US Army Corps of Engineers
Galveston District

PROJECT DEFICIENCY REPORT
AND FINDING OF NO SIGNIFICANT IMPACT
WITH ENVIRONMENTAL ASSESSMENT

Matagorda Ship Channel Project Deficiency Report
(Entrance to Matagorda Ship Channel)

September 2020

(This page left blank intentionally.)

TABLE OF CONTENTS

FIGURES

TABLES

PLATES

APPENDICES

LIST OF ACRONYMS

AAHU	Annual Average Habitat Unit
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CHL	Corps of Engineers Coastal Hydraulic Laboratory
Corps	U.S. Army Corps of Engineers
CPA	Calhoun Port Authority
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
EA	Environmental Assessment
EDR	Engineering Documentation Report
EFH	Essential fish habitat
EIS	Environmental Impact Statements
EM	Engineer Manual
EM 1110-2-1613	Engineer Manual 1110-2-1613, Hydraulic Design Guidance for Deep Draft Navigation Projects, dated May 2006
EP	Engineer Pamphlet
EPA	U.S. Environmental Protection Agency
ER	Engineer Regulation
ER 1105-2-100	Engineer Regulation 1105-2-100, Planning Guidance Notebook, Principles and Guidelines, dated April 2011
ER 1130-2-520	Engineer Regulation 1130-2-520, Navigation and Dredging Operations and Maintenance Policies, dated November 2006
ER 1165-2-119	Engineer Regulation 1165-2-119, Modification to Completed Projects, dated September 1982
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FWOP	Future Without-Project
GIWW	Gulf Intercostal Waterway
HSI	Habitat Suitability Index
HTRW	Hazardous, Toxic and Radioactive Waste

July 2011 report	Consideration of Modification of MSC Entrance using Design Deficiency Authority, dated July 29, 2011
MCACES	Micro Computer Aided Cost Engineering System
MCY	million cubic yards
MII	Micro Computer Aided Cost Engineering System Second Generation
MLLW	mean lower low water
MLT	mean low tide
MSC	Matagorda Ship Channel
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NFS	Non Federal Sponsor
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and maintenance
P&G	Principles and Guidelines
PA	Placement Area
PIANC	Permanent International Association of Navigation Congresses
PAL	Planning Aid Letter
PAWSA	Ports and Waterways Safety Assessment
PCA	Project Cooperation Agreement
PDR	Project Deficiency Report
RHA	Rivers and Harbors Act
SHPO	State Historic Preservation Officer
SWD	USACE, Southwestern Division
SWG	USACE, Southwestern Division, Galveston District
TCEQ	Texas Commission on Environmental Quality
T&E	Threatened and Endangered
TEU	Twenty-Ft Equivalent Units
TPWD	Texas Parks and Wildlife Department
TSCA	Toxic Substances Control Act
TxGLO	Texas General Land Office

TXNDD	Texas Natural Diversity Database
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WES	U.S. Army Engineer Waterways Experiment Station
WVA	Wetland Value Assessment

(This page left blank intentionally.)

EXECUTIVE SUMMARY

This Design Deficiency Report (DDR) documents how and why the Entrance to the Matagorda Ship Channel meets the criteria for a design deficiency. This deficiency causes unsafe conditions in the entrance channel for navigation traffic, resulting in frequent delays and subjecting vessels to dangerous currents. The report follows ER 1165-2-119, Modification to Completed Projects, which allows justification that can be based on either safety or economic considerations. This DDR explains how the conditions in the Matagorda Ship Channel Entrance qualify it as a design deficiency based on safety alone.

The Entrance to the Matagorda Ship Channel was constructed by cutting a new inlet through the Matagorda Peninsula in 1963-1964. Since its construction the entrance channel has experienced strong currents that equal or exceed 3 knots more than 60 percent of the time and equal or exceed 5 knots 20 percent of the time. While cross currents at the gulf and bay sides of the entrance channel are not considered extreme on their own, the high currents in the channel make it difficult to overcome the cross current effect on the vessel navigating the channel. These currents have caused severe scouring and created difficulty for the users navigating the entrance channel. Through a series of ERDC studies, SWG determined that unsafe conditions at the entrance channel are a result of a deficiency in the original project design.

A memorandum from USACE Director of Civil Works to the SWD Commander (August 2013) concurred that a design deficiency exists at the Entrance to the Matagorda Ship Channel and directed SWG to proceed with a study to identify a practical modification that ensures the safe and reliable operation of the project. This report justifies a Recommended Corrective Action (RCA) to correct the design deficiency based on results of the previously completed ERDC work. Environmental compliance is documented with the associated Environmental Assessment and FONSI.

Consistent with ER 1165-2-119, the recommendation to correct the deficiency falls under existing project authority, and would not require additional Congressional authority. Per the ER, the Chief of Engineering, HQUSACE would approve the report and make the determination to implement the RCA.

The study is 100% federally funded and the non-federal partner for project construction is the Calhoun Port Authority (formerly the Calhoun County Navigation District). The first cost for the design and construction of the RCA for the deficiency (Structural Alternative

3 and Dredged Material Placement Alternative 3) is $76,112,000 as detailed in the cost estimates and $78,712,000 is the fully funded project cost.

1 INTRODUCTION

1.1 Project Location

The Matagorda Ship Channel (MSC) is a deep-draft channel, approximately 25 miles long, located on the central coast of Texas (Figure 1-1). Most of the MSC project is located in Calhoun County, Texas, while the southern portion and Entrance Channel are in Matagorda County. The channel is part of the Matagorda Bay System at Port Lavaca, about 120 miles southwest of Galveston, Texas. The MSC Entrance passes through a man-made cut (dredged at the time of the deep draft construction of the MSC in 1966.) along the western end of Matagorda Peninsula, a land body that separates Matagorda Bay from the Gulf of Mexico. The Gulf Intracoastal Waterway (GIWW) intersects the channel approximately 2.5 miles north of the cut through Matagorda Peninsula.

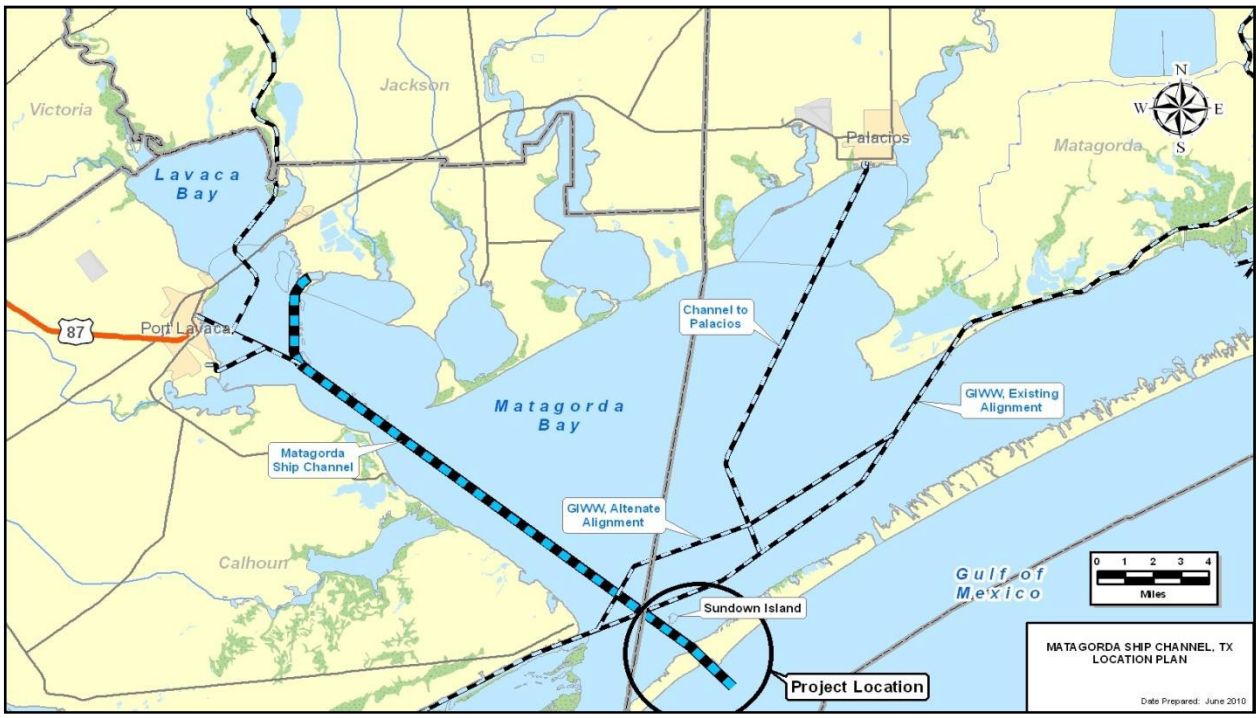

Figure 1-1 Project Location: MSC Entrance Channel

The man-made cut through the Matagorda Peninsula, allows deep-draft transit back and forth from the Gulf of Mexico (gulf) to Matagorda Bay (bay). On the gulf side of the cut, a pair of jetties flanking the channel and set approximately 2000 ft. apart extends at a 24 ft. depth into the gulf, protecting the ships and the channel from gulf side currents. As the cut crosses through the peninsula it narrows to approximately 950 ft. wide, greatly focusing the flow and increasing the velocity of the current in this area and on the bay side. The banks along the channel are lined with slope protection (2 to 4 ton stone). This

portion of the channel through Matagorda Peninsula where it constricts to a lesser channel width is referred to as the “bottleneck” (Figure 1-2).

Figure 1-2 MSC Channel Entrance

Sundown Island (Figure 1-3), which is located near the MSC Entrance, is a designated placement area (PA) used for both MSC and GIWW dredged maintenance material disposal. Sundown Island is managed by Texas Audubon Society as a bird rookery.

Pass Cavallo is located approximately 4.5 miles southwest of the MSC Entrance. It is the natural inlet connecting the Gulf of Mexico to Matagorda Bay. Since the opening of the MSC in 1964 there are concerns that Pass Cavallo will close in response to change in tidal velocities, resulting from the MSC Entrance through the peninsula. The change in the tidal hydraulics from the MSC Entrance, resulted in extensive shoaling in Pass Cavallo which decreased the inlet width by 9,500 ft. between 1946 and 1995.

Figure 1-3 Pass Cavallo location in relation to MSC Entrance Channel

Because the MSC has a northwest to southeast alignment, in prior reports and studies jetties and shorelines have been referred to as either north and south or east and west. For purposes of this report, the jetty and shoreline on the northeast side of the channel are referred to as the east jetty and east shoreline. The jetty and shoreline on the southwest side of the channel are referred to as the west jetty and west shoreline (Prior reports included in the Appendices may use different terminology).

1.2 Project Authority

Congress originally authorized navigation improvements in the Matagorda Bay area under the River and Harbor Act (RHA) of June 25, 1910. This authorization provided for an approximately 8 mile long channel measuring 7 ft. deep and 80 ft. wide from deep water in lower Matagorda Bay to Port Lavaca. The work was completed December 11, 1910.

The RHA of August 30, 1935 authorized the upper end of the channel to be extended a distance of about 1 mile to the shoreline at the entrance of Lynn Bayou. This work was completed August 19, 1936.

The RHA of August 26, 1937 authorized the enlargement of the channel from Lynn Bayou at Port Lavaca to deep water in Matagorda Bay near Port O'Connor. This channel had a depth of 9 ft. and a width of 100 ft. and was about 11 miles long. This work was completed in 1939.

The RHA of March 2, 1945. This Act provided for a channel extension 100 ft. wide and 6 ft. deep from Port Lavaca, via Lavaca Bay, Lavaca River, and Navidad River, to Red Bluff located at about mile 3 on the Navidad River, for a total distance of 20 miles. This work was completed in 1957. The RHA of 1945 also provided for a "harbor of refuge" 9 ft. deep near Port Lavaca with an approach channel 9 ft. deep and 100 ft. wide. This work was completed in 1960.

The RHA of July 3, 1958, as described in House Document 388, 84th Congress, second session, authorized the construction of a deep draft-navigation channel from the Gulf of Mexico through Pass Cavallo, 38 ft. deep, 300 ft. wide and about 6 miles long; an inner channel 36 ft. deep, 200 ft. wide and about 22 miles long across Matagorda and Lavaca Bay, a turning basin at Point Comfort, 36 ft. deep and 1,000 ft. square; and dual jetties at the channel entrance (these are the dimensions of the present-day channel). During preconstruction project design, hydraulic modeling indicated the location of the Entrance Channel should be moved from Pass Cavallo to a man-made cut across Matagorda Peninsula. The relocated Entrance Channel would provide a shorter and straighter Entrance Channel, shorter jetties, a shorter length of channel, and the probability that periodic maintenance requirements would be reduced. Construction of the deep-draft measures was completed in 1966.

The RHA of July 3, 1958, as described in House Document 131, 84th Congress, first Session, also authorized the channel from Pass Cavallo to Port Lavaca to be deepened to 12 ft. and widened to 125 ft. from the 12 ft. depth in Matagorda Bay to the Turning Basin at Port Lavaca. Authorization was given for the channel to the Harbor of Refuge near Port Lavaca to be enlarged to 12 ft. deep and 125 ft. wide over a distance of 2.1 miles.

1.3 Non-Federal Sponsor

According to Design Memorandum of No. 3, January 1962, paragraph 3-01, in December 13, 1961, the Calhoun County Navigation District No.1 (Calhoun Port Authority, or CPA) passed a resolution, and obtained further resolutions from the Matagorda County Navigation District Nos.1 and 2 dated December 13, 1961 and November 7, 1961 respectively, for the assumption of the non-Federal obligations for the MSC project as authorized by the RHA of 1958. The Chief of Engineers Report,

contained in House Document No. 388 of 84th Congress 2d Session, “Matagorda Ship Channel, Texas” describes the non-Federal Sponsor (NFS) responsibility for the project as a cash contribution of 50 percent of the incremental construction cost of the “deep-draft” channel (at that time 36 to 38 feet) over the estimated construction cost for a shallow draft channel. The reason was that it was expected that the benefits of the added depth would accrue to a single interest. (That turned out not to be the case.)

This Project Deficiency Study was initiated under the Inspection of Completed Works Program, and is 100% federally funded, a project partnership agreement was not initiated for this effort. The CPA, Point Comfort, Texas, is a political subdivision of the State of Texas, and is the current NFS for the operation and maintenance (O&M) of the MSC. The CPA is willing and able to participate as the local sponsor in partnership with USACE for construction of the RCA for the project deficiency. Prior to approval of this report CPA will provide a Letter of Intent (LOI) and a Statement of Financial Capability to the District Engineer and Commanding Officer of U.S. Army Corps of Engineers (USACE) Galveston District.

1.4 Navigation Safety Issue

The entrance of the MSC has experienced strong currents since its construction. Engineer Manual (EM) 1110-2-1613, Hydraulic Design Guidance for Deep Draft Navigation Projects, dated May 2006, classifies a current of 3 knots as strong. The Entrance Channel experiences strong currents that equal or exceed 3 knots more than 60 percent of the time and equal or exceed 5 knots 20 percent of the time. While cross currents at the gulf and bay sides of the Entrance Channel are not considered extreme, the high currents in the channel make it difficult to overcome the cross current effect on the vessel navigating the channel.

The strong currents have resulted in heavy scouring in the channel, erosion of the jetties, and more significant navigation difficulties and safety concerns for those vessels encountering the strong bayside cross currents and high longitudinal currents at the entrance. These conditions prevent safe transit by ship, as navigation control is difficult under the effect of these flows. The risk is so severe that ships are held for long periods of time, waiting for safe transit conditions. The high velocity conditions are design and construction related, as initial assumptions made during design proved to be incorrect and project features as constructed were based on the design assumptions and implementation of the bottle neck, resulting in the project not performing as intended.

At the time of design and construction, the location was considered optimal partly based on the anticipated currents and the decreased maintenance dredging that would be needed. General Design Memorandum No 3 dated January 1962, as approved, describes dual parallel jetties spaced 2,000 ft. apart beginning at the Gulf, extending through the peninsula and into the bay. As constructed, the Entrance Channel constricts to a 950 ft.

width through the peninsula creating a bottle neck. This configuration is included in the GDM without consideration for restricted flow above top edge of cut. This constriction decreases the inlet cross-sectional area and increases the current velocities. The current velocities result in the channel being frequently unusable for its authorized purpose of navigation.

1.5 Datum and Tidal Information

The USACE, Southwestern Division, Galveston District (SWG) Engineering Documentation Report (EDR) dated July 2015, titled *Vertical Datum Conversion: MLT to MLLW MSC* is included in the Appendix F. This EDR provides the datum conversion for the MSC. Throughout this report the MLLW datum is used. For additional information on datum conversions, reference Engineer Manual (EM) 1110-2-6056.

1.6 Previous Studies

Numerous studies have been performed in an attempt to address concerns of the NFS and users related to the strong currents through the Entrance Channel of the MSC and its intersection with the bay, and resulting impacts on users, navigation, and structures. Under the prior studies the Engineering Research and Design Center (ERDC) was tasked with performing modeling and analysis of the MSC. The following studies and ERDC reports under each study have been completed to date.

1. Reconnaissance Report – Initiated May 2000 Completed March 2004;
2. Section 216 Feasibility Report – Initiated in 2004 ended in 2006;
    - 2006 ERDC Technical Report "MSC, Texas: Jetty Stability Study;"
3. Operations and Maintenance Major Rehabilitation Study – Initiated in 2007 ended in 2009
    - 2008 ERDC Report “Morphologic Examination of the Stability of Pass Cavallo, Texas;”
    - 2007 ERDC Report “Evaluation of Risks to Navigation for the MSC Entrance;”

- 2011 ERDC Report “Risks to Navigation at the MSC Entrance, Texas, Phase 2: Evaluation of Significant Risk Factors,” (This was initiated under the Operations Study, but was finalized and completed after the study ended);

4. Bottleneck Removal using Chief’s Discretionary Authority (ER 1130-2-520) – Initiated and ended in 2009;
5. Engineering Deficiency Study – Initiated in February 2010 and ended in July 2011.
6. Matagorda Ship Channel Feasibility Study/EIS, Section 216 – Initiated in August 2016 and

The Engineering Appendix provides a summary of each of the ERDC reports. Each of the ERDC reports are included in Appendix E.

1.6.1 Reconnaissance Report

A reconnaissance study was initiated in fiscal year 2002 with a Reconnaissance Report Section 905(b) *Analysis for MSC* completed in 2004. This report concluded that jetty stabilization to improve the efficiency and safety of the channel appeared feasible. The report recommended detailed studies to quantify the magnitude of the costs and benefits associated with several types of improvements. As addressed in the *MSC Jetties Economics Close-Out (August 2011)* (Refer to Appendix G), the Report provided a preliminary economic analysis. The benefit-cost analysis assumed a catastrophic event would occur with a probability of 10 percent resulting in a loss of cargo to Port Lavaca/Port Comfort; a direct loss of jobs at the terminals; loss of property in the immediate area; and a loss of value-added to manufacturing. The resultant Benefit-Cost Ratio (BCR) for the alternatives ranged from 1.83 to 3.76. This information led to a recommendation to initiate a feasibility study.

1.6.2 Feasibility Study

In 2004 SWG initiated a Section 216 Feasibility Study to address issues with the Entrance Channel. Section 216 of the 1970 Flood Control Act authorizes the USACE to review previously completed Civil Works projects for beneficial improvements. The initial economic analysis was based on catastrophic failure of the jetties and interruption of navigation. ERDC was tasked by SWG to hydrodynamically model the existing condition. The results of the ERDC study are documented in the report, "Matagorda Ship Channel, Texas: Jetty Stability Study” (referred to as “ERDC 2006 Jetty Stability Study”).

The objective of the effort by ERDC was to evaluate alternatives for improving jetty stability at entrance to the MSC by reducing the velocity currents. The report by ERDC considered three basic alternatives and variations of the basic alternatives in addition to the no action alternative.

- Existing Condition - no action;
- Alt 1 - Remove west bottleneck through the peninsula;
- Alt 2 - Remove east and west bottleneck;
- Alt 3 - Remove east and west bottlenecks and add a flare to the bay entrance;
- Alt 3a - Remove west bottleneck, flare the bay entrance, and remove 1,500 ft. of the west rock jetty.

ERDC also considered two hypothetical alternatives that included the closure of Pass Cavallo

- Alt 4 - Existing condition and hypothetical closure of Pass Cavallo;
- Alt 5 - Remove east and west bottlenecks and add flange at the bay entrance (Alt 3) and hypothetical closure of Pass Cavallo.

ERDC concluded that Alt 3 best reduced the navigation safety concerns associated with the strong currents in the Entrance Channel, and reduced the scouring resulting from the crosscurrents at the bay side of the Entrance Channel.

For the feasibility study the project benefits were derived from prevention of a catastrophic failure of the jetties and ensuring protected commerce throughout the full period of economic analysis. Specifically the benefits were calculated based on reduction in vessel operating costs for aluminum ore and the costs of having the channel closed by a catastrophic event. The seven alternatives were examined and the resulting BCRs ranged from 9.1 to 16.3. In 2006, the feasibility study ran out of funds and additional General Investigation funds were not anticipated. As such, the study was stopped in 2006 due to the lack of funding.

1.6.3 Operation and Maintenance Major Rehabilitation Study

Concerns of risks to navigation provided a basis for start of an Operations and Maintenance Major Rehabilitation Study (OMMR*)* in 2007, funded by O&M. During this phase of study ERDC performed three more studies.

- 2008 ERDC Report “Morphologic Examination of the Stability of Pass Cavallo, Texas;”

- 2007 ERDC Report "Evaluation of Risks to Navigation for the MSC Entrance;" (referred to as the "ERDC 2007 Evaluation of Risk Report")
- 2011 ERDC Report "Risks to Navigation at the MSC Entrance, Texas, Phase 2: Evaluation of Significant Risk Factors,"

1.6.3.1 ERDC 2008 Pass Cavallo Report

The ERDC 2008 Pass Cavallo Report studied the stability of the cross sectional area of Pass Cavallo, which has decreased in size since opening of the MSC Entrance to Matagorda Bay in 1966. It also considered the impacts removing the bottle neck at the

MSC Entrance Channel would have on the stability of the pass. The report concluded that the construction of the MSC Entrance Channel, and stabilization by the jetties caused the volume of water flowing through Pass Cavallo to decrease. This resulted in shoaling of sediment which decreased the width of the channel at Pass Cavallo. At the time the report was completed in 2008, aerial photography indicated that the width of Pass Cavallo was nearly constant since 1990, with a slow increase in width as of 2007. The report concluded that the Pass Cavallo would remain open at its cross-sectional area, and that removing the bottle neck at the MSC Entrance would not notably change this.

1.6.3.2 ERDC 2007 Evaluation of Risk Report

The ERDC 2007 Evaluation of Risk Report evaluated factors such as jetty failure, shoaling, adverse currents, and scour to identify which of these factors would pose a significant risk of disrupting navigation at the MSC Entrance. ERDC looked at eight potential risk factors:

1) Jetty failure from hurricanes.
2) Shoaling from hurricanes.
3) Asymmetric currents from partial jetty failure.
4) Long-term deterioration of jetties.
5) Breaching of peninsula away from MSC.
6) Flanking of jetties or slope protection.
7) Strong and asymmetric current on the bay side of the peninsula and in the bottleneck.
8) Channel bottom scour that leads to slope failures that constrict the channel, creates adverse currents for navigation, or leads to shoaling of the channel.

The study identified three factors requiring further evaluation: (1) flanking of the jetties or slope protection; (2) strong and asymmetric current on the bay side of the peninsula and in the bottleneck; and (3) slope failures that constrict the channel that creates adverse currents for navigation or lead to shoaling of the channel. The other five factors were not considered significant risk.

1.6.3.3 ERDC 2011 Risk to Navigation Study

The ERDC 2011 Risk to Navigation Study was initiated during the OMMR Study, and finalized after the study ended. It assessed the risks to navigation based on three factors, recommended for further evaluation. The evaluation concluded that flanking of the jetties and slope protection from hurricanes or high tide or strong wind conditions would have minimal risk of disrupting navigation. The analysis only applied to short-term scenarios. The cross current through the breach would be weak compared to the longitudinal currents in the channel. Even though slope failures from the continuing scour would increase in frequency and severity, the size of the slope failures would not be large enough to cause shoaling problems or greatly alter the current in the channel. Therefore, although there would likely be increased frequency and cost of repairs to maintain the entrance it would not result in more than minimal disruption to navigation.

In addition, ERDC determined that the combination of the strong longitudinal current in the rock-lined bottleneck along with the cross current on the bay side of the peninsula pose the primary risk to disrupting navigation through ship grounding. The negative consequence would occur as a result of human error while navigating the channel.
The ERDC 2011 Risk to Navigation Study report recommended the complete removal of the bottleneck to provide the greatest reduction of risk to navigation due to the strong longitudinal currents. Removal of the bottleneck would stabilize the cross-sectional area in the Entrance Channel, minimize scouring, and achieve a current velocity of about 70-80 percent of the existing velocity. The report also stated that the adverse cross current effects in the bay could be reduced by the relocation of Sundown Island.

1.6.3.4 Conclusion of the OMMR Study

Following the guidance of Engineer Pamphlet (EP) 1130-2-500, Project Operations, the project delivery team (PDT) for the OMMR Study was unable to economically justify a project. EP 1130-2-500 requires a life-cycle analysis of structural reliability and associated consequences. Some of the information needed to support major rehabilitation was not available in the ERDC reports, including time-dependent reliability functions. Very little maintenance has ever been done on this project, making it difficult to look at a progression of O&M costs over time. In August 2009, it was concluded that the problem was not the structural condition of the jetties but that the risks are driven by the currents through the channel and a time-dependent reliability analysis would miss the real safety issues. The currents were considered to be unsafe per existing guidance recommended by USACE and the Permanent International Association of Navigation Congresses (PIANC), so other options besides an OMMR study were pursued.

1.6.4 Bottleneck Removal using Chief's Discretionary Authority (ER 1130-2-520)

In August 2009, it was decided to investigate whether removal of the bottleneck to reduce currents in the channel could be completed under the Chief's Discretionary Authority. Measures to reduce the high cross-currents on the bay side at the intersection with the channel would not be covered under the Chief's Discretionary Authority since additional structures such as flanges would be required. A qualitative analysis without an economic justification would be used to describe the consequences (potential for accidents or collisions, environmental). The project would not have economic benefits; however, there would be safety benefits. The study was conducted under provisions outlined in Engineer Regulation (ER) 1130-2-520, Navigation and Dredging Operations and Maintenance Policies, dated November 29, 1996, which provide that O&M funds may be used for increases in navigation channel dimensions at entrances, bends, sidings, and turning places within a project to allow for free movement of boats in accordance with the provisions under previous project authority.

U.S. Coast Guard (USCG) historical records provided little support in the way of incidents involving deep draft vessels in the Entrance Channel. Most incidents involved barges in the GIWW. The economist during that time found only one incident (May 2, 1994) that involved a deep draft vessel in the ship channel that was relevant to the study. In addition, when the estimated cost for removal of the bottleneck with the material being placed at the least cost location (beach) exceeded $80 million, SWG realized the project could not be implemented under the Chief's Discretionary Authority.

1.6.5 2010 Engineering Deficiency Study

In February 2010, USACE, Southwestern Division (SWD) directed SWG to investigate corrective measure to the MSC Entrance as a design or construction deficiency. Based on the criteria in Engineer Regulation (ER) 1165-2-119, Modification to Completed Projects, dated September 1982, the construction required for the corrective action recommended in this report is authorized under the existing project authority. The ER states that a construction deficiency is a flaw in the Federal construction of a project that significantly interferes with a project's authorized purposes or full usefulness as intended by Congress at the time of the original project development. The ER also states that the corrective action therefore falls within the purview of the original project authority.

As addressed in the Engineering document titled: *Consideration of Modification of MSC Entrance using Design Deficiency Authority,* dated July 29, 2011 (referred to as the July 2011 report) as per ER 1165- 2-119, USACE can design and construct a corrective project under the existing project authorization from Congress. A corrective project must meet the requisite conditions listed below:

1. It is required to make the project function as initially intended by the designer in a safe, viable, and reliable manner.
2. It is not required because of changed conditions.
3. It is generally limited to the existing project features.
4. It is justified by safety or economic considerations.
5. It is not required because of inadequate local maintenance.

The Engineering Deficiency Report concluded that despite velocities in the channel exceeding the current recommended design guidance, the MSC Entrance does not meet the criteria in ER 1165-2-119 for modification under the Design Deficiency authority. The project did not qualify for Condition 1, or Condition 2.

In July 2011 SWG prepared a report titled “Matagorda Ship Channel, Texas Compilation of Studies on the Entrance Channel through Matagorda Peninsula, Final Report” (Appendix G Annex 1). This report includes a summary of the work completed under the Engineering Deficiency Study from 2011. The Engineering Deficiency Study concluded that the MSC Entrance Project meets Conditions 3, 4, and 5 listed above. At the time, the MSC Entrance failed to meet two of the five criteria required for modification under the Design Deficiency authority in ER 1165-2-119, therefore the study ended.

1.6.6 ERDC 2011 DMMP Study

In 2011 ERDC completed an additional report “Analysis of Dredged Material Placement Alternatives for Bottleneck Removal MSC, Texas,” (referred to as ERDC 2011 Dredged Material Placement Study). The 2011 DMMP Study considered alternatives to place dredged material from removal of the bottle neck.

The report considered alternatives to place material on the beach located southwest of the MSC Entrance and at Sundown Island. The report considered the effects of placement of material at Sundown Island and expansion of the island on crosscurrents in the bay/MSC Entrance intersection. The report concluded that placement of material and expansion of the island did not significantly increase the cross current. The report also considered placement of material on the beach and the effects this may have on Pass Cavallo. The report concluded that placement on the beach increased the rate on transport of material towards Pass Cavallo; it would become part of the Pass Cavallo ebb

shoal complex; and it would be reworked with the passage of cold fronts in winter. Therefore, the beach placement options were considered viable, and that Pass Cavallo would maintain its present day equilibrium.

1.6.7 Matagorda Ship Channel Improvement Project

The study was prepared under the authority of Section 216 of the 1970 Flood Control Act. The purpose of the project is to reduce transportation costs and increase operational efficiencies of maritime commerce movement through the Calhoun Port Authority by expanding the MSC channel dimensions. The recommended plan would deepen the channel to 47 ft MLLW, widen the Entrance Channel to 600 ft, widen the main channel to 350 ft, and increase the turning basin to 1,200 ft. The project would be cost shared between USACE and the Calhoun Port Authority.

(This page left blank intentionally.)

2 RECOMMENDATION FOR PROJECT DEFICIENCY STUDY

Although the 2010 Engineering Deficiency Study ended with the conclusion that the MSC Entrance did not meet 2 of the 5 criteria, in April 2012, SWG reassessed the potential for continuing under the Design or Construction Deficiency criteria. The document "Information Summary Design Deficiency at Matagorda Ship Channel" (Appendix G Annex 2) focused on a reassessment of Conditions 1 and 2. The following provides a summary of the supporting conclusion that all conditions as outlined in the ER for a project design deficiency are met for the MSC Entrance.

2.1 Criteria for Project Deficiency Study

ER 1165-2-119 Paragraph 7a, presents the criteria for modification to an existing project as a design or construction deficiency. The ER states that a design or construction deficiency is a flaw in the Federal design or construction of a project that significantly interferes with a project's authorized purposes or full usefulness as intended by Congress at the time of the original project development. The ER also states that the corrective action therefore falls within the purview of the original project authority. Per the ER, USACE can design and construct a corrective action for the deficiency under the existing project authority without further Congressional authorization if the following conditions are met:

1. It is required to make the project function as initially intended by the designer in a safe, viable, and reliable manner.
2. It is not required because of change conditions.
3. It is generally limited to the existing project features.
4. It is justified by safety or economic considerations.
5. It is not required because of inadequate local maintenance.

Criteria 1 – It is required to make the project function as initially intended by the designer in a safe, viable, and reliable manner.

In the April 2012 reassessment, based on review of the design documentation and hydraulic model study, the degree of scour experienced in the channel was not intended. This scour was caused by higher average current velocities than was specified in the design documentation. Consequently, navigation risks have increased.

Further, by coupling an Escoffier curve with an "equilibrium" inlet cross section area with tidal prism relationship, significant scour could have been predicted given the design cross-sectional area of the inlet. This technique had been developed at the time of initial

design. However, it is not evident that this analysis was completed in the design documentation.

In considering the high design velocities, the designers incorporated measures to protect the Entrance Channel banks from erosion. The side slopes were flattened to 1 vertical to 5 horizontal in lieu of 1 vertical to 3 horizontal. Additionally, 20,000 tons of riprap stone was stockpiled to provide shoreline protection as erosion developed. However, the bottom of the navigation channel remained unprotected from erosive velocities and was subjected to extreme scour.

Based on these factors, Criteria 1 is met. This project does not function as initially intended by the designer in a safe, viable, and reliable manner.

Criteria 2 – It is not required because of changed conditions.
In the April 2012 reassessment it was noted that the previous review identified the increased shipping traffic above the project basis as a “changed condition”. However, to account for high current velocities, shipping traffic is restricted only to periods in which transit velocities are navigable.

The project design vessel cannot safely navigate the MSC Entrance Channel because of existing conditions in and around the bottleneck. Based on this consideration, Criteria 2 is met. Modifications to the MSC Entrance are not required because of changed conditions.

Criteria 3 – It is generally limited to the existing project features.
Project deficiency is limited to the existing project features of the Entrance Channel to the MSC. This includes the man-made cut through the Matagorda Peninsula which was constructed as part of the original project. Criteria 3 is met since the Entrance Channel is an existing project feature.

Criteria 4 – It is justified by safety or economic considerations.
Project deficiency for the MSC Entrance Channel and its RCA is based on safety considerations only. A 2013 HQUSACE memorandum, SUBJECT: Alignment on Path Forward for the MSC Project Deficiency Study, concurred with the recommendation that the corrective actions can be justified based solely on reducing safety concerns. Criteria 4 is met based on safety considerations.

Criteria 5 – It is not required because of inadequate local maintenance.
The problems associated with the MSC Entrance are a result of the dimensions of the man-made cut through the peninsula. Criteria 5 is met since the navigation channel is adequately maintained, such that lack of maintenance is not the cause of the deficiency.

2.2 Recommendation for Corrective Action as a Project Deficiency

In summary, the MSC Entrance meets all five criteria required for modification under a project deficiency per ER 1165-2-119. As alluded to in a previous discussion, an August 2013 U.S. Army Corps of Engineers Headquarters (HQUSACE) memorandum concurred with an April 2012 SWG assessment and proposal to proceed with a study to identify a practical channel modification that will ensure safe and reliable operation of navigation vessels in the MSC Entrance. The HQUSACE concurred that a project deficiency existed that resulted in a flaw in the Federal design or construction of the project and that this deficiency significantly interfered with the project's authorized purposes and full usefulness as intended by Congress at the time of the original project development.

In June 2016, SWG prepared a Scope of Work "Matagorda Ship Channel Design Deficiency Study" (Appendix G Annex 3) to reinitiate the Design Deficiency Study. In a Memorandum dated September 15, 2016 SUBJECT "Alignment on Path Forward for the Matagorda Ship Channel Project Deficiency Study" (Appendix G, Annex 4) the HQUSACE concurred on a path forward to proceed with a project deficiency study for the MSC, with the determination to justify the project solely on reduction in safety concerns based on ER 1165-2-119 (reference 7.a) criteria 4, that states that a deficiency must be "justified by safety or economic considerations.

The project deficiency study would rely heavily on the large body of work previously completed, and require limited new work. The focus of new work would be on environmental compliance, preliminary design, and certified cost.

2.3 Report Scope and Content

This Project Deficiency Report (PDR) and Environmental Assessment (EA) are intended to document the results of the project deficiency study by providing the justification for the project. USACE regulations were followed in preparation of the PDR and EA. They include ER 1165-2-119 *Modifications to Completed Projects;* ER 1105-2-100 *Planning Guidance Notebook, Principles and Guidelines* adopted by the Water Resources Council, Council on Environmental Quality (CEQ); regulations and guidance for implementation of

the National Environmental Policy Act (NEPA); and ER 200-2-2 *Procedures for Implementing NEPA.*

This PDR presents available information related to:

- Existing conditions in the vicinity of MSC Entrance Channel.
- Problem identification
- RCA
- Environmental effects of RCA and its impacts
- Public involvement and agency coordination

ER-1165-2-119 (reference 1.c) criteria 4 states that a design deficiency must be "justified by safety or economic considerations." Conditions at the entrance of the MSC have a direct impact on the safety and reliability of navigation of vessels in the MSC and the Gulf Intercoastal Waterway. Therefore, the RCA for the project deficiency will be justified based solely on safety concerns.

3 EXISTING CONDITIONS

An EA titled “MSC Deficiency Study Matagorda County, Texas,” was prepared to assess existing conditions, and affected environment in the project area. The EA and Findings of No Significant Impact (FONSI) are incorporated by reference into this PDR, and is included in Appendix A. The following provides a brief summary of the existing conditions: Refer to the EA for additional information.

Matagorda Bay is a large, shallow body of water generally paralleling the coastline in the upper Coastal Bend region of Texas and is separated from the Gulf of Mexico by Matagorda Peninsula. The bay system includes Lavaca Bay to the northwest, Carancahua and Tres Palacios Bays to the north, and a series of smaller secondary and tertiary bays, bayous, and marshes around its periphery. Geographically, the study area is predominantly surrounded by low-lying, undeveloped alluvial lands of the coastal plain, which are comprised of wetland and prairie vegetation typical of the upper Gulf Coast Region of Texas. Sundown Island is in Matagorda Bay approximately 1.3 miles west of the Matagorda Peninsula. Important resources within the proposed project area include water exchange, current velocity, salinity, sea level change, barrier islands, wetlands, aquatic resources, fisheries and essential fish habitat, wildlife, aquatic nuisance species, threatened and endangered species, water quality, air quality, noise, sediment quality, recreational resources, and cultural resources.

The MSC water exchange is greater in the winter than in the summer, mainly because the stronger wind in the winter drives more flow in and out of the bay. Pass Cavallo has apparently reached a dynamic equilibrium with tidal forcing and wind-setup ebb current through the inlet at this time. The MSC design deficiency causes increased current velocities which range from 1.4-5.1 knots, which results in scouring and loss of vessel control. The mean sea-level trends at Rockport (1948-1999) was 1.51 ft. per century. Existing salinities range from 20-30 parts per thousand. The existing Matagorda Ship Channel bank lines are located in an area that was previously disturbed when the channel was constructed, but has since re-vegetated with dune and saline marsh plant species.

Additionally, as a result of these strong currents, the Matagorda Bay Pilots have implemented “Daylight Restricted Vessel Movement Criteria”. Those criteria include:

1. ALL vessels whose draft is within four (4') feet of the current maximum draft will be restricted to daylight only transits under normal conditions,
2. ALL vessels 541 feet (165 m) or greater in length will be restricted to daylight only transits,

3. ALL vessels judged unsafe for handling at night will be restricted to daylight only transits.
4. Any vessel having deck gear forward of the ships wheelhouse will be restricted to daylight transits only.
5. Vessels with a beam greater than 25 meters will be restricted to daylight when a dredge is in the channel.

Based on the estimated dimensions for the original design vessel provided by the Deep Draft PCX (594' LOA x 94' beam x 34' draft) these restrictions indicate that this vessel would be restricted on all 3 dimensions (Criteria 1, 2, & 5). Additionally these daylight restrictions limit operations to less than 12 hours a day in 12 of 12 months of the year, which seems to validate concerns extending back to the original channel design.

Open-water habitats support communities of benthic organisms and corresponding fisheries populations. Phytoplankton (microscopic algae) are the major primary producers (plant life) in the open-bay and nekton populations include fish, shrimp, and crabs. Birds occasionally found in the area include a variety of waterfowl, shorebirds and wading birds, a variety of gulls, terns, herons, and egrets. Mammals potentially found within terrestrial areas in and adjacent to the project area include the hispid cotton rat (Siomodon hispidus), the eastern cottontail (Sylvilagus floridanus), opossum (Didelphis virginiana), raccoon (Procyon lotor), coyote (Canis latrans), and white-tailed deer (Odocoileus virginianus). Essential fish habitat (EFH) consists of those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity of species that are federally managed by the Gulf of Mexico Fishery Management Council (GMFMC) and by the National Marine Fisheries Service (NMFS). The project area is located in Ecoregion 5 and includes EFH designated by the GMFMC for red drum (Sciaenops ocellatus), white shrimp (Litopenaeus setiferus), brown shrimp (Farfantepenaeus aztecus), and Spanish mackerel (Scomberomorus maculatus). Aquatic nuisance species are known to occur within the project area that may have been introduced as a result of ballast water discharge or boat hull fouling include the Australian jellyfish (Phylloriza punctata), the Pacific white shrimp (Litopenaeus vannamei), the white crust tunicate (Didenum perlicidum), and sauerkraut grass (Zoobotryon verticillatum). The piping plover (Charadrium melodus), red knot (Calidris canutus rufa), Kemp’s ridley (Lepidochelys kempii), green (Chelonia mydas), and loggerhead (Caretta caretta) sea turtles are threatened or endangered species most likely to occur in and around the project area.

Cultural resources in the project's vicinity could potentially include shipwrecks, campsites, dense shell middens, and cemeteries, containing projectile points, stone, bone, and shell tools, aquatic and terrestrial faunal remains, hearth features, ceramics, and in some

cases human remains and associated funerary objects. Cultural resources investigations would be performed to identify and evaluate any historic properties within proposed construction areas.

The project area is located within Matagorda County, Texas, and is part of an area designated as in attainment for air quality. Existing noise producers in the area are from commercial vessels, fishing boats, automobiles, all-terrain vehicles, and wildlife. The water quality in the vicinity of the project is generally considered to be good; Aquatic Life Use, Fish Consumption Use, Contact Recreation Use and General Use are fully supported or they are of no concern.

The bottleneck soil borings indicated the sands to be fine to very fine beach sands, similar to those encountered and tested along the Texas coastline from Galveston to Port Mansfield. Soil samples were collected along the west shore of the Matagorda Ship Channel, and analyzed for munitions constituents (MC). None of the MC was detected above ambient soil concentrations in the sample that was collected along the west shore of the ship channel. Recreation activities include saltwater fishing, biking, camping, hiking, birding, picnicking, and seasonal hunting.

4 PROBLEM IDENTIFICATION

As identified and discussed in Section 1.4 of this report, numerous studies have been initiated on the MSC Entrance Channel. This PDR and EA relied on the analysis and conclusions of those reports to identify the problems in the MSC Entrance Channel and provide recommendation for corrective action for the deficiency. The ERDC 2006 Jetty Stability Study, 2007 Evaluation of Risk Study and the 2011 Risk to Navigation Study, and the 2011 Dredged Material Placement Study provided significant information and analysis used to support the development of a RCA for this PDR.

4.1 Problem Statement

Section 1.4 describes the navigation and safety issues associated with the MSC Entrance. Based on prior ERDC reports, the problems at the MSC Entrance include:

1) **Cross Current at Jetties.** One of the existing risks to navigation at the MSC is the cross current at the gulf entrance to the jetties. Wind is primarily from the southeast and it generates a cross current directed toward the southwest at the gulf entrance to the jetties. A cross current at the gulf entrance is only a significant problem for inbound ships. Once the bow of the inbound ship is inside the jetties, cross currents (either toward the southwest or toward the northeast) on the stern region of the ship tend to rotate the ship. In the case of a cross current toward the southwest, the ship is rotated clockwise. In anticipation of this rotation, the pilot applies a significant amount of port rudder. For a strong cross current, the ship will have a significant starboard drift angle even after it is completely inside the jetties. The pilot must realign the ship within the channel before reaching the bottleneck.

2) **Strong Current Velocity in Bottleneck**. Another existing risk to navigation is the strong current velocity through the bottleneck. The Kraus et al. (2006) report documents depth-averaged velocities in the center of the channel in the bottleneck as great as 5.2 knots based on numerical modeling of two significant tide conditions. The Entrance Channel experiences strong currents that equal or exceed 3 knots more than 60 percent of the time and equal or exceed 5 knots 20 percent of the time. For ships heading into a strong current, the speed over the ground is low and the speed through the water is great. The primary problem reported by the pilots when going against a strong current is the sensitivity of ship to steerage. Small ship angles relative to the current tend to become larger because of the lateral forces acting on the bow of the ship and must be quickly counteracted to keep the ship under control.

3) **Sundown Island (also known as Bird Island).** Another risk factor faced by ships in the existing MSC Entrance results from a cross current entering the channel from the northeast during an ebb tide cross currents resulting from flow leaving the channel toward the northeast during flood tide. Sundown Island creates an area of variable horizontal current velocity in the channel that impacts ships as they travel southwest of the island.

4) **Pass Cavallo.** Pass Cavallo, the natural inlet to Matagorda Bay, is located southwest of the MSC Entrance Channel It is important that any alternatives considered for corrective action to the MSC Entrance Channel, or placement of dredged material, not affect the current conditions of Pass Cavallo.

ERDC report TR 11-8 “Risks to Navigation at the Matagorda Ship Channel Entrance, Texas” compiled a listing of potential risk probability assessment method and subsequent evaluation of the MSC entrance channel. The evaluations documented in this report included ship simulations for both non-structural and structural options to reduce hydrodynamic factors that would influence the probability of ship groundings. The ERDC report also included a synopsis of a Coast Guard National Ports and Waterways Safety Assessment (PAWSA). That study included Port Lavaca which is serviced by MSC. The ERDC report includes following information on the Coast Guard study.

> The U.S. Coast Guard (USCG) conducted a risk-based decision-making process to evaluate the need for and plan future vessel traffic management projects. Ports and Waterways safety Assessment (PAWSA) workshops were completed in 28 ports around the United States between 1999 and 2001. Port Lavaca was one of the 28 ports. The port risk model includes 20 risk factors as shown in Table 19. The typical workshop panel was composed of pilots, port authorities, environmental interest groups, recreational and commercial fisherman, USCG, Corps of Engineers, tug and towboat operators, local and state officials, etc. Note that this evaluation is based on the entire MSC channel whereas the study

conducted herein only evaluates the gulf entrance to just south of the old GIWW.

Based on information from all 28 ports, Port Lavaca ranked high in the following of the 20 categories considered:

- 3rd in percent of high-risk shallow draft.
- 7th in volume of shallow draft vessels.
- 7th in volume of fishing and pleasure craft.
- 3rd in tide and river currents.
  (Behind: (a) Berwick Bay that has 5-6 knot river currents during floods with primarily barge traffic and (b) Port Everglades that has variable and strong cross currents and larger number of ships).
- 1st in waterway complexity.
- 4th in volume of hazardous chemical cargoes.

In summary, the navigation safety problems identified at the MSC Entrance Channel are:

- Strong currents through the land cut (i.e., the bottle neck) cause safety risk and transportation delays. Cross currents equal or exceed 3 knots 60% of the time, resulting in a delay in navigation vessels safely entering the MSC.
- Cross-currents at the intersection of the bay and the Entrance Channel of the MSC cause navigation safety risk and scouring behind jetties resulting in instability of the jetties. Any jetty breach caused by a strong storm that is not quickly repaired may rapidly expand and cause additional discharge associated with strong and dangerous currents.
- The risks to navigation have been independently recognized and documents.
- Local measures have been put in place in order to minimize risk at the expense of project operation.

4.2 Without Project Conditions

The without project conditions (project without corrective action) are generally the same as described for the existing conditions discussed in Section 3. The channel is not functioning as intended.

The “Daylight Restricted Vessel Movement Criteria” implemented by the Matagorda Bay Pilots will continue to be in effect. Based on the estimated dimensions for the original design vessel provided by the USACE Deep Draft PCX (594' LOA x 94' beam x 34' draft)

the restrictions indicate that vessel meeting any design criteria dimension or larger would be restricted (Criteria 1, 2, & 5) to daylight operation. These daylight restrictions will continue to limit MSC operations to less than 12 hours a day in 12 of 12 months of the year.

4.3 Plan Formulation

4.3.1 Planning Opportunities

Opportunities include the following:

- Develop a plan for corrective measures to correct the project deficiency and reduce navigation safety concerns at the MSC Entrance to enable the existing project to function as intended in a safe, viable, and reliable manner.
- Minimize impacts to the existing ecosystem in the vicinity of the MSC Entrance, while maximizing benefits through beneficial use of material removed for the recommended corrective measure over a 50 year period of analysis.

4.3.2 Planning Objectives

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

- Identify a safe, cost effective, environmentally acceptable corrective action to address a project deficiency of the MSC Entrance Channel, by reducing the currents in the Entrance Channel, cross currents at the intersection of the channel and the bay, and channel scouring.

4.3.3 Planning Constraints

Constraints are restrictions that limit the planning process. Plan formulation involves meeting the study objectives while avoiding constraints. Specific study constraints include:

- The study process and plans must comply with Federal and State laws and policies;
- Recommendation should not contribute significantly to the closure of Pass Cavallo;
- Enlargement of Sundown Island should not increase shoaling in the GIWW or increase safety risks;
- Material used for beach restoration should not re-enter the MSC;
- Impacts to fish and wildlife habitat should be minimized as much as possible.

4.3.4 Plan Formulation Process

Planning objectives and constraints form the basis for subsequent plan formulation, alternative screening and the identification of the RCA. The expected Future Without Project (FWOP) Condition (synonymous to the "No-Action Plan") was developed for comparison with other alternatives. Non-structural and structural alternatives were developed. Development of the RCA first considered alternatives to correct the deficiency resulting from current velocities in the MSC Entrance Channel, as well as strong cross currents at the intersection with the bay. Once an alternative was identified that would adequately address the deficiency, alternatives for disposal of the dredged material were considered. The final recommendation is to correct the deficiency and dispose of the dredged material.

4.4 Alternatives to Correct the Deficiency

4.4.1 No Action Alternative

USACE is required to consider the option of "No-Action" as one of the study alternatives. With the No Action Plan (i.e., the FWOP), it is assumed that no project would be implemented by the Federal Government or by local interests. The No-Action Alternative consists of not removing the bottleneck in the MSC Entrance which would result in continuing unsafe navigation conditions. Maintenance of the Entrance Channel between the jetties would continue under existing practices in accordance with the Environmental Impact Statement (EIS) titled "Maintenance Dredging MSC, Texas" and EIS titled "MSC, Ocean Dredged Material Disposal Site Designation".

4.4.2 Non-Structural Alternatives

Non-structural alternatives do not alter the existing condition. These alternatives contain operational measures that reduce or avoid hazards, such as waiting for conditions that allow safe transit of ships, increased spacing time between vessels, reduced vessel speeds, and providing pilots or guides during times when the current is high. These measures were already in use to minimize the effects of the deficiency. However, the safety issues created by the design deficiency are not alleviated.

The three non-structural alternatives considered in this study are

- Daytime-only transits
- Transits allowable only in conditions with cross currents that are less than 5 knots
- Real-time broadcasts of the current meter.

4.4.3 Structural Alternatives

Since this PDR relies on analysis previously completed, structural alternatives considered were limited to those evaluated under prior studies and reports... The design alternatives for the report originated in the ERDC 2006 Jetty Stability Study, pages 20 and 21. In particular, the study evaluated three structural alternatives to address the design deficiencies of the MSC Entrance.

The structural alternatives for corrective action are:

- Existing Condition (No Action)
- Structural Alternative 1: Removal of the West bottleneck only
- Structural Alternative 2: Removal of the East and West bottleneck only
- Structural Alternative 3: Removal of the East and West bottleneck and adding a flare at the bay/channel intersection

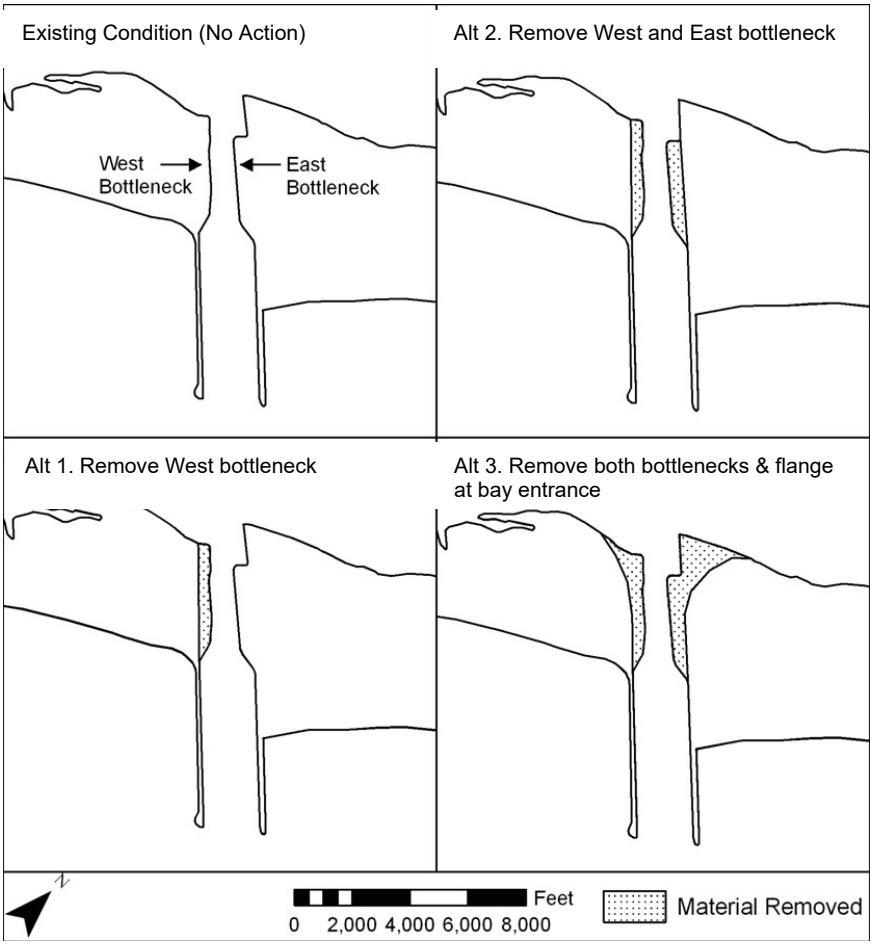

Figure 4-1 Jetty stability alternatives evaluated in ERDC/TR-06-7

4.4.4 Summary of Hydrodynamic Comparisons of Structural Alternatives

ERDC used the ADCIRC model to calculate model current velocities and discharges for the 3 structural alternatives as well as for the calibrated existing without project condition. The description of hydrodynamics and alternative evaluations are identified in the ERDC/CHL TR-06-7, Matagorda Ship Channel, Texas: ERDC Jetty Stability Study (ERDC Jetty Study). In particular, the high magnitude of current velocity was of main interest because of its impact on navigation safety as well as on channel scouring around the jetties and revetment. Six stations between the bayside and gulf-side of the entrance channel were compared under two time periods within a year (January 2004 and 12 July to 10 August 2004) to represent impacts of differences in seasonal wind speeds. The speeds were identified in both flood and ebb tidal conditions.

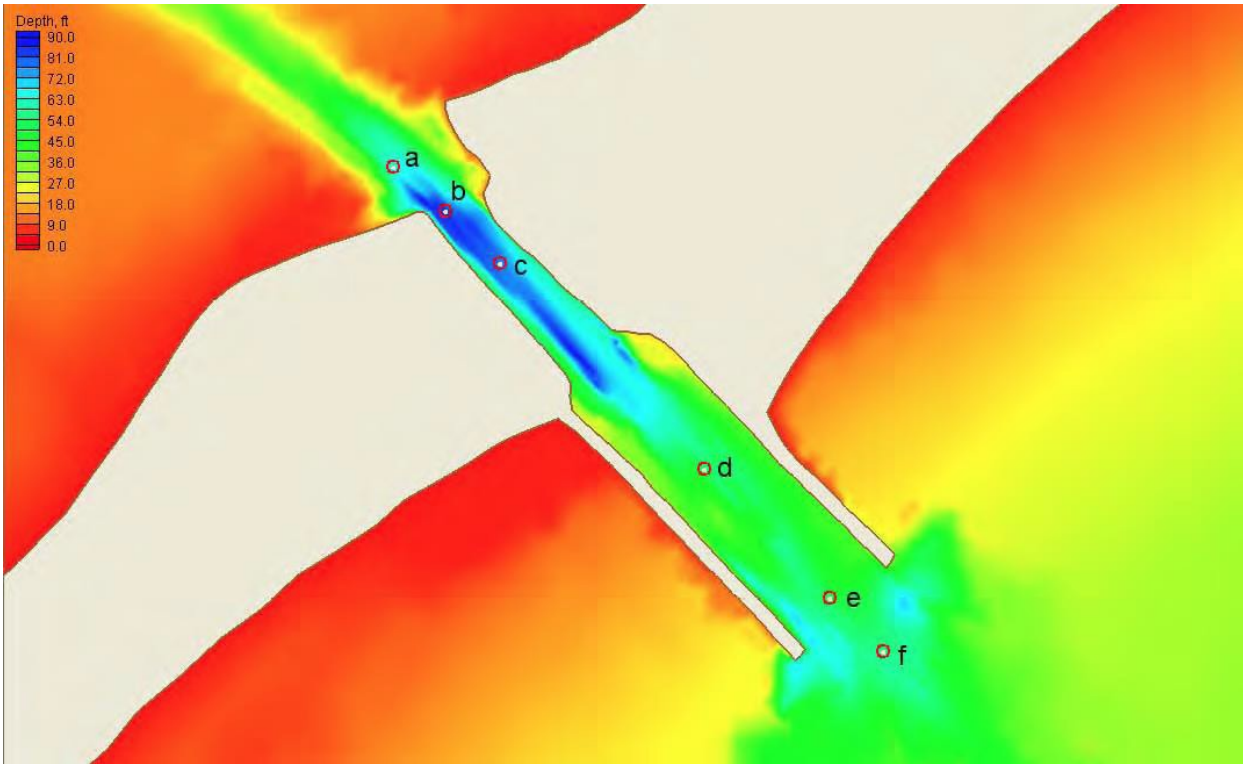

Figure 4-2 Locations of Stations Used for Modelling

The ERDC Jetty Study calculated maximum flood and ebb current speeds for each of the 6 stations for both time periods (January 2004 and 12 July-10 August 2004). The results for both tidal conditions for the existing conditions and each alternative are displayed in 4 tables in the ERDC Jetty Study. The study also includes several figures that identify percent exceedance diagrams of flood and ebb current velocities calculated at each of the 6 stations and each of the time periods. All of the differences in results were compared between the 3 alternatives, measured against the existing, or no action, condition. Finally,

the study contains pie charts of the results of percent occurrence of calculated flood and ebb conditions in both time periods for the 3 alternatives for two of the stations: c and e.

Overall, Alternative 2 and 3 had similar reductions in longitudinal current velocities from the existing condition at stations b and c. Alternative 2 had 19-27 percent reductions while Alternative 3 had reductions between 20-29 percent. Alternative 3 provided the greatest current reduction to existing conditions at station b where a scour hole exists. The 2 alternatives provide substantial current magnitude reductions from the existing condition for both tides at the bay side of the MSC Entrance. At the gulf side the current in the middle of the channel increases substantially during flood tides compared to the existing condition. This is inevitable because the cross section of the channel increases in the with-project condition, allowing more water to exchange (flux). However, in Alternative 2 the lack of a flair modification the east bayside transition to the entrance channel, coupled with a greatly increased channel cross-section, allowed significant cross current velocities in the bayside approach reach to the entrance channel near station a to remain. Alternative 3, with the flair modification to the east bayside transition, demonstrated superior velocity reduction at station a. for all scenarios modeled in the 2006 ERDC report. As a result of cross current and scour concerns all further consideration of the full bottle neck removal included the flared transition feature and Alternative 2 was dropped.

4.4.5 Summary of Risk Comparisons of Alternatives

The 2011 ERDC report TR11-8 included evaluations using ship simulation modeling to assess the impact of various structural alternatives on cross currents impacting navigation and a Ship Event Model (SEM) to evaluate the various navigation scenarios in determining the probable risk for groundings. Discussion of the evaluations are located on pages 121-142 of the ERDC report.

The ship simulation modeling was applied to evaluate the risk reduction potential of the bottleneck modification alternatives developed in the earlier 2006 EDRC/CHL TR 06-7 report. The vessel employed in the simulation was a tanker with dimensions of length between perpendiculars = 584’, beam = 86’, and draft = 36’, which is very similar to the dimensions attributed to the design vessel identified in the original DM (594' LOA x 94' beam x 34' draft).

Cross currents at both the Bayside and gulf side of the entrance channel pose complex navigational conditions creating lateral vessel movement as the ships are entering the fast currents in the bottleneck. However, the alternatives considered are unable to directly affect the occurrence of those cross currents. Management of velocity within the

entrance channel allows for mitigation of cross current effect. Based on the hydrodynamic modeling and ship simulation results it was determined that only the complete removal of the bottleneck was an effective solution relative to the critical risk factor of cross currents on exiting the bay side of the entrance channel. The options involving removal of only one side of the bottleneck resulted in a worsened cross current conditions based on elicitation from the pilots performing the simulations. The full removal of the bottleneck also resulted in some increase in cross currents but reduced longitudinal velocities within the entrance channel, which resulted in an overall improvement in ship handling exiting the entrance channel. This effectively eliminated all alternatives other than the full removal of the bottleneck as a viable structural option. The ship simulation evaluation results are located on pages 135-142 of the ERDC report.

The SEM model combined the relative probabilities of grounding from the expert elicitation of the pilots with various statistical distributions of the relative occurrence and magnitude of longitudinal current, cross current, ship category, ship direction, tide direction and magnitude, and visibility (night transit, fog, etc…). It is important to note that none of the evaluations provided cross current data that would allow modification of the SEM score based on that critical metric. The model allows the creation of an aggregate score for risk of grounding. The SEM was run for structural and non-structural navigation risk management options and all the potential combinations of navigation parameters and 21,960 ship transits over a 30 year period. Transits are based berthing data for vessels similar in class to the design vessel and provided an average of 366 per year, with each berthing representing 2 transits of the entrance channel.

The existing channel condition was run for all the parameter combinations with no restrictions or modifications and produced an average relative risk score of 1330. The existing channel condition was also run with a combination of parameters reflecting the lowest possible risk conditions, as defined by channel pilots, and used a risk baseline. It should be noted that even applying the combination of parameters with the lowest possible perceived risk, the risk score for the existing condition was not zero. The baseline risk score of 494 was approximately 1/3 the value of the total average risk score for the unmodified / unrestricted conditions. The baseline score was applied to the final risk scores to allow normalization of the values for each risk management option versus a “No Action” base condition to a scale of 0-1 to facilitate plan comparison. However, it should be noted that “Daylight Restricted Movement” is the currently the Existing Condition. The equation applied to normalized scores is:

(Alternative SEM rating - 494) / (Base SEM rating – 494)

Table 4-1 presents a comparison of the relative risk performance of the evaluated non-structural and structural alternatives based on both the Ship Simulations and the SEM modeling. The comparison of normalized risk scores includes values based on the "No Action" base condition utilizing the equation above. Although the partial removal of the bottleneck was not modeled in the SEM, the risk score has been estimated here as similar to the full removal of the bottleneck. In reality the reduction of longitudinal velocities produced by this alternative would likely result in a lower SEM score. More critically however, the result of the Ship Simulation modeling identified that this partial removal alternative would worsen the cross current conditions. The SEM evaluation results are located on pages 127-128 of the ERDC report.

Table 4-1 Alternative Risk Comparison

Alternative	SEM Rating	Normalized Risk Reduction Score vs Base	Longitudinal Current Effect	Cross Current Effect
No Action Base Condition*	1330	1.00	Moderate to High Risk	Moderate to High Risk
Daylight Restriction**	1218	0.87	Moderate to High Risk	Moderate to High Risk
Channel Velocity Restriction	1279	0.94	Moderate Risk	Moderate to High Risk
Partial Bottleneck Removal	1241***	0.89	Moderate Risk	High Risk
Full Bottleneck Removal	1181	0.82	Moderate Risk	Moderate Risk

*The No Action Base Condition excludes any restriction or channel modification.

** Daylight Restriction is the Operational Existing Condition

*** Not modeled, assumed to be 60% of full removal based on ERDC/CHL TR 06-7

4.4.6 Analysis and Comparison of Risk Management Alternatives

In order to develop a performance based comparison of the alternatives an estimate potential consequences from navigational impacts was developed. Nation Transportation Safety Board report MAR 15/01 describes of incident in the Houston Ship Channel from 2014 providing the extent and nature of a relatively small oil spill (546 tons ~ 168,000 gallons, from a single fuel barge).

> "The oil spill reached its greatest extent of impact on April 10, when about 13 miles of shoreline were heavily oiled and about 40 miles were lightly to moderately oiled. The oil spill endangered several environmentally sensitive areas located on or along about 160 miles of coastline. One of the most impacted areas was Matagorda Island, a 38-

mile-long barrier island located about 120 miles southwest of Galveston, containing about 26,000 acres of salt marsh and tidal flats."

"At the peak of the response in early April, more than 2,200 personnel from 18 federal, state, and local agencies, as well as contractors from about 80 businesses, were working on the salvage, containment, decontamination, and cleanup operations.23 They also organized and staffed the command center. About 150 volunteers per day helped survey and flag oiled beaches and wildlife to cleanup crews following behind.24 Between the Galveston and Matagorda area commands, as of April 14, 2014 (about 3 weeks after the spill), deceased wildlife included 32 dolphins, 22 other mammals, 401 birds, 38 reptiles, and 5 sea turtles. Only six oiled birds were able to be successfully treated and released."

An estimate of the spill cleanup cost was produced based on oil cleanup cost information (1997 dollars) taken from a paper presented at the 1999 International Oil Spill Cleanup Conference. The estimated range of cost just for the oil cleanup could be from $5.25 - $13.3 million, depending on the average cost per ton, and relative precision applied. A mid-range estimate for oil spill cleanup would be roughly $9.25 million. However, we do not have any information on which to base the complete cost of environmental response and losses, nor the economic disruption cost. It appears that these costs could be relatively broad for this incident, or similar incidents, in this region. Based on the description of the response and impacts the estimate for oil cleanup was doubled, and rounded up to account for the environmental response and the local economic disruption. This produces an estimate of consequence of approximately $20 million dollars.

The 2011 ERDC technical report engaged in a thorough review of methodologies for determining a probability for grounding in a given channel. Ultimately ERDC applied a grounding probability of 0.0007 for the Matagorda Channel from that assessment. With this probability, a potential annualized value for consequence of $14,000 would result. Because the SEM provides a "relative" probability for reduction of risk, normalized versus the existing condition it can be applied to the grounding probability of 0.0007 for existing conditions. As an example applying the SEM relative value of 0.82 achieved by the bottle neck removal to the 0.0007 existing grounding probability a modified grounding probability of 0.00057 results for that alternative. Correspondingly the annualized consequence value is reduced to $11,400.

Using the existing grounding probability and estimate consequence value relative and applying the relative risk reduction performance for each of the considered alternative a

form of cost effectiveness analysis was performed, and is presented in Table 4-2. It should be noted that there is considerable scaling of consequence from incident to incident, as well as adjustments from the 1997 price levels.

In considering the comparison of the various alternative actions, as considered through multiple study efforts, it should be kept in mind that there are several confounding factors. One is that the Daylight Restricted Movement alternative is in place as the existing condition, and as such has no associated cost. In addition, it should be considered that neither of the non-structural measures, daylight restriction or the velocity restriction, technically modify risk related conditions. Rather, they prevent risk by inhibiting vessel movement.

Table 4-2 Relative Cost Effectiveness Comparison

	Alternative	Cost X $1,000	Normalized Risk Reduction Score vs Base	Annual Consequence	Longitudinal Current Risk SEM Based Score	Cross Current Risk Ship Simulation Based
1	No Action Base Condition*	$0	1.00	$14,000	Moderate to High	Moderate to High
2	Daylight Restriction**	$0	0.87	$12,180	Moderate to High	Moderate to High
3	Channel Velocity Restriction	$200	0.94	$13,160	Moderate to High	Moderate to High
4	Partial Bottleneck Removal	$38,000	0.89***	$12,460	Moderate	High
5	Full Bottleneck Removal	$76,112	0.82	$11,400	Moderate	Moderate
6	Alt 2+3#	$200	0.81	$11,340	Moderate to High	Moderate to High
7	Alt 2+3+5#	$76,312	0.63	$8,820	Moderate	Moderate

*The No Action Base Condition excludes any restriction or channel modification.

** Daylight Restriction is the Operational Existing Condition

*** Not modeled, assumed to be 60% of full removal based on ERDC/CHL TR 06-7

#Description of the evaluation methodology is assumed to allow the SEM risk scores to be additive.

From a technical evaluation standpoint another confounding factor is the coincident effect of cross-currents. The alternatives can only mitigated, rather than modified, the impact of cross currents, as previously discussed. For the structural alternatives these risk impacts were apparent in the Ship Simulation modeling but only translated to the SEM model in a qualitative manner, and did not influence the SEM scores. As has been previously documented the modelers instead generally screened out those structural alternatives that hydrodynamic or Ship Simulation modeling indicated worsened the cross current condition. The partial bottleneck removal alternative is presented, but as indicated creates divergent navigation risk conditions.

A final consideration regarding this cost effectiveness comparison is that the ERDC risk assessment did not evaluate the effects of any combinations of alternatives. While the bottleneck removal alternatives are mutually exclusive, each of those options and the remaining alternatives would be potentially, although perhaps not desirably, combinable and compound the lowering of risk.

ERDC, in Technical Report 11-8, concluded that Structural Alternative 3 best reduced the navigation safety conditions associated with the strong currents in the Entrance Channel, and reduced the scouring resulting from the crosscurrents at the intersection of the channel and the bay. The nonstructural alternatives reduce risk but do not modify any of the channel conditions of concern to navigation. Therefore Alternative 3, removal of the east and west bottleneck and adding a flare at the bay/channel intersection, was selected as the structural alternative to correct the project deficiency. This includes removal of the bottleneck on both the east and west side of the land cut. In order to accomplish this the existing rock dike would be removed and set back approximately 400 to 500 ft., providing a 2000 ft. width to align with the existing jetties.

4.5 Alternatives for Placement of Dredged Material

Alternative 3 would result in approximately 5 million cubic yards (MCY) of dredged material. The ERDC 2011 Dredged Material Placement Study considered several alternatives for placement of dredged material associated with removal of the bottleneck. Alternatives considered for dredged material disposal in this PDR were limited to those that were previously evaluated.

Alternatives for dredged material placement are:

- Dredged Material Placement Alternative 1 (Existing Condition/No Action): The bottleneck remains in place, and current OMRR&R practices for dredging and disposal of the existing channel continue.
- Dredged Material Placement Alternative 2: All of the material placed on the beach located south of the west jetty. (Plate W-011).
- Dredged Material Placement Alternative 3: 25% of the material placed at Sundown Island, and 75% of the material placed on the beach located south of the west jetty with 3.75 MCY placed on the beach in a 390 acre disposal area (Plate W-005), and 1.25 MCY placed on Sundown Island in a 71 acre disposal area (Plate W-006).

4.5.1 Comparison of Dredged Material Placement Alternatives

The Wetland Value Assessment methodology (WVA) was used to evaluate the effects to fish and wildlife resources. Implementation of the WVA requires that habitat quality and quantity (acreage) are measured for baseline conditions, and predicted for future without and future with-project conditions. Each WVA model utilizes an assemblage of variables representing the suitability of different habitat types needed to support a diversity of fish and wildlife species. The Barrier Island WVA Model_09092011.xlsx Version 1.0 (WVA Model) approved and provided by the ECO-PCX was used.

The WVA provides a quantitative estimate of project-related impacts to fish and wildlife resources. Although, WVAs may not include every environmental or behavioral variable that could limit populations below their habitat potential, they provide a cost-effective means of assessing creation and restoration measures in coastal wetland communities.

The product of a Habitat Suitability Index (HSI) value and the acreage of available habitat for a given target year is known as the Habitat Unit (HU) and is the basic unit for measuring Project effects on fish and wildlife habitat. HUs are annualized over the Project life to determine the Average Annual Habitat Units (AAHUs) available for each habitat type. The change (increase or decrease) in AAHUs for each future with-project scenario, compared to future without-project conditions, provides a measure of anticipated impacts. A net gain in AAHUs indicates that the Project is beneficial to the fish and wildlife community within that habitat type; a net loss of AAHUs indicates that the Project would adversely impact fish and wildlife resources.

For the recommended structural corrective action, 82 acres consisting of 40.07 Average Annualized Habitat Units (AAHUs) of barrier island habitat would be directly impacted by dredging and placement of material. In order to offset this impact the dredged material placement alternatives were compared using WVAs. Dredged Material Placement Alternative (DMP) 1 is the existing condition that has zero dredged material placement.

DMP 2:

This alternative consists of placing all of the dredged material on the beach located south of the west jetty.

Placement at the Beach: Approximately 5 MCY of material would be placed in the surf zone south of the west jetty for beach restoration. As the material is discharged, it would be reworked by wave action, and the deposited sand would migrate along the seashore with the littoral drift. The proposed project would provide the benefit of reducing the recessional trend of the shoreline, thus preserving the beach and its habitat. This area was cut off from long-shore sediment transport when the channel and jetties were constructed.

With implementation of DMP 2, 498 acres and 29.92 AAHUs of beach habitat would be restored by placement of the material. The initial dredged material fill height would be placed to 3 ft. MLLW. The deposited sand would migrate down the shoreline overtime. DMP 2 would not offset the project's impacts.

DMP 3:

This alternative consists of placing 25% of the dredged material at Sundown Island, and 75% of the dredged material on the beach located south of the west jetty.

Placement at Sundown Island: The placement of dredged material on Sundown Island would directly create a 51-acre sub-aerial island adjacent to Sundown Island with a 73-acre underwater footprint. The initial dredged material fill height would be placed to 6 ft. MLLW. The WVA Model projected that the 51-acre island feature would provide 30.58 AAHUs over the 50 year Native salt marsh species on Sundown Island are expected to colonize the area within 3 growing seasons.

Placement at the Beach: Placement of dredged material at the beach would directly restore 300 acres 17.01 AAHUs of beach habitat. The initial dredged material fill height would be placed to 3 ft. MLLW. As the material is discharged, it would be reworked by wave action, and the deposited sand would migrate along the seashore with the littoral drift. The proposed project would provide the benefit of reducing the recessional trend of the shoreline, thus restoring the beach and its habitat.

This alternative would provide a total of 47.59 AAHUs with both the beach and island features. Table 4.7 below compares AAHUs for the alternatives.

Table 4-3 Net AAHUs Created Disposal Plans

Alternative #	AAHUs lost	AAHUs created	Net AAHUs
DMP 1	0	0	0
DMP 2	40.07	29.92	-10.15
DMP 3	40.07	47.59	+7.52

4.5.2 Recommended Dredged Material Placement Alternative

When comparing the AAHUs for each DMP, it is important that the AAHUs created meets or exceeds the AAHUs impacted by the recommended structural corrective action, which has a loss of 40.07 AAHUs. There are no changes to AAHUs for DMP 1 since it is the existing condition. DMP 2 creates 29.92 AAHUs which results in a net loss of approximately 10 AAHUs. DMP 3 provides 47.59 AAHUs which offsets the AAHUs impacted by the recommended structural corrective action, and provides a net gain of approximately 8 AAHUs. Therefore, DMP 3 is recommended for placement of the dredged material. It places all of the material dredged on the western side of the Entrance Channel and half of the material dredged on the eastern side would be placed on the beach, and placement of the remaining material dredged from the eastern side of the channel on Sundown Island. Disposal locations are shown in Figures 4-3 and 4-4 below.

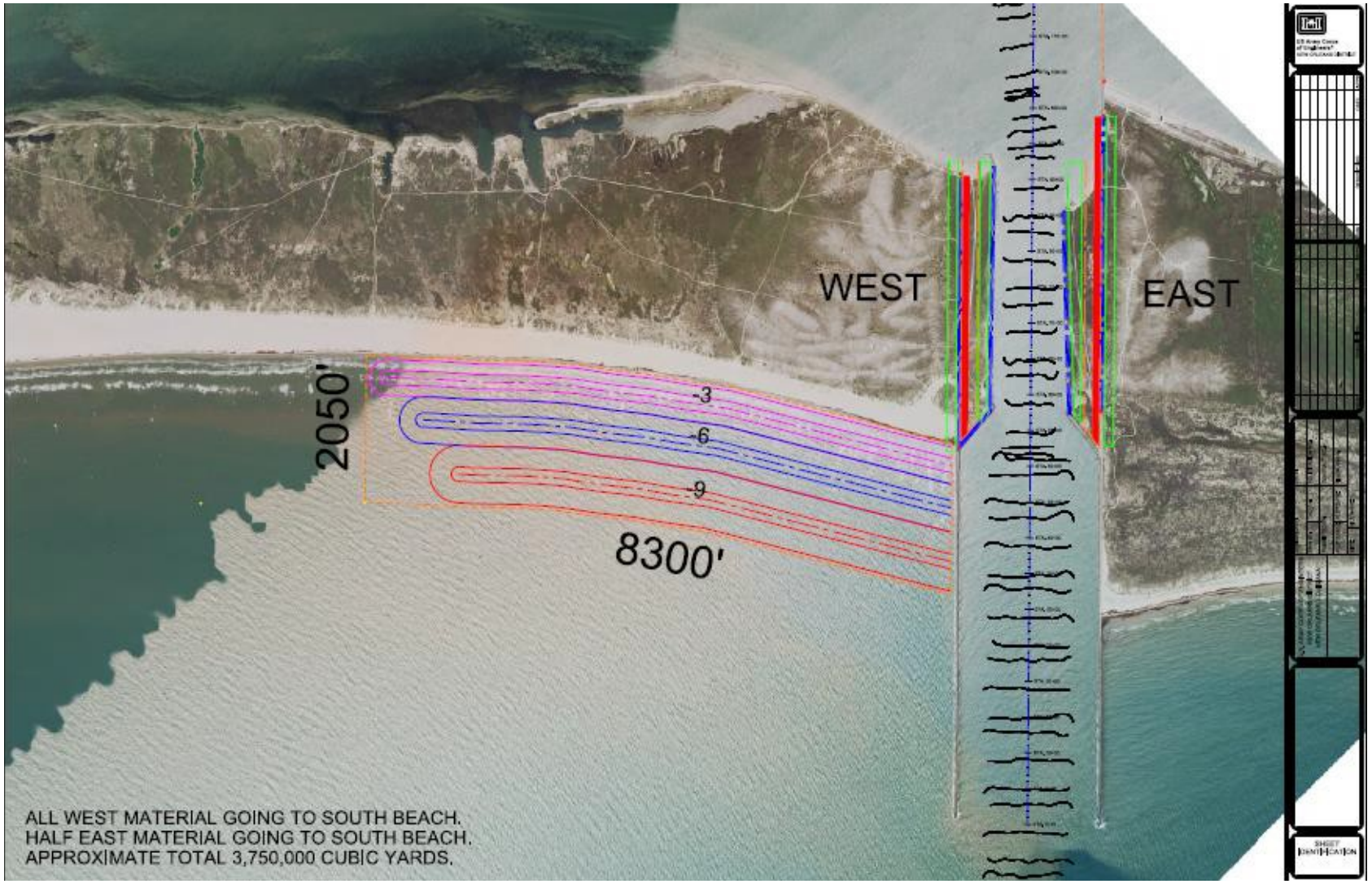

Figure 4-3 DMP 2 Placement on the Beach

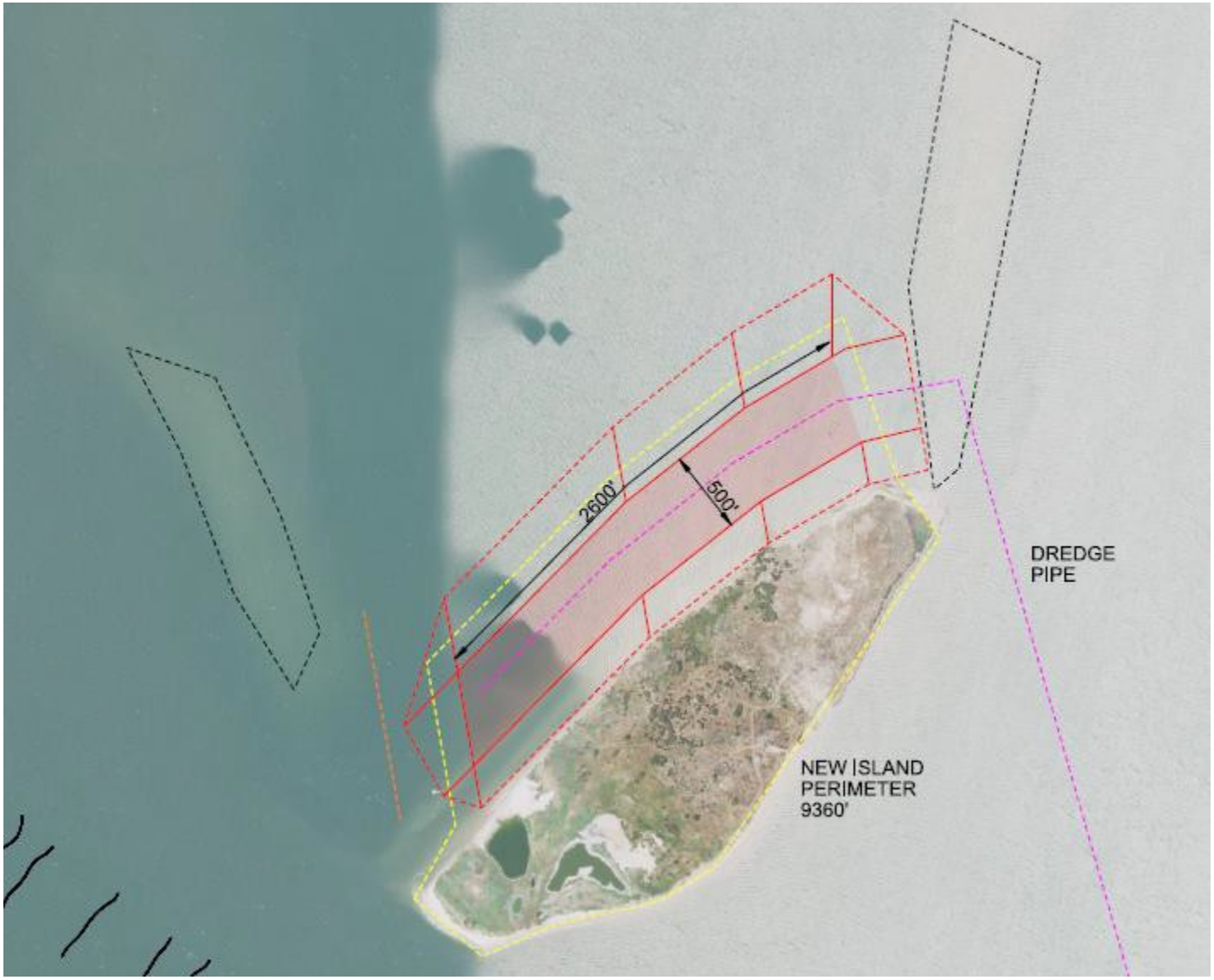

Figure 4-4 DMP 2 Placement on Sundown Island

5 THE RECOMMENDED CORRECTIVE ACTION (RCA)

Based on the previous analysis completed by ERDC, the RCA to correct the project deficiency at the MSC Entrance Channel includes removal of the bottle neck on both sides of the channel, and the addition of a flare at the intersection of the Entrance Channel and the Bay (Structural Alternative 3). ERDC modeling indicated that this alternative best meets the goals and objectives of the project by reducing the currents in the Entrance Channel; reducing cross currents at the intersection of the Entrance Channel and the Bay; and preventing channel scouring, all of which would allow for safe navigation of ships. For placement of the dredged material, the alternative which places 25% of the material at Sundown Island, and 75% of the material on the beach located south of the east jetty is recommended (Dredged Material Placement 3). This alternative minimizes the impacts to the existing ecosystem through beneficial use of dredged material. Together they comprise the RCA.

5.1 Detailed Description of the RCA

The RCA includes removing the existing rock dike on both sides of the channel and reusing the stone to construct a new 2,800-ft dike on the west bank and 3,800-ft dike on the east bank of the MSC. A barge canal would be mechanically dredged to a depth of -14 MLLW from the bay side and dredged material would be placed in the permanent placement area behind the new dikes and in temporary placement areas to be hydraulically dredged later. A 3 ft. blanket of stone would be placed for armoring the new channel slopes from elevation +4.0 to -17 ft. MLLW. The full width of the MSC Entrance Channel would be widened from the existing 950 ft. to 2,000 ft. Dredging would be performed using a hydraulic cutterhead dredge to a depth of -40 ft. MLLW. Approximately 2,454,000 cubic yards (cy) would be dredged on the west channel side and placed in a 344-acre placement area (Plate W-005).

The material would be discharged in the surf zone adjacent to the west jetty for beach restoration. Approximately 2,454,000 cy would be dredged on the eastern channel side; half would be placed in the surf zone adjacent to the west jetty. The other half would be placed adjacent to Sundown Island on the northwestern side creating a 51-acre island expansion with a 73-acre water bottom footprint. Three areas of existing large jetty stone, 1,950 linear ft. (1.4 acres) would be removed and reused for construction of the flare on the bay side. The flare extensions from the foreshore dikes are approximately 850 ft. on the west side and 860 ft. on the east side. (Plates W-001 through W-007 in the Engineering Appendix show the construction sequence for removal and placement of dredged material.)

5.2 Engineering and Design

5.2.1 Geotechnical Investigations

Between 1961 and 1962, twenty eight (28) undisturbed 6-inch borings were made in the vicinity of the channel entrance. These were made along both the jetty alignments and the channel alignment. Additional soil borings were not performed for this study. Additional borings were not needed for this effort. See Engineering Appendix B for more detail.

As discussed in the Engineering Appendix B, analysis of the referenced historic boring logs indicate that the foundation materials, in general, consist of medium to very dense fine sands to an elevation of about 60 to 65 ft. below MLLW. Thin seams of soft clay were encountered in some borings at depths varying from 20 ft. to 40 ft. below MLLW. Below the sands, the plastic to stiff red clay of the Beaumont Clay formation of the Pleistocene Age is encountered. The information available from the historic boring logs was used to investigate settlement and stability analysis of implementing the RCA during construction, and long term performance of the project once construction is complete. Results of this analysis are included in Appendix B.

5.2.2 Civil Design

The RCA requires removal of the existing shoreline protection foreshore dike and jetty stone spurs, clearing of vegetation and non-earthen debris from the proposed dredge footprint, dredging of the bottleneck reach to an expanded top width of 2000’ (matching the jetty reach configuration), disposal of the dredged material, construction of a flared section at the bayside limit of the land cut, and placement of erosion protection on the newly dredged channel shoreline alignment. The flare design is the same configuration as presented in the Design Memorandum, No. 3, Appendix, Exhibit 2, published in January 1962. It represents a conservative in-kind design. Engineering Appendix B provides a detailed assessment of the construction sequence and quantities to complete this work.

5.3 Real Estate Requirements

The Real Estate Plan included in Appendix D provides a detail description of the real estate requirements for the RCA. Within the project footprint there are four (4) existing perpetual easements and two (2) existing disposal areas. The Real Estate Plan provides a description of the existing required easements along with a brief description of the

necessary additional easements required. The NFS is required to furnish all Land, Easement, Real Estate, Relocation, and Disposal (LERRDD) for the RCA.

5.4 Aids to Navigation (ATONs)

There are several Aids to Navigation that may require relocation in order to implement the RCA. These include a light near channel station 0+000 and lighted buoys near channel station 3+800.

5.5 Operation and Maintenance

A Preliminary Project Assessment (PPA) for Dredged Material Management Plan (DMMP) for the MSC was prepared in January 2000, and describes the current dredging and disposal practices for the MSC. For navigation, the Entrance Channel from the Gulf of Mexico through to Matagorda Bay is approximately 2.8 miles long and maintained to a depth of 40 ft. MLLW, and a width of 300 ft. Maintenance dredging occurs on a 4 year cycle by hopper dredge with all material placed in an offshore open water disposal area. Dredging records dating back to 1970 indicate a yearly average of 375,152 CY dredged from this reach.

Once the RCA is implemented, additional O&M is not anticipated. The navigation channel will continue to be maintained under current O&M practices. Anytime a strong storm causes a jetty to breach, it is important that they continue to be quickly repaired. Otherwise, strong flows and associated sediment erosion and accumulation could occur during tidal cycles that cause rapid expansions of the openings. Therefore, jetty inspections need to be conducted immediately following strong storms.

5.6 Value Engineering

Value Engineering (VE) is a process used to study the functions a project is to accomplish. As a result, the VE team takes a critical look at how these functions are met, and it identifies alternative ways to achieve the equivalent function while increasing the value, and the benefit to cost ratio of the project. The project was studied using the USACE standard VE methodology. A VE Study was completed in April 2011, with a final report provided in July 2011 (Appendix H), as part of the Engineering Deficiency Report.

The VE Study proposed alternatives related to slope protection measures along the bottleneck, and alternatives for disposal of the dredged material. Responses to the VE Study recommendation are included in the report. Most of the recommendations were not

adopted. There is one that was further considered and is included in the recommendations of this PDR.

The VE study noted that removal of the existing rock, and placement of new rock accounted for a large percentage of the total construction cost. Alternative 1 in the VE study recommended reusing the existing rock. The RCA includes reusing the existing rock, and placing it on the slopes of the channel alignment.

5.7 Risk and Uncertainty with the RCA

Risk and uncertainty are intrinsic in water resources planning and design. The following describes risk and uncertainty associated with the RCA.

5.7.1 Environmental Factors

The endangered Kemp's Ridley sea turtle could potentially nest along the Matagorda Island beaches. The US Fish and Wildlife Service (USFWS) recommended avoiding beach disposal during the sea turtle nesting season April 1 to September 15 and SWG agreed. The construction sequence is flexible enough to accommodate the nesting window therefore the risk level is low. There is the potential for the threatened piping plover and red knot to use the bay and beach shoreline for wintering habitat. Surveys would be performed to identify the presence/absence of plovers and coordination with the USFWS would be initiated if needed, therefore the risk level is low. For Sundown Island placement, a previous commitment was made to place dredged material between September 1 and February 28 to avoid the colonial bird nesting season. Based on the proposed action, there is a low potential to affect historic properties. These affects consist of direct impacts from earth moving and dredging activities related to construction and impacts from dredged material placement, specifically disturbance of the gulf and bay bottom. In a letter dated October 25, 2018, the Texas State Historic Preservation Officer determined that the proposed work poses no adverse effect to land and submerged cultural resources... A Phase 1 Environmental Site Assessment (ESA), has been completed for the project area. The records and database searches identified one Formerly Used Defense Site (FUDS). No signs of Hazardous, Toxic, and Radioactive Waste (HTRW) were found during the site visit. Based on information gathered during the Phase I ESA, there is a low probability of encountering munitions and explosives of concern or HTRW at this site. No further HTRW investigation related to the proposed project is necessary.

5.7.2 Real Estate Acquisition

The Real Estate Plan (Appendix D) describes existing perpetual easements associated with the MSC, and the need for additional easements for construction of the RCA, and disposal of the material removed from the Entrance Channel bottleneck. The RCA requires a non-standard disposal easement of 9.51 acres of land adjacent to the current existing easement on the east bank of the Entrance Channel as well as an additional 39.49 acres located east of the current existing easement.

The assumption is that Calhoun Port Authority has the ability to obtain the required LERRD to remove the bottleneck sections of the Matagorda Ship Channel Entrance. This risk is there are undivided land owners interest in Matagorda Peninsula with no less than 400 potential unidentified land owners. These uncertainties may result in increased project cost and delay in schedule, which are captured in the Cost and Schedule Risk Analysis (CSRA).

5.7.3 Relative Sea Level Change

Engineer Technical Letter (ETL) 1100-2-1, *Procedures to Evaluate Sea Level Change, Impacts, Responses, and Adaptation*, dated June 30, 2014, requires that the Corps consider unknowns in Relative Sea Level Change. EM 1100-2-8162 provides USACE Guidance for incorporating the direct and indirect physical effects of projected future sea level change across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects. To account for the unknowns in sea level change the Corps considers “high”, “intermediate”, and” low” estimates of sea level change projections.

The USACE Sea Level Change Curve Calculator (2017.55) was used to perform the Relative Sea Level Change (RSLC) calculation for the MSC Entrance. See Reference 8. NOAA station ID 8774770 (Rockport, TX) was selected as the referenced gage. The project start year is 1992. The estimated RSLC from 1992 to 2100 at NOAA Gage 8774770 is provided at Figure 5-1. The provided figure has three different RSLC estimates. The “low” rate curve is the historical RSLC. The “intermediate” rate of local mean sea level change is estimated using the modified National Research Council (NRC) Curve I and is corrected for the local rate of vertical land movement. The “high” rate of local mean SLC is estimated using the modified NRC Curve III and is corrected for the local rate of vertical land movement. The low, intermediate and high RSLCs between two years can be obtained from the following figures for each specific year and subtracted them to obtain RSLCs between two interested years.

Therefore, the “low”, “intermediate”, and “high” RSLCs estimated for MSC Entrance could be 0.85 ft., 1.32 ft., and 2.81 ft. respectively, for a 50-year period (2020 – 2070). The “low”, “intermediate”, and “high” RSLCs estimated for MSC Entrance could be 1.69 ft., 2.73 ft., and 5.99 ft. respectively, for a 100-year period (2010 – 2100).

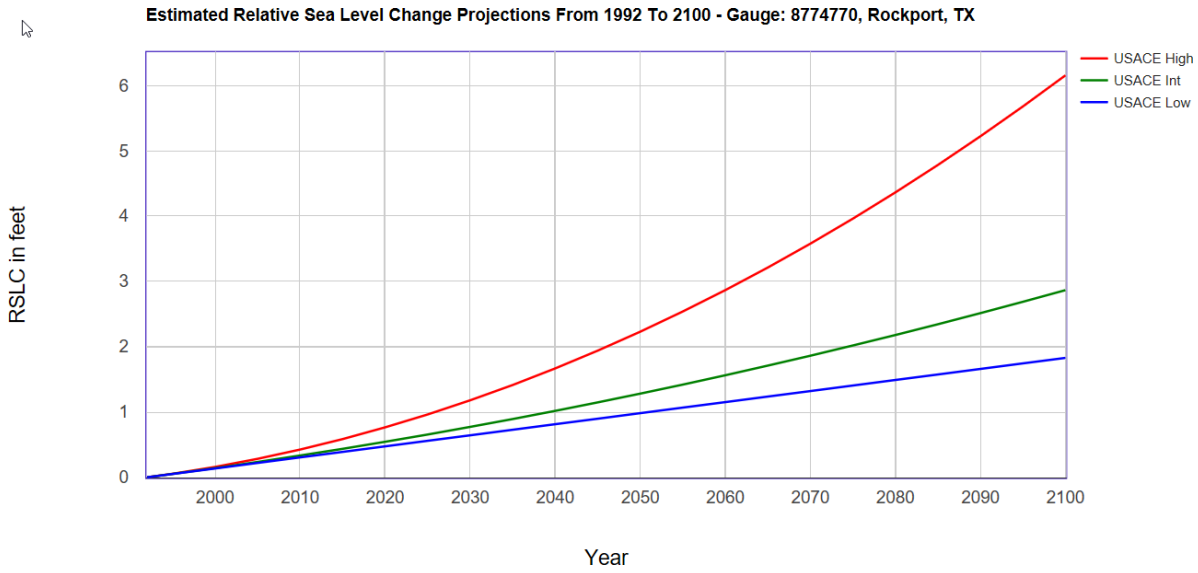

Figure 5-1 RSLC Estimates for Specific Year at NOAA Gage 8774770 (Rockport, TX)

Widening and deepening projects on channels historically do not have impact on altering the relative sea level change rate. It is not expected that sea level change (low, moderate, or high estimated values) will change the functionality or performance of the proposed design. The selected design has included the consideration to counter increases in currents that may arise from sea level change. Any additional impacts from relative sea level change on surge are also expected to be insignificant.

According to NOAA Gage 8774770 (Rockport, TX), the tidal datum and extreme water levels could be as high as 5.20 and 6.18 NAVD88 feet for a 50- and 100-year return frequency, respectively. Therefore, a rock berm of 5.20 and 6.18 NAVD88 feet height will be needed to protect shoreline erosion from a 50- and 100-year return tidal datum and extreme water levels, respectively. Stated in TR-OX-X (Page 68), ERDC recommends that the SWG consider a sand berm that would be temporary or a more permanent rock extension to stop overwash that is presently occurring and appears to be expanding in area. The berm or extension should connect the existing jetty root to higher ground. The berm or extension would greatly reduce the potential for flanking failure of the MSC Entrance.

By considering RSLC, an additional height needs to be added to the tidal datum and extreme water level. Therefore, a rock berm of 6.05, 6.52 and 8.01 NAVD88 feet high, respectively, will be needed for shoreline protection if the design will consider the low, intermediate and high RSLCS for a 50-year return frequency. A rock berm of 7.87, 8.91 and 12.17 NAVD88 feet high, respectively will be needed for shoreline protection if the design will consider the low, intermediate and high RSLCS for a 100-year return frequency.

5.7.4 Cost and Schedule Risk

The CSRA was performed to identify issues that could impact the estimated construction cost and duration. Several factors were identified in the CSRA as key risks. The Risk Register from the CSRA is included in Appendix C. Risk to the project cost included the following high risk items: contact modifications and fuel prices. Moderate risk to the project cost included: production rates and real estate acquisition. Additional low risk items were also identified, and are shown on the risk register. Based on the identified risk, the cost estimate for the construction contract, design and construction management, and Lands and Damages include a 30 percent contingency.

Risk to the project schedule included the following high risk items: real estate acquisition; availability of funding; construction modifications; and fuel prices. Fifteen moderate and low risk items were also identified and are shown on the risk register. The identified schedule risk resulted in a 12.17 month construction schedule. The project has a 402% contingency for the total project schedule of 61.7 months over the base schedule of 12.3 months. The contingencies for cost and schedule are based on the formal Crystal Ball risk analysis process.

5.8 Project Cost

5.8.1 Design and Construction Costs

The draft cost estimate for design and construction of the RCA is provided in Appendix C. This cost estimate is subject to change based on the results of reviews. The final certified cost will be included prior to finalization of the report.

The draft cost estimate reflects a price level as of October 1, 2020. The first cost for the design and construction of the deficiency corrective action is $76,112,000 as detailed in the cost estimates. The fully funded cost for the design and construction of the RCA is $78,712,000. These costs were developed using III Version 4.2 in accordance with

guidance in Corps engineering regulations. A summary of the cost is provided in Table 5-1.

Table 5-1 Project First Cost and Fully Funded Cost

Cost Account	Construction General – General Navigation Features (GNF)		
		Project First Cost ($K) *October 2020 Price Level*	**Fully Funded Cost ($K)** *October 2020 Price Level*
02&09	Relocations & Channels and Canals	$59,778	$62,038
01	Lands and Damages	$4,292	$4,292
30	Planning, Engineering and Design	$7,226	$7,330
31	Construction Management	$4,817	$5,051
	Total Correction Action Cost	**$76,112**	**$78,712**

5.8.2 Cost Sharing

Additional authorization is not required for construction to correct the deficiency. Per ER 1165-2-119 *Modifications to Completed Projects,* corrective action for a design or construction deficiency falls under the original project authority. In addition the ER states that cost sharing for correction of the design or construction deficiency should be consistent with the cost sharing in the original project authorization. Authority to correct the deficiency falls under the RHA of 1958 which authorized the deep draft navigation channel from the Gulf of Mexico through Pass Cavallo. At the time of construction of the project the channel was cost shared 50/50 between Federal and non-Federal responsibility. Corps policy is that the currently applicable project cost sharing should be used for the cost sharing of design deficiencies, which is reflected, for example, in Engineer Pamphlet 1105-2-58, Continuing Authorities Program, 01 March 2019 (replacing Appendix F of Engineer Regulation 1105-2-100), Section 25.c:

> "If the study concludes that a deficiency exists, the corrective works will be processed as a new project decision. Design and implementation work will be carried out under the original PPA, once it has been modified to reflect the addition of the deficiency correction work under the new decision document, and will be cost shared consistent with the applicable CAP Section. However, if there is not an existing PPA for the project, one will be prepared to cover design and implementation work necessary to correct the design deficiency."

The original PCA specified a cost of share of 50/50, and no exception was requested of the ASA (CW). Therefore, the cost sharing requirement to implement the RCA, per ER 1105-2-100, would be in accordance with current WRDA guidelines. Subsequent to the most recent revision of ER 1105-2-100, Appendix F, the WRDA of 2016 revised the cost share for construction of deep draft navigation projects. Per Section 1111 of WRDA 2016, **t**he Federal cost share for the PED and construction is 75% and the non-Federal cost share is 25% for General Navigation Features (GNF) with project depths between 20 and 50 ft depth. Construction to correct the design deficiency will fall under the cost share requirements of WRDA 2016. The only GNF features considered for this project are removal of the bottleneck and disposal of the dredged material.

The NFS must provide all project LERR required for the construction. Per ER 1105-2-100, Appendix E, Exhibit E-1, the required post-construction deferred NFS cash contribution is equivalent to 10 percent of the total project cost of the GNF of the Project, plus the applicable statutory rate of interest. The NFS payment of the 10 percent cash contribution is deferred until after completion of the project, or completion of a separable element of the project and is payable over a period not to exceed 30 years. The deferred 10 percent NFS cash contribution is reduced by the value of the LERR provided by the NFS.

Table 5-2 reflects the cost allocation for the RCA at October 2020 price levels.

Table 5-2 Cost Share

	Total ($K)	Federal Plan Federal Cost ($K)	Non-Federal Cost ($K)
General Navigation Features		**75%**	**25%**
PED	7,225	5,419	1,806
Construction	59,519	44,639	14,880
Construction Management	6,815	5,111	1,704
Subtotal Construction of GNF	**71,559**	**53,669**	**17,890**
Relocations	259	0	259
Lands, Easements, and ROW	4,292	0	**4,292**
Lands, Easements, Relocations and ROW (LERR)	**4,551**	0%	100%
Aids to Navigation	0	0	0
10% of GNF (less LERR)[1]	3,060	0	3,060
Total Project First Costs	**$76,112**	**$55,169**	**$22,941**

[1] The NFS will be required to make a cash contribution towards the 10% of the GNF cost less the cost of LERR. [(GNF*10%)-LERR] = [$76,112,000*.1 = $7,611,200- $4,551,000+incidental cost) = ($3,060,200)].

5.9 View of Non-Federal Sponsor

The NFS, CPA, supports and recognizes the importance of the project and the recommendations to correct the deficiency at the MSC Entrance. The NFS provided a Letter of Intent dated May 8, 2019 and Statement of Financial Capability dated (Insert date). In the letter of intent the NFS provided the following statement of support for the recommendation:

CALHOUN
Port Authority
POINT COMFORT, TEXAS*USA

(361) 987-2813, Fax (361) 987-2189 • 2313 FM 1593 South • P.O. Box 397 • Point Comfort, Texas 77
www.calhounport .com

PORT OF PORT LAVACA - POINT COMFORT

Providing Calhoun County Industries with Direct Deep-Draft Access toGlobal Markets

May 8, 2019

Colonel Lars N. Zetterstrom
Galveston District
U.S. Army Corps of Engineers
P. 0. Box 1229
Galveston, Texas 77553-1229

Re: Matagorda Ship Channel, Project Deficiency Study, Matagorda County

Dear Colonel Zetterstrom,

The Calhoun Port Authority of Calhoun County, Texas extends its full support for the Matagorda Ship Channel, Project Deficiency Study, Matagorda County. We understand in July, 2016, The U.S. Army Corps of Engineers Headquai1ers concurred in the proposal to conduct a study to identify a practical modification to ensure the safe and reliable operation of the Matagorda Ship Channel, Texas project. An engineering deficiency is a flaw in the Federal des ign or construction of a project that significantly interferes with the project's authorized purposes or full usefulness as in tended by Congress at the time of original project development. Corrective action, therefore, falls within the purview of the original project authority. The conclusion of the Study will result in an approved Project Deficiency Report and Environmental Assessment in the May-June , 2019 timeframe.

The current plan (Structural Alternative 3 and Dredged Material Placement Alternative 3) calls for the removal of the Jetty Channel " bottleneck" and expand the top width of the Jetty Chaimel by dredging; construction of bayside flairs with the removed dredged material and placement of erosion protection along the widened Jetty Channel reach. We are committed to this project and are willing, able and fully prepared to execute a Project Partnership Agreement (PPA) at the earliest opportunity wherein our cost is estimated to be approximately $22.546 million and $3.802 million in Lands and Damages and Relocations credits. This expenditure will be pendin g congressional funding.

The Calhoun Port Authority supports the conclusions of this study and understand the importance of this project. We remain committed to working with our partners to identify funding strategies and are committed to keeping this project moving forward.

Thank you once again for the good work of the Galveston District. Please contact me if you need any additional information.

Sincerely,

J. C. Melcher, Jr.
Chairman
Calhoun Port Authority

/dmk

Board Members: J. C. Melcher, Jr. Board Chair; Shields A. Holladay , Sr., Board Secretary; H. C. Wehmeyer, Jr.; Johnny J. Perez; Luis De La Garza; Jasper "Jay" Cuellar
Executive Staff: Charles R. Hausmann, CPA, Port Director; Forrest E. Hawes, Deputy Port Director; David **M.** Knuckey, P.E., Direc tor, Engineering Services;
David Roberts, Port General Counsel

(This Page Intentionally Left Blank)

6 PUBLIC INVOLVEMENT AND AGENCY COORDINATION

6.1 Environmental Impacts

In accordance with NEPA, and in compliance with ER 200-2-2, Procedures for Implementing NEPA, an Environmental Assessment (EA) has been prepared to analyze and document the potential impacts of the RCA and reasonable alternatives to the natural and human environment. A copy of the EA for the RCA is included in Appendix A.

The EA provides an assessment of the environmental consequences for each of the alternatives considered, including the RCA. The following provides a summary of the overall cumulative impacts of implementing the RCA. The final array of Alternatives presented in this are the No- Action, Alternative 2, and Alternative 3 (RCA). The impacts analysis of these three alternatives are discussed in Chapter 4 of the EA. The EA discusses the environmental effects of the RCA (referred to as Proposed Action in the EA), compared to the No-Action Alternative or Future Without-Project condition.

Alternative 1: No-Action Alternative. The no-action alternative is not removing the bottleneck in the MSC and continuing to have unsafe navigation conditions in the MSC. Maintenance of the entrance channel between the jetties would be discharged in the offshore disposal site in accordance with the FEIS titled “Maintenance Dredging Matagorda Ship Channel, Texas” and FEIS titled “Matagorda Ship Channel, Ocean Dredged Material Disposal Site Designation”.

Alternative 2: Bottleneck Removal with 100% Placement on the Beach. Approximately 5 million cubic yards of material would be placed in the surf zone south of the west jetty for beach restoration resulting in the creation of 498 acres and 29.92 AAHUs of beach habitat. As the material is discharged, it would be reworked by wave action, and the deposited sand would migrate along the seashore with the littoral drift. The RCA would provide the benefit of reducing the recessional trend of the shoreline, thus preserving the beach and its habitat. This area was cut off from long-shore sediment transport when the channel and jetties were constructed.

Alternative 3: Bottleneck Removal with 75% Beach and 25% Sundown Island Placement. Approximately 3.7 million cy of material would be placed in the surf zone south of the west jetty for beach restoration resulting in the creation of 300 acres and 17.01 AAHUs of beach habitat. As the material is discharged, it would be reworked by wave action, and the deposited sand would migrate along the seashore with the littoral drift. The proposed project would provide the benefit of reducing the recessional trend of

the shoreline, thus preserving the beach and its habitat. This area was cut off from long-shore sediment transport when the channel and jetties were constructed.

The placement of approx. 1.2 million cy of dredged material would directly create a 51-acre subaerial island adjacent to Sundown Island with a 73-acre underwater footprint. The WVA Model projected that the 51-acre island feature would provide 30.58 AAHUs over the 50-year Native salt marsh species on Sundown Island are expected to colonize the area within 3 growing seasons. This alternative would provide a total of 47.59 AAHUs with both the beach and island features.

Impacts to resources are discussed throughout Section 4.0 of the EA. Important resources within the proposed project area include water exchange, current velocity, salinity, sea level change, coastal barrier resources, wetland, aquatic resources, fisheries and essential fish habitat, wildlife, aquatic nuisance species, threatened and endangered species, water quality, air quality, noise, sediment quality, recreational resources, cultural resources, socio-economics, and hazardous, toxic, and radioactive wastes. The following resources have been considered and found to not be affected: aesthetics, environmental justice, submerged aquatic vegetation, and prime and unique farmland soils. Because the project is located on a remote barrier island, it was determined there would be no direct disproportionately high or adverse human health or environmental effects on any minority and/or low-income populations as per E.O. 12898. No, prime and unique farmland soils, as defined by the Farmland Protection Policy Act, would be affected by the proposed project.

Since the proposed project consists of new work dredging to correct design deficiencies in an existing navigation channel any new and initial impacts to ecological resources would occur primarily during the new work dredging to construct the project. Because the recommended plan is located on barrier islands and in open water, direct impacts of corrective actions are limited to coastal barrier islands, open water, and bay bottom habitats. These habitats consist of dunes and water bottoms that is ubiquitous in Matagorda Bay and the Gulf of Mexico. Impacts to other resources are temporary, minor, or both (e.g. aquatic resources, wildlife, water quality), or will not occur (e.g. prime and unique farmland soils). Therefore, no significant impacts from dredging or placement of dredged material are expected. Full details of impacts are discussed in Section 4.0 of the EA.

Cumulative impacts are those impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or persons undertake such actions. Cumulative

impacts can result from individually minor but collectively significant actions taking place over a period of time. Impacts include both direct effects (caused by the action and occurring at the same time and place as the action), and indirect effects (caused by the action but removed in distance and later in time, and reasonably foreseeable).

The economy of Port O'Connor, TX, is deeply rooted in tourism, commercial fishing, and marine commerce. As a result of a long history of continuing urbanization and commercialization, both land and water resources in the project vicinity have been altered. Past and present projects involving alterations of land and water within the vicinity of the MSC Deficiency Project include the original construction and maintenance of the MSC, the original construction and maintenance of the nearby GIWW, development and ongoing modification of private dwellings on Matagorda Island, and oil & gas exploration. Reasonably foreseeable future projects in the vicinity of the project include improvements to infrastructure and the existing MSC navigation channel. A few representative projects are listed below:

1) Matagorda Ship Channel, TX Section 216 – Review of Completed Projects Draft Integrated Feasibility Report and Environmental Impact Assessment
2) GIWW maintenance
3) Gulf Intracoastal Waterway, Brazos River Floodgates and Colorado River Locks, Texas Project addresses modifications to the Brazos River Floodgates (BRFG) and Colorado River Locks (CRL) to improve navigation through the BRFG and CRL structures in Brazoria and Matagorda Counties, TX.
4) Matagorda Liquified Natural Gas Project
5) Matagorda Island residential development

From a NEPA standpoint, proposed bottleneck removal between the jetties would occur within an area that has undergone channel construction and maintenance dredging in the past as well as residential development. As such, the area is considered a disturbed area with little to no vegetated shoreline because of previous placed stone when compared to other areas of the Matagorda Bay.

The project would temporarily displace fish and wildlife species and marine benthic organisms during construction activities. Mobile fish and wildlife species would relocate to nearby suitable habitat. Much of the benthic substrate in the project footprint is poor quality disturbed habitat due to the vessel traffic. As such, impacts to the benthic population from construction of the project are considered negligible.

The water column and water quality would be temporarily affected by turbidity during construction activities during periodic maintenance dredging north of the entrance. The

MSC Deficiency Project would have long term beneficial impacts on the socioeconomics of tenants and customers in the project area by eliminating vessel wait time of the existing vessels calling on port facilities.

In conclusion, the anticipated adverse impacts of the proposed project to human health and the environment are minimal and would not significantly contribute to the cumulative effects of past, present, and future projects within the project vicinity. The result of the project would provide a safer navigation channel for the port and the public.

6.2 Environmental Compliance

The EA went out for a 30-day public review. The review is discussed in detail in Section 6.3. Environmental compliance is complete. The following coordination was completed and is included in Section 8.0 of the Final EA.

Endangered Species Act

The evaluation of the presence of threatened and endangered (T&E) species is summarized in Section 3.1.10, and potential project impacts are discussed in Section 4.9.2 of the EA. The evaluation for T&E presence included the most recent U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) listings for the subject counties, and coordination through Texas Parks and Wildlife Department (TPWD). A final Biological Assessment (BA) that discusses the potential impacts to federally listed species in detail is included as Appendix B of the EA.

These federally listed protected species may occur in the Project Area, but the RCA is not likely to adversely affect them: the piping plover, piping plover critical habitat, red knot, Kemp's ridley sea turtle, non-nesting green sea turtle, and non-nesting loggerhead sea turtle. The following measures are proposed to prevent or minimize potential adverse effects to threatened and endangered species to the extent practicable.

- Piping plover and red knot surveys would be performed when the USACE gets confirmation that the proposed project is going to be funded for construction. If these species are found during surveys, the USACE will reinitiate consultation with the Service to review the potential effects of the work on these species and establish conservation measures to avoid take, harm, or harassment. If construction schedule allows, work affecting the piping plover would be conducted outside of wintering season (July 15 to May 15).
- The USACE has committed to avoiding beach placement of dredged material during

sea turtle nesting season (April 1 to September 15).

• If construction occurs during October - March, best management practices for addressing cold stunned and stranded sea turtles would be incorporated into the project Plans and Specifications requirements.

• Dredging for the proposed project would be primarily conducted using hydraulic cutter head dredges which have been found to avoid the taking sea turtles in the water.

USFWS agrees that with the implementation of the conservation, avoidance and minimization measures noted above, the likelihood of an impact occurring to the piping plover, red knot, and Kemp's ridley sea turtle is at present insignificant and discountable. USFWS, therefore, concurs with the determination that the project may affect, but is not likely to adversely affect these species nor is it likely to adversely modify critical habitat in a letter dated December 4, 2018.

Fish and Wildlife Coordination Act

USFWS provided a planning aid letter (PAL) to assist with the planning of the proposed project by providing comments and recommendations related to impacts on fish and wildlife resources. The USFWS recommends:

1. Additional coordination, possibly further consultation, will be needed when funding becomes available for the project. USACE concurs.
2. Conduct work affecting plover and habitat outside of wintering season (July15 to May 15). USACE would conduct plover and red knot surveys when the project receives funding.
3. No survey work for nesting sea turtles has been conducted for this area. Nesting has been documented within one mile of the RCA. USACE agrees not to dispose on the beach during the sea turtle nesting season (April 1 to September 15.)
4. Follow USFWS guidelines for coastal construction projects for identification and appropriate response for occurrence of the West Indian manatee. USACE concurs.
5. Access routes and staging areas for proposed work that will be done using trucks are not identified in the figures provided for the RCA in the MSCDP BA-EA. USFWS recommends that these be added, along with conservation measures where these are outside of the footprint of the project impact area. Access routes and staging are within the Project footprint.
6. The MSCDP BA-EA description also notes that the bulldozers may be used to work the material slated for the permanent disposal site. See comment above on staging and access routes for land equipment. Bulldozer work is within the project footprint.
7. USFWS recommends that placement of dredge material in the Gulf nearshore waters avoid the sea turtle nesting season of April 1 to September 15. USACE concurs.

8. USFWS recommends that placement of material on or near Sundown Island follow the guidance as outlined in the FEIS as follows: Only beach quality sand will be placed. Material will only be placed on Sundown Island between September 1 and February 28. USACE concurs.
9. USFWS recommends that the USACE consider using any leftover jetty stone on Sundown Island. USACE will consider this, if available.

Coastal Zone Management Act

In a letter dated January 8, 2019, the Texas General Land Office determined that the RCA will not have adverse impacts on coastal natural resource areas in the coastal zone and is consistent with the goals and policies of the Texas Coastal Management Program. Compliance with the Coastal Zone Management Act (CZMA) of 1972 is provided in Appendix E.

Coastal Barrier Resources Act

The evaluation of the CBRA is summarized in Section 3.1.5, and the potential project impacts is discussed in Section 4.5.2 of the EA. This Act was established to minimize the loss of human life, wasteful Federal expenditures, and damage to wildlife and natural resources associated with coastal barriers. Coastal barriers are defined as “bay barriers, barrier islands, and other geological features composed of sediment that protect landward aquatic habitats from direct wind and waves.” Further, the Federal government discourages development on designated undeveloped coastal barriers by restricting certain Federal financial assistance, including USACE development projects. The entire PA adjacent to Sundown Island is located in CBRS unit T-07P. A federal expenditure is allowable within the CBRS, if it meets any of the exceptions (16 U.S.C. § 3505(a)(1)-(5)). The RCA meets the following 6(a)(2) exception:

- The maintenance or construction of improvements of existing federal navigation channels (including the Intracoastal Waterway) and related structures (such as jetties), including the disposal of dredge materials related to such maintenance or construction. A federal navigation channel or a related structure is an existing channel or structure, respectively, if it was authorized before the date on which the relevant System unit or if portion of the System unit was included within the CBRS.

The MSC was authorized by the River and Harbor Act of 1958. The Act authorized construction of a deep-draft navigation channel from the Gulf of Mexico across the Matagorda Peninsula. In a response dated February 5, 2019, the USFWS concurs with

the SWG determination that the proposed project meets the 16 U.S.C. 3505(a)(2) Exception and has fulfilled its obligation to consult with USFWS under the CBRA. Compliance with the CBRA is provided in Appendix F of the EA.

Clean Water Act

Section 404 of the Clean Water Act (CWA) regulates dredge and/or fill activities in U.S. waters. Section 404(b)(1) of the CWA, for which the Section 404(b)(1) Guidelines were developed, regulates discharges of dredged or fill material to maintain the integrity of waters of the United States, including activities under the Corps Civil Works Program. The Proposed Action would require dredging in U.S. waters. The EA was prepared to support the decision-making process implementation of the Proposed Action, and the discussion of the impacts of the proposed action has taken into consideration the Section 404(b)(1) Guidelines. SWG evaluated the Proposed Action pursuant to Section 404(b)(1) of the CWA and signed the evaluation. This analysis is included in Appendix D of the EA.

The TCEQ is responsible for conducting Section 401 certification reviews of proposed Federal actions, including those proposed by USACE, for the purpose of determining whether the proposed discharge would comply with State water quality standards. A copy of the State Water Quality Certification, dated January 18, 2019, is included in Appendix G.

Clean Air Act

The evaluation of the Air Quality is summarized in Section 3.1.12, and the potential project impacts is discussed in Section 4.12.2 of the EA. In a letter dated September 18, 2018, the TCEQ agrees with the finding of no significant impact and has no objection to the Project. Compliance with the Clean Air Act (CAA) is provided in Appendix G.

Hazardous, Toxic and Radioactive Waste (HTRW)

HTRW is addressed in Section 5.0 of the EA provided in Appendix A. Based on information gathered during the Phase I ESA, there is a low probability of encountering MEC or HTRW at this site. No further HTRW investigation related to the proposed project is necessary, and the project may proceed as scheduled. The RCA will not involve sites or wastes regulated under the Comprehensive Environmental Response, Compensation and Liability Act of the Resource Conservation and Recovery Act.

National Historic Preservation Act (NHPA)

Compliance with the National Historic Preservation Act of 1966, as amended (54 U.S.C. § 306108), requires the consideration of effects of the undertaking on all historic properties in the project area and development of mitigation measures for those adversely affected properties in coordination with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation. Cultural resources conditions and impacts of the RCA are discussed in Sections 3.1.11 and 4.11.2, respectively. In a letter dated October 25, 2018, the Texas SHPO determined that the proposed work poses no adverse effect to land and submerged cultural resources. It has been determined, in consultation with the Texas SHPO and in accordance with 36 CFR 800.4, that the RCA will have no adverse effect upon historic properties within the area of potential effect.

Council on Environmental Quality (Memorandum; Prime or Unique Farmlands)

The RCA would not impact any lands considered prime or unique farmlands, as none of the soils found within the project vicinity are considered prime or unique farmland soils. In a letter dated September 10, 2018, the US Department of Agriculture indicated the proposed project is exempt from the Farmland Protection Policy Act and no further consideration for protection is necessary.

Executive Order 11988 (Floodplain Management)

Federal agencies are directed to evaluate the potential effects of proposed actions in floodplains. Although the RCA is located within a floodplain, the RCA would not cause increased flooding in developed areas, nor contribute to increased future flooding.

6.3 Public Involvement Activities

The public was provided an opportunity to comment on the RCA and proposed mitigation plan during the 30-day public review of the EA that started August 29, 2018 and ended on September 27, 2018. Notification was provided by posting the documents on SWG's public document review website: *(www.swg.usace.army.mil/BusinessWithUs/PlanningEnvironmentalBranch/DocumentsforPublicReview.aspx*), postcards mailed to adjacent property owners, and by mailing a public Notice of Availability to approximately 388 recipients. Copies of the Draft EA and FONSI were also sent to the Port O'Connor and Bay City branch libraries for viewing.

Comments submitted during that process were considered and addressed. Responses to the public comments are provided in Appendix H of the Final EA.

6.4 Coordination of Corrective Action with Federal and State Agencies

The RCA was coordinated with the USFWS, Texas Parks and Wildlife Department (TPWD), and National Marine Fisheries Service (NMFS). The EA and a Draft Findings of No Significant Impact (FONSI) was sent to Federal and State agencies including the following:

- Environmental Protection Agency Region 6
- NOAA 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
- Governor's Office of Budget and Planning
- Railroad Commission of Texas
- Honorable John Cornyn
- Texas Department of Transportation

7 CONCLUSIONS

The purpose of this PDR is determine if a project deficiency exists at the MSC Entrance, and provide a recommendation for corrective action that will ensure the project may perform as originally intended. The project meets all five criteria for a design or construction deficiency. The current configuration of the Entrance Channel results in strong currents that equal or exceed 3 knots more than 60 percent of the time and equal or exceed 5 knots 20 percent of the time. The currents exceed the criteria set forth in EM 1110-2-1613, which classifies a current of 3 knots as strong. These currents create navigation safety concerns, resulting in the need to correct the deficiency based on safety alone. Because these safety concerns are a result of the project configuration at the time construction this is a project deficiency and the corrective actions can be completed under the existing project authority.

Analysis by ERDC is that the structural measure that adequately corrects the deficiency is to remove the bottle neck on both the east and west side of the Entrance Channel, and to construct a flare at the intersection with the bay (Alternative 3). This configuration will reduce the strong currents in the Entrance Channel, and the cross currents in the bay/channel intersection by 20 to 30 percent with the corrective action. This is anticipated to result in approximately 40.07 AAHUs lost, in order to account, the recommendation to place 25% of the dredged material at Sundown Island, and 75% of the material placed on the beach located south of the east jetty is anticipate to create 47.59 AAHUs, offsetting the loss (Dredged Material Placement Alternative 3).

It is assumed that the channel will continue to be maintained under current O&M practices. Strong flows and associated sediment associated with strong storms can cause erosion and accumulation could occur during tidal cycles that cause rapid expansions of the openings. Therefore, jetty inspections and need to be conducted and breach repair need to take place immediately in the aftermath of strong storms.

The first cost for the design and construction of the RCA for the deficiency is $76,112,000 as detailed in the cost estimates. The fully funded cost for the design and construction of the deficiency corrective action is $78,712,000.

The environmental impacts of the RCA have been assessed and it has been determined that the RCA would have no significant impact upon water exchange, current velocity, salinity, sea level change, barrier island wetland, aquatic resources, fisheries and essential fish habitat, wildlife, aquatic nuisance species, threatened and endangered species, water quality, air quality, noise, sediment quality, recreational resources, cultural

resources, socio-economics, and cumulative impacts. Therefore, an EIS for the RCA is not warranted.

(This Page Intentionally Left Blank)

8 RECOMMENDATIONS

I, the District Commander, have reviewed the Project Deficiency Report, Finding of No Significant Impact, and Environmental Assessment, and have given consideration to all significant aspects in the overall public interest including but not limited to, environmental and engineering feasibility. Selection of the Recommended Corrective Action (RCA) considered alternatives, impacts, and views of the non-federal sponsor, interested agencies, and the concerned public. I hereby recommend construction of Structural Alternative 3: Removal of the East and West bottleneck and adding a flare at the bay/channel intersection along with Dredged Material Placement Alternative 3 as the RCA for the MSC project deficiency. This RCA would alleviate the ongoing navigation safety concerns at the MSC Entrance Channel and allow the project to function as originally intended. Because construction and O&M of the RCA can be implemented under the existing project authority, there is no need for new Congressional authorization. The project will be cost-shared 75-25 using Construction General funds.

I have determined that the RCA is in accordance with environmental statutes and the public interest, and is consistent with requirements described in applicable law, policy and guidance. I recommend the RCA with such modifications thereof as in the discretion of the Commander, Southwest Division, may be advisable.

_____ _____

Date

Timothy R. Vail
Colonel, U.S. Army
Commanding

(This Page Intentionally Left Blank)

REFERENCES

Kraus, N. C., Lin, L., Batten, B. K., and Brown, G. L. (2006). "MSC, Texas: Jetty Stability Study," Technical Report ERDC/CHL-TR-06-7, US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Vicksburg, MS. (Referred to as ERDC 2006 Jetty Stability Study)

Kraus, N. C., and Batten, B. K. (2008). "Morphologic Examination of the Stability of Pass Cavallo, Texas," ERDC/CHL-TR-08-6, US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Vicksburg, MS. (Referred to as ERDC 2008 Pass Cavallo Study)

Maynord, Stephen T., Seabergh, William C., Lin, L., Kraus, N.C., Webb, Dennis W. (Draft, October 16, 2007). "Evaluation of Risks to Navigation for the MSC Entrance," Technical Report ERDC/CHL-TR-0X-X US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Vicksburg, MS. [NOTE: this report was never published/finalized].

Maynord, Stephen T., Lin, L., Kraus, N.C., Webb, Dennis W., Lynch, Gary, Wahl, Ronald E., Leavell, Daniel A., Yule, Don E., and Dunbar, Joseph B., (August 2011). "Risks to Navigation at the MSC Entrance, Texas, Phase 2: Evaluation of Significant Risk Factors," Technical Report ERDC/CHL-TR-11-8 US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Vicksburg, MS.