuing port and shipping industry development. Impacts associated with the Recommended Plan would be temporary and minor, requiring no compensatory mitigation. With compliance to environmental regulations and use of BMPs during construction, 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

ER-1105-2-100 (Page E-62) states under 2(a) Harbors, General Navigation Features, Section 101 specifies cost shares for general navigation features (GNF) 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). For GNF features not changing depths, such as breakwaters, locks, channel widening, etc., cost sharing shall be at the percentage applicable to the authorized or existing depth, whichever is greater. The percentage also applies to mitigation and other work cost shared the same as GNF. 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 GNF. This may be paid over a period not to exceed thirty years, and LERRDs acquired for this project may be credited against it. The Water Infrastructure Improvements for the Nation Act of 2016, Section 1111 (WIIN Act) modifies the cost share percentages for new work, originally stated in WRDA 1986.

The Recommended Plan for the modifications includes mobilization (mob/demob) costs. See **Table 8-1** for General Cost Allocation breakout.

Table 8-1 - General Cost Allocation

Feature	Federal Cost % ¹	Non-Federal Cost % ¹
General Navigation Features (GNF) ²	<ul style="list-style-type: none"> ●90% from 0 feet to 20 feet ●75% from 20 feet to 50 feet ●50% for greater than 50 feet 	<ul style="list-style-type: none"> ●10% from 0 feet to 20 feet ●25% from 20 feet to 50 feet ●50% for greater than 50 feet
Mitigation ³	●Averages 65%, based on GNF	●Averages 35%, based on GNF
Navigation Aids	●100% USCG	●0%
Operation and Maintenance		
GNF	●100% except incremental costs are shared at 50% above 50 feet operation for maintenance > 50 feet	●0% except incremental costs are shared 50% cost for maintenance > 50 feet

¹ The non-Federal sponsor shall pay an additional 10 percent of the costs of GNF over a period of 30 years, at an interest rate determined pursuant to Section 106 of WRDA 86. The value of LERRD acquired for this project shall be credited toward the additional 10 percent payment.

² WIIN Act (2016) modified new work cost share percentages originally stated in WRDA 1986.

³ The mitigation cost share for the project authorized under WRRDA 2014 was prorated to reflect 40 percent of original PA on an acreage basis. The cost share is calculated based upon the weighted cost share of the channel reaches placed into PA 8 and their depth within the dredging prism.

8.2 Cost for the Recommended Plan

The Total Project Cost Summary (TPCS) for the design and construction of the Recommended Plan was certified on March 16, 2018, at October 1, 2017 price levels (see **Appendix B**). As previously shown in **Table 6-4**, the Project First Cost (Constant Dollar Cost at current price level) of the Recommended Plan is \$38,499,000. The Total Project Cost or Fully Funded Cost (Constant Dollar Cost fully funded with escalation to the estimated midpoint of construction) is \$41,183,000.

The costs for the Recommended Plan include the construction of the channel widening to 400-feet, bend easing, and the turning notch, LERR, PED, and construction management (E&D and S&A). Associated costs are not part of the recommended Federal project but are a necessary non-Federal responsibility. These costs are not included within the Project First Costs; however, they are an economic cost used in determining the BCR. The costs for the HFPP modifications (stability wall and re-designation of the wave barrier) expected to be implemented under Section 408 prior to construction of the Recommended Plan are associated costs. Non-Federal costs include pipeline relocations and modifications to the HFPP. The Recommended Plan does not require any relocations, berthing/dock owner costs. Additionally, the Recommended Plan will not require installation of new or modification of any aids to navigation.

As a reminder, an economic update for the authorized project has been conducted concurrent with the GRR investigations to determine the modification necessary to enable the Panamax design vessel to transit safely to and from the Velasco Container Terminal. Costs for the full project with the GRR modifications are included in **Section 9, Economic Update**.

8.3 Cost-Sharing Apportionment

The project cost for determining the cost-sharing requirements is based on the Project First cost. The Project First cost for all project components is separated into expected non-Federal and Federal cost shares and detailed in **Table 8-2**.

Table 8-2 – Project First Cost Allocation for Recommended Plan to 46-feet (\$000)

Cost Account	Project Features	Federal	Non-Federal	Total
		<i>(Oct 2017 Price Level)</i>		
General Navigation Features (GNF)				
12	Navigation, Ports & Harbors – Deep Draft ¹	\$24,353	\$8,118	\$32,471
16	Bank Stabilization ¹	\$1,125	\$375	\$1,500
Total GNF Costs		\$25,478	\$8,493	\$33,970
LERR (100% Non-Federal Cost)				
01	Lands and Damages	\$0	\$4,529	\$4,529
LERR Cost (100% Non-Federal Cost)		\$0	\$4,529	\$4,529
Total Project First Cost		\$25,478	\$13,022	\$38,499
Associated Non-Federal Costs				
11	Levees & Floodwalls (HFPP Modifications) ²	\$0	\$14,000	\$14,000
12	Berth 7 Improvement (dock & dredging)	\$0	\$20,462	\$20,462
Total Associated Non-Federal Costs		\$0	\$34,462	\$34,462
Project First Cost plus Associated Costs		\$25,478	\$47,484	\$72,961

¹Costs include PED and Construction Management totals

²Implementation of HFPP modifications expected to occur under Section 408 (100% non-Federal cost)

8.4 Non-Federal Sponsor PED Efforts Conducted Concurrent with Study

Most PED activities of the project authorized in WRRDA 2014 are on hold until the GRR is approved; however, some PED efforts for a portion of the “Lower Stauffer Channel” will be performed by the local sponsor under a Memorandum of Understanding (MOU) concurrent to the development of the GRR. The MOU will allow Port Freeport to receive credit against the non-Federal share of the Federal project, provided the work accomplished is integral to the Federal project. Approval to allow execution of the MOU with Port Freeport to construct the Lower Stauffer Channel prior to the public release of the draft GRR was obtained from the ASA (CW) on October 8, 2015. The work to be conducted under the MOU involves dredging a portion of the Lower Stauffer Channel to 46 feet MLLW. Note the Lower Stauffer Channel is authorized to 51 feet MLLW under WRRDA 2014.

The proposed WIK will be evaluated per the requirements of ER 1165-2-208, *In-Kind Contribution Credit Provisions of Section 221 of the Flood Control Act of 1970, as Amended*, dated 17 February 2012, and an integral determination made on what materials and/or service provided by the NFS is integral to the study. To be integral to the study or project, the material or service must be part of the work that the Federal Government would otherwise have undertaken for the study or for construction of what is ultimately determined to be the Federal project.

8.5 Policy Decision - Authorities Required to Construct Features

8.5.1 Authorities Required to Modify Features

The USACE may implement the proposed channel widening, bend easing, and turning notch expansion pursuant to the Chief of Engineers’ discretionary authority and statutory authority contained in 33 U.S.C. 562. However, any modifications to another Federal Project, such as the HFPP, would require either congressional authorization or a Section 408 approval. Additionally, a modification for which a Section 408 approval is sought would be constructed by the NFS at 100-percent non-Federal expense. **Table 8-3** differentiates which features would be allowed under the discretionary authority of the WRRDA 2014 authorization and which would features would require congressional authorization or Section 408 approval.

Section 408 of Title 33 of the U.S. Code (33 U.S.C. 408) generally requires non-Federal entities to obtain permission from the Secretary of the Army to alter or modify existing USACE projects. The Secretary of the Army has delegated this approval authority to the USACE Chief of Engineers.

Table 8-3 – Authority Required per Feature (and Resulting Modifications)

Feature	Work Resulting from Construction	Alteration to	Authority Required
Channel Widening	Insert Stability Wall to mitigate reduced FOS of Levee	Old River North Levee	•Congress, or •Section 408
	Dredge out Underwater Berm	Underwater Berm	¹
	Channel Widening to 400 feet at Dow Thumb (Reach 2)	WRRDA 2014	•Discretionary; 33 U.S.C. 562
Bend Easing	Relocate Wave Barrier	North Wave Barrier	•Congress, or •Section 408
	Dredge/Excavate Bend Easing once Wave Barrier Relocated/Re-designated	WRRDA 2014	•Discretionary; 33 U.S.C. 562
Turning Notch	Dredge Turning Notch Adjacent to Upper Turning Basin	WRRDA 2014	•Discretionary; 33 U.S.C. 562

¹ From a geotechnical stability perspective, the underwater berm is considered a component of the HFPP Old River North Levee; however, when the levee was constructed/accepted into the Federal Project it was the natural ground adjacent to the levee toe.

This FIGRR-EA represents the complete plan to achieve an implementable solution. The NFS is currently pursuing approval to construct modifications the HFPP under Section 408, at 100 percent non-Federal cost. The NFS has stated they do not intend to request reimbursement for said HFPP modification costs. HFPP modifications must be completed prior to construction of the channel widening or bend easing features.

8.6 Changes in Project Purpose

There have been no changes in project purpose.

8.7 Changes in Local Cooperation Requirements

There have been no changes to the Local Cooperation Requirements.

8.8 Changes in Location of Project

There have been no changes in the location of the project.

8.9 Changes in Scope of Authorized Project

ER 1105-2-100 states the following: “*Changes in scope are increases or decreases in the outputs for the authorized purposes of a project. Outputs are the projects physical effects which (usually) have associated benefits (hence, project purpose).*” The following are changes in scope for the overall project.

8.9.1 Removal of Future PA 9 from the 2012 Feasibility Report DMMP

The placement plan for the authorized project included the future construction of PA 9 on a land tract that was under use as pasture. The site is located northwest of the FHC, west of the Brazos River Diversion Channel, and north of the SH 36. The NFS no longer owns the tract in fee.

The DMMP coordinated during the Feasibility study has been updated and the following assumptions verified to determine the least cost placement plan.

- Proposed PA 8 has sufficient capacity to contain all new work material from the construction of the authorized project that was designated to go to PA 8 and PA 9.
- All maintenance material for the authorized project would go offshore to the ODMDS 1A as is current O&M practice. This has been demonstrated to be the least cost placement plan.

8.9.2 Reduction of Environmental Mitigation Associated with Future PA 9

Per the 2012 Feasibility Report, the construction of PA 9 would result in impacts to 16 acres of ephemeral freshwater wetlands, and impacts to 21 acres of riparian forest. These impacts would no longer occur and mitigation for the project would be reduced significantly, as more than half of wetland impacts for the entire authorized project were associated with this proposed PA.

All historic property impacts associated with the 2012 Feasibility Report were associated with development of proposed PA 9; elimination of this feature avoids all historic property impacts.

8.10 Design Changes

The only design changes associated with the authorized project would be those proposed under the reevaluation; the navigation features proposed under the Recommended Plan. The Recommended Plan would consist of increasing the existing width of FHC in Reach 2 to 400 feet and thus eliminating the constriction in the channel around Dow Thumb, providing a bend easing, and providing a turning notch at the Upper Turning Basin, all to 46 feet deep. These features are necessary to allow the Panamax design vessel for Reach 3, to transit around the Dow Thumb, to and from the Velasco Container Terminal.

Widening of the FHC around the Dow Thumb would require: 1) insertion of a stability wall into the terrestrial portion of the Dow Thumb at the waterside toe of the HFPP levee, and 2) the removal of the underwater berm along the toe of the levee. The construction of the bend easing would require: 1) the re-designation of the west portion of the North Wave Barrier to the Old Quintana Road, and 2) the dredging of the bend easing. The NFS intends to implement re-designation of the wave barrier and construction of the stability feature under Section 408 at 100 percent non-Federal cost. Without these modifications to the authorized project, the Panamax design vessel will not be able to transit efficiently and safely to the Velasco Container Terminal and the benefits associated with Reach 3 would not be accrued as intended by Congress.

8.11 Comparison of the 2012 Feasibility Report DMMP and Revised DMMP

The 2012 Feasibility Report included a 50-year DMMP. Since the project's authorization, one of the two PAs (PA 9) that was slated for future construction and use for dredged material placement is no longer available for the authorized project. Therefore, a new placement plan was developed to establish adequate 50-year placement for the Federal project authorized in WRRDA 2014. The quantities from the Recommended Plan are included in the revised DMMP.

8.11.1 New Work Placement Comparison

Table 8-4 provides the new work placement plan for the 2012 Feasibility Report as authorized and a revised placement plan with new work material originally designated for placement in PA 9 now being placed into PA 8. Recommended Plan new work quantities (GRR Features) have been included in the revised new work placement plan. All new work material for the GRR features is designated for placement into PA 1. Capacity analysis for PA 1 included the Lower Stauffer WIK quantity of 270,000 cy at the NFS request due to proximity. However, all Lower Stauffer new work material (inclusive of the new work to be dredged as WIK) was designated for placement into PA 8 for the WRRDA 2014 project. As such, capacity for the WIK is available in either PA 1 or PA 8.

Table 8-4 – Comparison of New Work Placement Plans (Authorized and Revised)

Channel Reach	Begin Station	End Station	2012 Feasibility Report New Work Placement Plan		Revised New Work Placement Plan with Recommended Plan quantities	
			Volume (CY)	PA	Volume (CY)	PA
Extension Future	-370+00	-300+00	795,000	ODMDS 1	795,000	ODMDS 1
Outer Bar	-300+00	0+00	8,290,000	ODMDS 1	7,980,628	ODMDS 1
Jetty Reach	0+00	71+52	648,000	ODMDS 1	1,979,697	ODMDS 1
Lower Turning Basin	71+52	78+52	208,000	PA 8	101,945	PA 8
Channel to Brazosport and Turning Basin	78+52	115+00	1,716,000	PA 8/ PA 9	1,072,777	PA 8
Channel from Brazosport Turning Basin	115+00	132+66	391,000	PA 9	160,117	PA 8
Channel to Upper Turning Basin and Upper Turning Basin	132+66	184+20	490,000	PA 9	1,087,630	PA 8
Lower Stauffer Channel*	184+20	222+00	1,387,000	PA 9	1,538,065	PA 8
Upper Stauffer Channel	222+00	260+00	427,000	PA 9	574,560	PA 8
GRR Features	142+00	185+00	0	--	1,734,000	PA 1
TOTALS			14,352,000		17,024,419	

*Note that for the PA capacity analysis involving the WIK volume of 270,000 cy new work placement capacity exists within either PA 8 (shown in this table) or PA 1 (as shown in Table 6-1). The analysis included PA 1 at the NFS request due to proximity.

8.11.2 Maintenance Placement Comparison

The **Table 8-5** provides a comparison of the maintenance plan in the 2012 Feasibility Report and the modified maintenance placement plan to account for the loss of PA 9 and the addition of the Recommended Plan maintenance volumes.

Table 8-5 – Comparison Maintenance Volumes Totals for 50 Years (WRRDA 2014 and GRR)

Channel Reach	Begin Station	End Station	2012 Feasibility Report Maintenance Plan		Revised Maintenance Plan with Recommended Plan quantities	
			Volume (CY)	PA	Volume (CY)	PA
Channel Extension and Jetty Channel	-370+00	78+52	159,416,960	ODMDS 1A	159,416,960	ODMDS 1A
Lower Turning Basin to Brazosport Turning Basin	78+52	123+40	7,529,640	PA 1 (1,817,240) PA 8 (5,712,400)	7,529,640	ODMDS 1A
Brazosport Turning Basin to Stauffer Channel	123+40	260+00	8,993,130	PA 9	8,993,130	ODMDS 1A
GRR Features	142+00	185+00	0	-	1,885,400	ODMDS 1A
TOTALS			175,939,730		177,825,130	

A 50-year maintenance cost comparison of offshore placement (with use of a hopper dredge) vs upland placement (with use of pipeline dredge) was performed to determine the least cost plan for placement of material. The relatively small volume of maintenance material for the channel would

result in smaller bank heights of material required for dredging. When smaller bank heights (less than two feet) are encountered, hopper dredges are better suited to handle this configuration as opposed to large pipeline dredges that require deeper bank heights for improved efficiency. In addition, pipeline dredges generally incur higher mobilization/demobilization costs when compared to hopper dredges due to their slower speed of travel and larger size of crew required. Because of the factors mentioned, preliminary cost estimates indicate upland placement of material would be 42 percent more expensive when compared to offshore placement.

8.12 Views of Non-Federal Sponsor and Others

The non-Federal sponsor, Port Freeport for the existing project has actively participated in the entire planning process, including development as WIK for the Engineering Appendix and NEPA products. Their primary concern has been to provide modifications to allow for transit of the Panamax vessel to and from the Velasco Container Terminal and realize the benefits intended by Congress. The NFS fully supports the Recommended Plan.

8.13 Recommended Plan and Recent USACE Initiatives

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 goals and objectives outlined in the refreshed Campaign Plan (FY15-19, May 2015) include: 1) Support National Security; 2) Transform Civil Works; 3) Reduce Disaster Risks; and 4) Prepare for Tomorrow. This project is in support of two of the four goals for USACE contained in the latest (FY15-19, updated May 2015) USACE Campaign Plan. This plan is available at the following address: <http://www.usace.army.mil/about/campaignplan.aspx>. Specifically, this project supports Goal 2 (Transform Civil Works) and Goal 4 (Prepare for Tomorrow).

8.13.1 USACE Actions for Change as Reflected in the Campaign Plan

Specifically, this project supports the USACE Campaign Plan Goal 2 (Transform Civil Works) and Goal 4 (Prepare for Tomorrow) in the following actions.

- The study analyzed potential effects over the study area.
- Direct and indirect effects of the project on the environment were avoided to the maximum extent possible.
- Risk analysis is being conducted throughout the study.
- Project risks will be communicated during the public review of the study findings.

8.13.2 Environmental Operating Principles

The USACE Environmental Operating Principles (EOPs) were developed to ensure our missions include totally integrated sustainable environmental practices. Throughout the study process, these EOPs are considered at the same level as economic issues. Environmental consequences of construction and operation have been considered in developing the Recommended Plan, which avoids and minimizes all significant environmental impacts. Sustainability and risk management were integral considerations in developing a plan that would minimize impacts to the existing Freeport HFPP by incorporating the stability wall feature and the proposed relocation of a portion of the existing wave barrier. The Recommended Plan has been developed in consultation with stakeholders and resource agencies. Resource agency knowledge and evaluation methods developed for similar projects were applied in the impact analysis. A thorough NEPA and engineering analysis has ensured that we will meet our corporate responsibility and accountability for actions that may impact human and natural environments in the Brazoria regions. This analysis will be transparent and communicated to all individuals and groups interested in USACE activities. The seven re-energized EOP principles (July 2012) are available at the following webpage: <http://www.usace.army.mil/Missions/Environmental/Environmental-Operating-Principles/>.

9 ECONOMIC UPDATE

9.1 Economics

A separate but related effort to perform an Economic Update for the authorized project is included in the GRR documentation. The Economic Update will focus on the authorized project features and depths from the 2012 Feasibility Report, while the economic analysis for the GRR will focus on Reach 2 and 3 of the channel around the Dow Thumb. The economic update will include the selected bend easing, widening & notch (GRR recommendation), and the authorized depths from the 2012 Feasibility Report. The configurations of the Economic Update are provided below in **Figure 9-1** and **Table 9-1**. This approach requires the assumption that the maximum width at the Dow Thumb is determined at the 46-foot depth, not the 51-foot in Economic Reach 2.

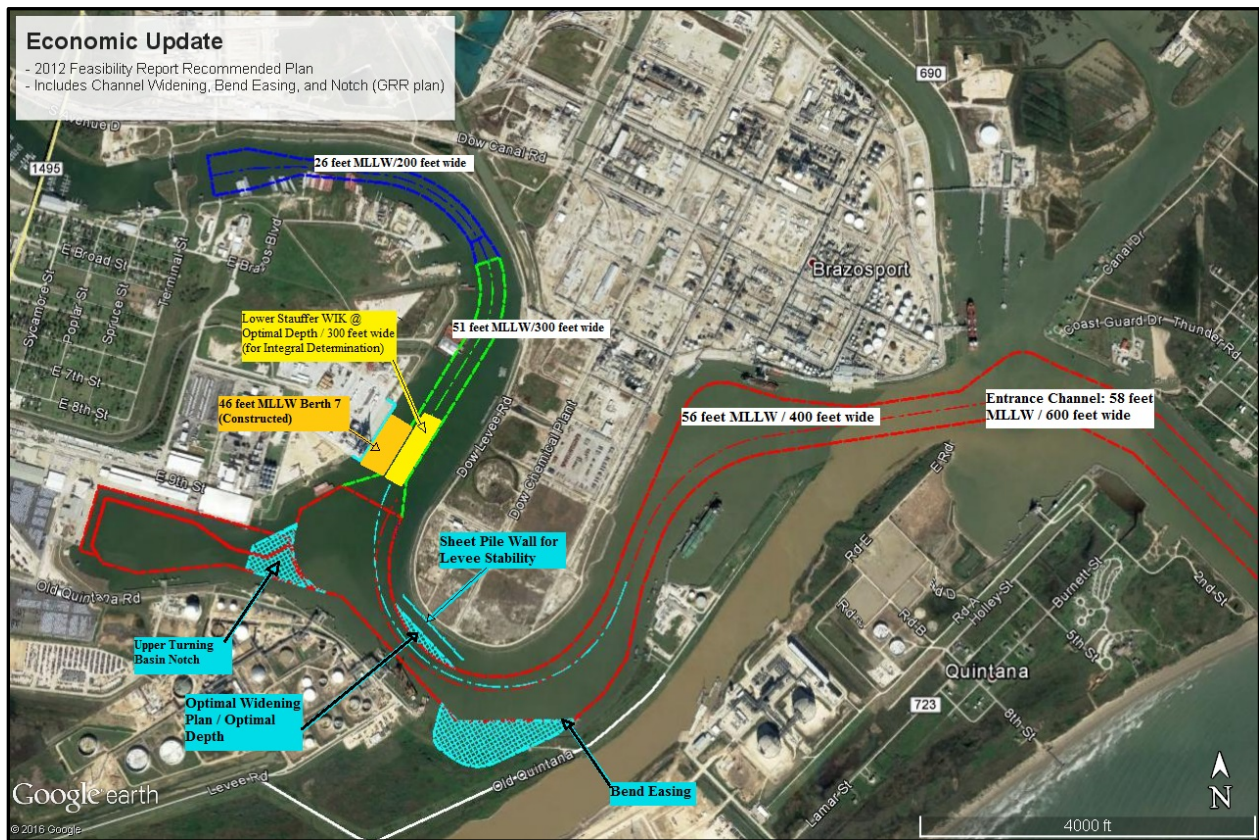


Figure 9-1. Economic Update Evaluation

Table 9-1 - Economic Update Depths and Widths

Economic Reach	Depth (MLLW)	Width (feet)
Reach 1	56	600
Reach 2	51	400
Reach 3	51	300
Reach 4	26	200

Details about the economic update can be found in the **Appendix A, Economic Appendix**. In short, containerships and Roll-on Roll-off vessels (RoRos) were included in the Recommended Plan calculations, and all deep draft benefitting traffic along the FHC were included in the economic update analysis.

9.2 Total Project First Cost Comparison

Table 9-2 provides the Project First Cost for 1) the WRRDA 2014 authorized cost at October 2013 price levels, 2) the WRRDA 2014 authorized cost updated to current price levels, and 3) the Project First Cost for the WRRDA 2014 updated costs at current prices levels with the Recommended Plan costs included.

Table 9-2 – Project First Cost Comparison Summary of WRRDA 2014 Project(\$000)

<u>Cost Account and Feature</u>	Project First Cost		
	WRRDA 2014 Authorized	WRRDA 2014 Authorized	WRRDA 2014 Updated plus GRR Recommended Plan)
	Price Levels		
	Oct 2013	Oct 2017	Oct 2017
01 Lands & Damages (100% Non-Federal)	\$1,702	\$1,843	\$6,372
06 Fish & Wildlife Facilities	\$166	\$204	\$204
12 Navigation, Ports & Harbors ¹	\$209,432	\$198,721	\$225,281
16 Bank Stabilization (GRR only)	\$0	\$0	\$1,389
30 Preconstruction Engineering & Design (PED) ²	\$18,449	\$19,817	\$23,740
31 Construction Management (E&D, S&A)	\$9,567	\$14,919	\$17,015
Project First Cost	\$239,316	\$235,504	\$274,003
Associated Costs (Other Federal and non-Federal)³			
Other Federal Costs (100% Federal)³			
12 Aids to Navigation –USCG ³	\$1,392	\$1,384	\$1,384
Associated Cost Subtotal (Other Federal Costs)²	\$1,392	\$1,384	\$1,384
Associated Costs (100% Non-Federal Cost)³			
11 Levees & Floodwalls (GRR only) ^{3,4}	\$0	\$0	\$14,000
12 Berth Improvements/Dock Dredging ³	\$58,878	\$58,028	\$58,028
Associated Cost Subtotal (Non-Federal Costs)³	\$58,878	\$58,028	\$72,028
Total Associated Costs (Other Federal and Non-Federal)³	\$60,270	\$59,412	\$73,412
Project First Cost plus Associated Costs	\$299,586	\$294,916	\$347,416

¹ Cost decreased due to changes in labor rates, fuel costs, and interest rates.

² Includes \$1,871,000 of Spent Costs (GRR & PED).

³ Associated costs that are not part of the recommended Federal project but are a necessary non-Federal responsibility.

⁴ Implementation of HFPP modifications is expected under Section 408

Note: There may be slight differences due to rounding.

9.2.1 Cost Implications of Additional Features for the WRRDA 2014 Authorization

There are cost implications to modifying the 2012 Feasibility Report. The maximum amount that a project may cost is defined in Section 902 of WRDA 1986. This is often called the 902 Limit or Project Cost Cap. “The maximum project cost limit imposed by Section 902 is a numerical value specified by law which must be computed in a legal manner (Engineer Regulation 1105-2-100 Appendix G).” The maximum project cost includes 1) the authorized cost (adjusted for inflation), 2) the current cost of any studies, modifications, and action authorized by WRDA 1986 or any later law, and 3) 20 percent of the authorized cost (without adjustment for inflation). The cost of modifications required by law is to be kept separate and added to other allowable costs. The sum of these three components equal the maximum project cost allowed by Section 902.

Table 9-3 provides the FHCIP Maximum Cost Limit by Section 902 of \$321,603,000, as established using the certified 902 tool. This demonstrates that the cost of the FHCIP plus the cost of the Recommended Plan would not exceed the 902 Limit.

Table 9-3 – FHCIP Project 902 Limit¹ (\$000)

Freeport Harbor Channel Improvement Project Maximum Cost Limit by Section 902 (October 2017 price levels, 2.75 % interest rate)	
FHCIP Authorized Cost, inflated through construction	\$295,432
Cost of modifications required by law	\$0
20 percent of authorized cost	\$47,860
FHCIP Maximum Cost Limit by Section 902	\$321,603

¹Calculations derived from Certified 902 Tool

9.3 Equivalent Annual Costs and Benefits

Table 9-4 provides a summary for this economic analysis in October 2017 dollars. The total average annual benefits of \$37,322,000 for the project exceeds the total average annual costs of \$25,855,000, yielding net benefits of \$11,467,000 and a continued justified project with a BCR of 1.44.

Table 9-4 – Equivalent Annual Benefits and Costs (\$000)

Equivalent Annual Benefits and Costs (October 2017 Price Level, 50-Year Period of Analysis, 2.75 Percent Discount Rate)	
Investment costs	
Total Project Construction Costs	\$325,084
Interest During Construction	\$12,850
Total Investment Cost	\$337,934
Average Annual Costs	
Construction Average Annual Costs	\$12,517
OMRR&R	\$13,337
Total Average Annual Costs	\$25,855
Average Annual Benefits	
Net Annual Benefits	\$11,467
Benefit-Cost Ratio	1.44

9.4 Cost Sharing Apportionment

The Cost Apportionment for the Authorized Project plus the Recommended Plan at October 2017 price levels is presented in **Table 9-5**. These costs differ from those in **Table 9-2** due to the inclusion of PED and Construction Management costs across the different channel segments.

Table 9-5 – Cost Apportionment (\$000)

Project Feature		Project First Cost		
		October 2017 Price Levels		
		Federal	Non-Federal	Total
General Navigation Features (GNF)¹				
06	PA Mitigation-Contract 8 (90/10)	\$44	\$5	\$49
06	PA Mitigation-Contract 8 (75/25)	\$297	\$99	\$395
06	PA Mitigation-Contract 8 (50/50)	\$167	\$167	\$333
12 ²	Navigation Ports & Harbors (90/10)	\$4,584	\$509	\$5,093
12 ²	Navigation Ports & Harbors (75/25)	\$68,379	\$22,793	\$91,171
12 ²	Navigation Ports & Harbors (50/50)	\$67,374	\$67,374	\$134,747
12 ²	GRR-Navigation Ports & Harbors (90/10)	\$0	\$0	\$0
12 ²	GRR-Navigation Ports & Harbors (75/25)	\$24,353	\$8,118	\$32,471
12 ²	GRR-Navigation Ports & Harbors (50/50)	\$0	\$0	\$0
16	Bank Stabilization (90/10)	\$0	\$0	\$0
16	Bank Stabilization (75/25)	\$1,125	\$375	\$1,500
16	Bank Stabilization (50/50)	\$0	\$0	\$0
Spent Costs		\$1,871	\$0	\$1,871
Total GNF Cost		\$168,192	\$99,439	\$267,631
LERR Costs				
01	Land & Damages (100% Non-Federal)	\$0	\$6,372	\$6,372
Total LERR Cost		\$0	\$6,372	\$6,372
Total Project First Cost		\$168,192	\$105,811	\$274,003
Associated Costs (Other Federal and Non-Federal)³				
Other Federal Costs³				
12	Navigation Aids (USCG) 100% Federal ³	\$1,384	\$0	\$1,384
Associated Cost Subtotal (Other Federal Costs)³		\$1,384	\$0	\$1,384
Associated Costs (100% Non-Federal Costs)³				
11	Levees and Floodwalls (HFPP Modifications) ^{3,4}	\$0	\$14,000	\$14,000
12	Associated Costs (Berthing) ³	\$0	\$58,028	\$58,028
Associated Cost Subtotal (Non-Federal Costs)³		\$0	\$72,028	\$72,028
Total Associated Costs (Other Federal and Non-Federal)		\$1,384	\$72,028	\$73,413
Project First Cost plus Associated Costs		\$169,577	\$177,839	\$347,416

¹ Costs included PED and Construction Management totals.

² The Water Infrastructure Improvements for the Nation Act (WIIN Act) dated January 4, 2017, under Section 1111, modified the cost share percentages for the new work originally stated in WRDA 1986.

³ Associated costs that are not part of the recommended Federal project but are a necessary non-Federal responsibility

⁴ Implementation for HFPP modifications expected to occur under Section 408

10 PUBLIC INVOLVEMENT AND AGENCY COORDINATION*

10.1 Coordination of the DIGRR-EA with Federal and State Agencies

The EA and a Draft Findings of No Significant Impact (FONSI) were sent to Federal and State agencies including the following:

Environmental Protection Agency Region 6
National Marine Fisheries Service
Texas Commission on Environmental Quality
Texas General Land Office
Texas Historical Commission
Texas Parks and Wildlife Department
U.S. Coast Guard
U.S. Fish and Wildlife Service
Natural Resource Conservation Service
Texas Parks and Wildlife Department
Texas Water Development Board
Texas Office of State-Federal Relations
Texas Department of Transportation

10.2 Summary of Comments

The public was afforded an opportunity to comment on the TSP during a 30-day public review of the DIGRR-EA beginning April 11, 2017. Local governments, industry and citizens submitted a total of 15 comments. All comments have been considered in preparing the final report and responses are provided in **Appendix D**. All of the commenters were supportive of the project; however four noted specific concerns that should be addressed. The Brazos Pilots Association and all local or regional government commenters support the Recommended Plan. Enterprise Products/Seaway Marine Terminal provided information on three pipelines that may be affected by construction of the Bend Easing feature. The USACE and Port Freeport will contact Enterprise Products during the PED phase when this information will be utilized to develop the final construction design. One commenter asked that potential impacts to air, water and sediment quality be clarified and another stressed that the project should not adversely affect the integrity of the existing Freeport HFPP system.

The Alabama-Coushatta Tribe of Texas and the Kiowa Tribe of Oklahoma reviewed the DIGRR-EA and noted that the project would not impact known cultural properties associated with those tribes. A total of eight Federal and state resource agencies commented on the DIGRR-EA. All of these letters and associated USACE coordination are presented in **Appendix E**. Specific comments are summarized in **Section 6.6** of this main report.

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

It is recommended that the FHCIP, authorized under WRRDA 2014, be modified generally as described in this report as the Recommended Plan, with such modifications as in the description 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 FHC from the modification and continued maintenance of a portion of the FHC.

Recommended Plan. The Project First Cost for the Recommended Plan at October 2017 price levels is \$38,499,000, which includes the cost of constructing the general navigation features and the value of LERRs estimated as follows: \$33,970,000 for channel modification and dredged material placement and \$4,529,000 for LERRs. There are no pipeline relocation costs or environmental mitigation costs associated with the Recommended Plan. The estimated Federal and non-Federal shares of the Project First cost are \$25,478,000 and \$13,022,000, respectively. The Recommended Plan includes a total of \$34,462,000 in associated costs (\$20,462,000 dock & dredging and \$14,000,000 HFPP modifications). The HFPP modifications are expected to be implemented under Section 408. The Fully Funded Cost for the Recommended Plan is \$41,183,000. The average annual benefits were calculated to be \$7,237,000 with average annual costs of \$4,155,000, and a BCR of 1.74.

Economic Update. This general reevaluation also included an economic update of the WRRDA 2014 authorized project. This economic update includes the costs of the WRRDA 2014 authorized project updated to October 2017 price levels plus the cost of the Recommended Plan. The estimated Project First Cost is \$274,003,000, which includes \$267,427,000 for channel modification and dredged material placement; \$204,000 for environmental mitigation; \$6,372,000 for LERRs (except utility relocations) provided by the non-Federal sponsor. Note there are no utility relocations for the project. The estimated Federal and non-Federal shares of the Project First Cost are \$168,192,000 and \$105,811,000, respectively.

A total \$73,413,000 in associated cost are comprised of the following breakout: \$1,384,000 for Navigation Aids (100 percent Federal cost); \$14,000,000 (100 percent non-Federal costs) for the HFPP modifications to be implemented under Section 408 prior to construction of the GRR Recommended Plan; and, \$58,028,000 in Berthing and Dock dredging.

Total average annual costs for the project are \$25,855,000, which includes \$12,517,000 in average annual costs for construction and \$13,337,000 incremental annual O&M costs. The Fully Funded

Cost of the project (Project First Cost escalated to the estimated midpoint of construction) is \$295,432,000.

Section 902 Limit. As shown previously in Table 9-3, the maximum project cost limit imposed by Section 902 for the authorized project is \$321,603,000. This cost was established using the certified 902 tool.

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:

Port Freeport shall:

- a. Provide 10 percent of the total cost of construction of the GNF 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 50 feet; plus 50 percent of the total cost of construction of the GNFs attributable to dredging to a depth in excess of 50 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 the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Government to commercial navigation;
 - (3) 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 50 feet; plus 50 percent of the total cost of construction of the GNFs attributable to dredging to a depth in excess of 50 feet;
- b. Provide all lands, easement, and rights-of-way (LER), including those necessary for the borrowing of material and disposal 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 LER and relocations, including utility relocations, provided by the non-Federal sponsor for the GNFs. If the amount of credit afforded by the Government for the value of LER, and relocations, including utility relocations, provided by the non-Federal sponsor equals or exceeds 10 percent of the total cost of construction of the GNF, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of LER and relocations, including utility relocations, in excess of 10 percent of the total costs of construction of the GNFs;
- d. Provide, operated, and maintain, at no cost to the Government, the local service facilities in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Government;
- e. Provide 50 percent of the excess cost of O&M of the project over that cost which the Government determines would be incurred for O&M if the project had a depth of 50 feet;
- f. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, and maintaining GNFs;
- g. Hold and save the United States free from all damages arising from the construction of O&M of the project, an betterments, and the local service facilities, except for damages due the fault or negligence of the United States 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 Requirement 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 determine necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under LER that the Government

- determines to be necessary for the construction or O&M of the GNFs. However, for lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Government provided 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 Government and the non-Federal sponsor, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under LER that the Government determines to be necessary for the construction or O&M 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, PL 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: 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;
- p. Not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal sponsor's obligations for the project costs unless the Federal agency providing the Federal portion of such funds verifies in writing that such funds are authorized to be used to carry out the project; and

Construction of the GRR Recommended Plan is estimated to take approximately two 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 that have accumulated in the channels at 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.

Those portions of the projects for the Freeport Harbor and Stauffer channels that are deepened or newly created shall be operated and maintained according to the terms and provisions of the new agreements. All other portions of the existing projects for the Stauffer Channel shall continue to be operated and maintained according to the existing agreement applicable to that portion of the channel.

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 need on lines not previously scheduled for removal, the District Engineer will update the project economic evaluation to reflect the cost, no changes to the Baseline Cost Estimate or Sponsor and Federal cost-sharing will be required.

11.2 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 the 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...”

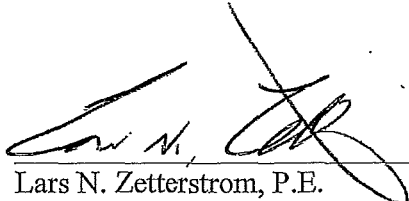
The proposed project meets the requirements for a categorical exemption due to the sponsor’s financial constraint and is recommended as the Recommended Plan. Additional deepening beyond 46 feet was not evaluated in this study so the NED plan could not be identified. This constrained Recommended Plan consists of widening the channel to 400 feet, and constructing a bend easing, and a turning notch, all to a depth of 46 feet, as described in **Section 6.0** of this report.

11.3 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.

10 APR 18

Date


Lars N. Zetterstrom, P.E.
Colonel, U.S. Army
Commanding

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