Final Environmental Assessment
Expansion of Placement Areas 14 and 15
Houston Ship Channel
Chambers County, Texas

US Army Corps of Engineers ®
Galveston District

United States Army Corps of Engineers
Galveston District

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ACRONYM LIST

ARRA	American Recovery and Reinvestment Act
BA	Biological Assessment
BMP	Best Management Practices
BU	Beneficial Use (of dredged material)
BUG	Beneficial Uses Group
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
dB	Decibels
dBA	A-Weighted Sound Level

DMMP	Dredged Material Management Plan
EA	Environmental Assessment
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FWCA	Fish and Wildlife Coordination Act
GBANS	Galveston Bay Area Navigational Study
GLO	General Land Office
GMFMC	Gulf of Mexico Fisheries Management Council
HEP	Habitat Evaluation Procedure
HGB	Houston-Galveston-Brazoria
HGNC	Houston – Galveston Navigation Channel Project
HSC	Houston Ship Channel
HTRW	Hazardous, Toxic, and Radioactive Waste
ICT	Interagency Coordination Team
LRR	Limited Reevaluation Report
MLT	Mean Low Tide
MOA	Memorandum of Agreement
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
PA	Placement Area
PCB	Polychlorinated biphenyl
PHA	Port of Houston Authority
ppt	Parts per Thousand
SEIS	Supplemental Environmental Impact Statement
SH	State Highway
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
TCEQ	Texas Commission on Environmental Quality
TCMP	Texas Coastal Management Program
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
UCPA	Upland Confined Placement Area
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compound
WMA	Wildlife Management Area

1.0 INTRODUCTION

The purpose of this Environmental Assessment (EA) is to document changes to the Houston Galveston Navigation Channel, Texas (HGNC) Project and the potential environmental effects of those changes. A large portion of the work for the proposed project would be performed under the American Recovery and Reinvestment Act of 2009 (ARRA). The project would serve to expand HSC Placement Areas (PAs) 14 and 15 to increase dredged material placement capacity. PA 14 is an approximate 250-acre upland placement area and PA 15 is an approximate 288-acre placement area. The existing facilities would be expanded through the creation of a combination of an upland PA and beneficial use marsh PAs. Additionally, the project would reduce maintenance costs by removing additional material from the HSC for the construction of containment levees, thereby reducing the frequency of maintenance dredging.

This EA presents the potential environmental effects associated with the construction and operation of PAs proposed by the U.S. Army Corps of Engineers (USACE), Galveston District (the District). It describes the proposed project and presents the project purpose and need, alternatives, the affected environment, and consequences on the natural and human environment. The public was afforded the opportunity to provide comments on the proposed project. Appendix I provides the public comments received during the public notice period along with the District's responses to these comments.

This document is consistent with the National Environmental Policy Act (NEPA) of 1969 (42 USC § 4321) by describing the systematic, interdisciplinary evaluation of the potential effects to the natural and human environment for issues of concern. This EA has also been prepared to be consistent with the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500-1508), USACE Engineer Regulation (ER) 200-2-2 (*Environmental Quality: Procedures for Implementing NEPA*, 33 CFR 230), and ER 1105-2-100 (*Planning Guidance Notebook*).

1.1 Project History

Galveston Bay, the largest inland bay on the Texas coast, is a relatively shallow estuary located along the northeast Texas coastline. The bay is traversed by maintained, deep-water navigational channels which provide access to the deepwater ports of Houston, Texas City, Bayport, and Galveston. The HSC traverses Galveston Bay and provides access from the Gulf of Mexico to Houston. The HSC originally opened as a deep-water channel in 1914 at a depth of 25 feet. The HSC was deepened to 40 feet deep and 400 feet wide in the late 1950s and early 1960s as larger ships required more space for safe passage through the channel.

The HGNC Project is a comprehensive program to improve the Houston and Galveston Ship Channels to accommodate larger, more modernized, twenty-first century ships and to enhance navigational safety in the channels. The local sponsor for the project is the Port of Houston Authority. A feasibility study for improving both Houston and Galveston channels was completed in July 1987. The study was referred to as the Galveston Bay Area Navigational Study (GBANS) and a Feasibility Report and Environmental Impact Statement were produced. The 1987 Feasibility Report recommended improving the HSC to include a 50-foot deep by 600-foot wide channel from Bolivar Roads to Boggy Bayou, intermittent widening from Boggy Bayou to the Clinton Island Turning Basin, and Federal assumption of maintenance dredging in Carpenter's Bayou. The Galveston Channel was recommended to be widened to 50 feet deep and 450 feet wide. Due to the magnitude of the environmental concerns raised at Washington level review, the study took 2.5 years to complete. An interagency agreement was reached in response to the issues raised during the Washington level review whereby the environmental concerns would be addressed prior to submitting the 1987 Feasibility Report to Congress and that a reevaluation study would be performed.

The limited reevaluation report (LRR) responded to environmental issues raised during Washington level review, made recommendations for project implementation, and presented a Supplemental Environmental Impact Statement (SEIS). The LRR and SEIS were completed in November of 1995 and recommended that the channel dimensions be dredged to 45 feet deep and 530 feet wide (USACE, 1995). The Chief of Engineers Report agreed with the findings of the LRR and the SEIS was approved on May 9, 1996. The project was authorized for construction on October 12, 1996, by the Water Resources Development Act of 1996. Project construction began with the receipt of construction general funds in October of 1997.

During the development of the LRR and SEIS, an Interagency Coordination Team (ICT) was developed to assist in the development of the environmental documentation for the project that would fully address the environmental concerns for the proposed widening and deepening of the HSC and Galveston Ship Channel. Local, state, and Federal agency representatives comprised the ICT, which oversaw studies to support environmental documentation in the LRR and SEIS including contaminant studies, oyster model studies, benthic recovery studies, cumulative impact studies, oyster reef studies, ship-handling simulation model studies, three dimensional hydrodynamic and salinity model studies, and beneficial uses of dredged materials study.

The beneficial uses of dredged materials study was performed by a sub-committee of the ICT called the Beneficial Uses Group, or BUG. The BUG is a coalition of eight government agencies tasked with identifying environmentally and economically responsible ways to utilize the material dredged from the HGNC expansion. Government agencies comprising the BUG are the Port of Houston Authority, the USACE, the United States Environmental Protection Agency (EPA), the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Natural Resources Conservation Service (NRCS), the Texas Parks and Wildlife Department (TPWD), and the Texas General Land Office (GLO). Work by the BUG resulted in a plan in which all new maintenance materials would be placed in designated areas in the Gulf of Mexico, used beneficially in the Gulf or the Bay, or placed in confined upland areas.

The levee construction for PAs 14 and 15 was originally completed by the Bayport Development Corporation under USACE Permit Number 6140 in conjunction with the Bayport Ship Channel dredging project, which was completed in 1974. The continued use of PAs 14 and 15 for placement of dredged maintenance material from the Houston Ship Channel was address in the "Final Environmental Statement – Maintenance Dredging Houston Ship Channel, Texas" (dated 17 December 1975). The District assumed maintenance of the Bayport Ship Channel in 1993.

1.2 Location of the Project Study Area

For the purpose of this EA, the project study area encompasses Galveston Bay, Texas, in addition to all areas within a 10-mile radius having a center-point at the existing opening between PAs 14 and 15, including the communities of Kemah, Seabrook, LaPorte, and Baytown. This study area allows for a complete evaluation of indirect and cumulative environmental, social, and economical effects associated with the proposed project. Exhibit 1 presents a vicinity map of the project study area for this EA.

1.3 Proposed Action

The proposed action includes the expansion of HSC PAs 14 and 15 to provide additional capacity for placement of dredged material generated during maintenance dredging activities along the HSC and the Bayport Ship Channel. This work would involve the construction of an approximate 169-acre upland PA between PAs 14 and 15 and the construction of up to three marsh PAs, or beneficial use (BU) sites. A mitigation marsh site of 88 acres would be constructed at the Bolivar Marsh Site in lower Galveston Bay near Bolivar Peninsula. The location is shown in Exhibit 1. This mitigation area would provide compensation for the conversion of estuarine habit to uplands as a result of the construction of the proposed upland PA expansion.

The BU sites would be designed to create intertidal marsh. Dredged material from on-going channel maintenance operations would be placed into BU sites and they would be planted with marsh vegetation when the elevations of the sites reach an appropriate height. Exhibit 2 shows the project construction features. The material for hydraulically constructing the containment levees for the PA expansion and BU sites would be obtained by mining (dredging) clay material from the HSC between Morgan's Point and the Bayport Ship Channel, down to a maximum depth of 80 feet. In addition, material may be obtained from the advanced maintenance of the Bayport Ship Channel flare and from the planned dredging of berths at the Bayport Terminal. During initial construction activities, material for construction of the eastern levee of the expanded PA would come from non-wetland portions of the area immediately east of PA 15, and also from between PAs 14 and 15. The eastern levee of the PA expansion area would be constructed to an initial elevation of 10 feet. The west levee initially would be constructed of rock material barged to the site and mechanically placed to an elevation of 6 feet. This rock material would be subsequently used for armoring of an earthen levee that would be constructed in 2020. Both levees would be sequentially raised during dredging cycles to match the elevations of PA 14 and 15 levees.

The new upland PA would connect the existing upland PAs 14 and 15 and would be constructed and operated in a similar manner as the existing upland PAs. The initial construction of the levees would begin in 2010 and is expected to take approximately one year to complete. Approximately 89,000 cubic yards of rock and 167,000 cubic yards of earthen material would be used for the initial construction, which would cover an area of about 31 acres. A temporary opening would be incorporated into the west levee to allow continued vessel access to existing oil and gas production facilities located between PAs 14 and 15. It is expected that these facilities would either be relocated or modified sometime within the next 10 years to accommodate the proposed upland PA. The District anticipates that the levees would be functionally completed and the expansion area ready to receive maintenance dredged material around 2020. The capacity of the new upland PA would be approximately 10 million cubic yards.

The construction of the levees for two of the BU marsh sites, Cells M-10 and M-7/8/9, would be conducted concurrent with the initial construction work for the upland PA levees, beginning in 2010. During initial construction, openings would be left to allow for water circulation until the sites are filled. Filling with maintenance material would be done according to need during future maintenance dredging cycles. It is expected that the first placement of material into these sites would occur during the next dredging cycles after construction, which would be 2012 for the Bayport Ship Channel and 2013 for the HSC. Cell M-10, an approximate 305-acre BU site, would require approximately 400,000 cubic yards of material to construct 11,000 linear feet of levees that would cover an area of approximately 35 acres. The initial capacity of Cell M-10 would be at least 4 million cubic yards. Cell M-7/8/9, an approximate 392-acre BU site, would require approximately 408,000 cubic yards of material to construct 12,000 linear feet of levees that would cover an area of approximately 37 acres. Cell M-7/8/9 would have an initial capacity of at least 5 million cubic yards.

Although the construction of Cell M-7/8/9 is being implemented as part of the proposed project, this work was previously authorized as part of the HGNC channel deepening and widening project and the environmental impacts were assessed in a 1995 Supplemental Environmental Impact Statement (USACE, 1995). This BU site was originally planned as three marsh cells but these cells would be combined into one large cell contained by one perimeter levee in the proposed project.

Marsh Cell M-11 is a future BU site that would be constructed within the 424-acre area shown in Exhibit 2. The size, configuration, and timing of construction of this BU site have not been determined at this time. As in the proposed upland PA expansion area, there are existing oil and gas facilities located within the proposed site. These facilities also would be subject to relocation or modification to accommodate this BU site, depending on the final size and configuration. The District would coordinate the development of plans for Cell M-11 with the BUG and appropriate resource agencies.

The mitigation work at Bolivar Marsh would consist of the creation of intertidal marsh by constructing a mosaic of mounds, excavated circulation channels, and sacrificial berms. The details of the mitigation work are described in Section 5.0. The construction of the mitigation site would begin in 2010 during the initial levee construction for the upland PA expansion area. Since the initial funding for the proposed project is limited, the mitigation work would be completed either all at once or in two phases, depending on the cost. For evaluation purposes in this EA, it was assumed that the mitigation marsh would be created all at once. If the work is done all at once, the total acreage of mitigation marsh would be 88 acres. If completed in phases, the acreage would be more, due to habitat value being created later. In the first phase, the portion of the mitigation work necessary to provide compensation for the impacts of construction of the levees for the new upland PA (approximately 15 acres) would be completed in the first phase and the remainder of the work would be completed concurrent with completing and filling the upland PA, beginning in 2020.

1.4 Purpose and Need for the Project

The purpose of the proposed project is to address the shortage of capacity for the placement of dredged material generated during maintenance dredging operations on the Upper Bay Reach of the HSC and on the Bayport Ship Channel. Periodic dredging must be performed to maintain the HSC at its authorized depth, reduce the risk of collisions and petroleum or chemical spills, and allow for safe vessel passage. Dredging is necessary because of the natural process of sedimentation; sediment that washes downstream or is disturbed by currents, wind, ship wakes, or other processes gradually deposits in channels and harbors.

Since the deepening and widening of the HSC, increased shoaling rates in the channel have required the earlier than planned construction of PAs. Along the Upper Bay Reach of the channel, BU Cells M-5 and M-6, which originally were planned to be constructed in 2020, have already been constructed. BU Cells M-3 and M-4, which originally were planned to be filled in 2020 and 2025, respectively, have already been filled. BU Cell M-5/6 has approximately 1.5 to 1.8 million cubic yards of capacity remaining and is expected to be filled during the dredging of the Upper Bay Reach in 2010. These areas originally were not anticipated to be filled until 2035. PAs 14 and 15 presently have about 8.3 and 5.5 million cubic yards of capacity remaining, respectively. Based on a preliminary assessment using projected sedimentation rates and assuming that BU Cell M-7/8/9 would be constructed immediately under existing authorization, Cell M-7/8/9 would be filled by 2013 and the remaining capacity of PAs 14 and 15, would be less than 1 million cubic yards each by 2019 and 2022, respectively. There would no longer be sufficient capacity in these PAs for the predicted volume of material that would need to be dredged from the HSC and Bayport Ship Channel to maintain these channels at the required depth. Without the construction of Cell M-7/8/9, the capacity would run out sooner.

Under ER 1105-2-100 Planning Guidance Notebook, federally maintained navigation projects must demonstrate that there is sufficient dredged material disposal capacity for a minimum of 20 years. Presently, the HSC and Bayport Ship Channel projects do not meet this requirement. The problem is most acute for the project reaches that use PAs 14 and 15 and the associated BU sites for placement of maintenance material. The District is planning to revise the existing overall Dredged Material Management Plan (DMMP) for the entire HGNC to address long-term capacity shortfalls. In the short-term, the availability of ARRA funding provides an opportunity for the District to implement the proposed project to alleviate the capacity problem where it is most acute. Constructing the upland expansion area and Cell M-10 would provide an additional 9 million cubic yards of capacity by 2011 and an additional 10 million cubic yards in 2020, which would contribute toward alleviating the long-term capacity shortage.

2.0 PROJECT ALTERNATIVES

Through coordination with the BUG and the development of the “BUG Plan” for placement of maintenance dredged materials for the HSC, in association with the development of the 1995 SEIS for the HGNC, the District committed to limiting placement options for maintenance material from the HSC to either upland confined placement areas (UCPAs) or BU marsh creation. The following sections describe the alternatives considered to meet the defined purpose and need for the project while being consistent with the BUG Plan. Section 2.1 provides a description of the alternatives considered and the reasons some were eliminated from further consideration. Section 2.2 describes the two alternatives carried forward for further analysis in the EA and Section 2.3 provides a comparison of the alternatives carried forward.

2.1 Alternatives Considered

In addition to the No-Action Alternative (described in Section 2.2.1), several action alternatives were considered. Four types of PAs were considered: use of UCPAs on the mainland; expanding existing PAs 14 and 15; new in-bay PAs at other locations; and raising levees on existing PAs 14 and 15. Issues considered for each alternative and reasons for the elimination of some from further consideration are discussed below.

2.1.1 Upland Confined Placement Areas on the Mainland

This alternative would consist of the construction and operation of UCPAs on the mainland. This would require identification and purchase of large land areas within a feasible pumping distance. Much of the land along the Galveston Bay shoreline is already developed for residential or industrial use, making availability of the acreage needed limited and acquisition cost prohibitive. Additionally, because the pumping distance to a UCPA would be further than current practices, the cost of maintenance dredging would be increased due to the need for additional dredge pipelines and booster pumps. From an ecological perspective, placement of the material in an upland site would adversely impact terrestrial habitats. Although these impacts would likely be minor, the beneficial use of the material as proposed in the recommended plan would result in a net gain in marsh habitat, ecologically benefiting the Galveston Bay ecosystem. Therefore, because of high costs associated with acquiring the land, increased cost associated with longer pumping distances, and potential for impacts to terrestrial habitat rather than net benefits to the bay ecosystem from BU placement, upland confined placement on the mainland was removed from further consideration.

2.1.2 Expanding PAs 14 and 15

The most feasible and cost effective alternative is to construct levees between the two PAs to combine the areas into one. The area between PAs 14 and 15 was originally planned as a circulation channel. However, the area has not functioned as anticipated and material is being naturally deposited between the PAs. Expanding these PAs would eliminate potential cost increases associated with increased pumping distances and provides the opportunity to use material beneficially for marsh creation. This alternative would address the long-term goals for placement of maintenance dredged material as defined in the purpose and need and would provide net ecological benefits to the Galveston Bay ecosystem through BU. For these reasons, this alternative was carried forward for further consideration. Additional detail describing this alternative is provided in Section 2.2.2 below.

2.1.3 New In-Bay Confined Placement Areas

This alternative focused on construction of new in-bay confined placement at a location in Galveston Bay other than at PAs 14 and 15. Maintenance material from the Upper Bay Reach and upper Mid-Bay Reach of the HSC and from the Bayport Ship Channel is currently placed in PAs 14 and 15. Although construction of one or more in-bay confined PAs would provide the opportunity for BU marsh creation, placing the material in another location within Galveston Bay would result in new impacts to bay bottom, and potentially increase the cost of maintenance dredging due to the likelihood of having to pump the material a longer distance compared to current practices. For these reasons, this alternative was removed from further consideration.

2.1.4 Raising Levees on Existing PAs 14 and 15

PAs 14 and 15 are currently used for placement of maintenance material dredged from the Upper Bay Reach of the HSC and the Bayport Ship Channel. As described in Section 1.4, these PAs are approaching capacity. To meet future maintenance material placement needs, the alternative of raising the levees at these PAs was considered. However, the levees at PAs 14 and 15 are currently being raised to accommodate the next maintenance dredging cycle and current plans for future operations include raising the levees to their geotechnical limits. Additional raising of the levees is not feasible. Therefore, this alternative was removed from further consideration.

2.2 Alternatives Carried Forward for Further Evaluation

Two primary alternatives were studied for the proposed project, the No-Action Alternative (Project Alternative 1) and the Expansion of PAs 14 and 15 Plan (Project Alternative 2).

2.2.1 Project Alternative 1 – No-Action Alternative

Under the No-Action Alternative, BU site M-7/8/9 would be constructed under existing authority and all other planned or programmed operations and maintenance activities would continue as long as placement capacity allows. As described in Section 1.4, increased shoaling rates in the HSC have resulted in the need to construct previously authorized PAs earlier than planned and all are expected to be at capacity by 2022. The No-Action Alternative would result in either a delay or halt in maintenance dredging in the Upper Bay Reach of the HSC and the Bayport Ship Channel.

Implementation of the No-Action Alternative would not meet the purpose and need of the project. Available PA capacity would not be expanded and existing PAs would reach capacity faster than anticipated, which could lead to interruption and/or delays of maintenance dredging activities of the HSC. Interruptions and/or delays of maintenance dredging activities could lead to navigational hazards for commercial vessels due to safe draft depths not being maintained within the HSC and result in increased risk for collisions and/or petroleum or chemical spills into the bay. Unsafe navigation within the bay would also lead to commercial shipping lines finding alternate ports to do business with, thereby adversely affecting the socioeconomics of the communities surrounding the HSC. As a result, the mix and volume of future vessel traffic within the HSC would be negatively affected.

Although the No-Action Alternative does not meet the need for and purpose of the proposed project, it is retained as a basis for comparison with the Proposed Alternative and is carried forward for detailed study.

2.2.2 Project Alternative 2 –Expansion of PAs 14 and 15 (Proposed Alternative)

Under the Proposed Alternative, the upland PA expansion and marsh beneficial use sites would be constructed. Expansion of PAs 14 and 15 would take place between the existing PAs within an area that includes the planned circulation channel, which has shoaled in and has not functioned as anticipated. The Proposed Alternative is described in detail in Section 1.3 and consists of the following elements (Exhibit 2):

- Approximately 169 acres of new upland PA between PAs 14 and 15;
- Approximately 305 acres of BU marsh created adjacent to the east side of PA 14 (Cell M-10);
- Approximately 392 acres of BU marsh created adjacent to the east side of PA 15 (Cell M-7/8/9);
- Up to approximately 424 acres of BU marsh created south of Cell M-7/8/9 (future Cell M-11); and
- A minimum of 88 acres of mitigation marsh created at Bolivar Marsh.

The current alignment of Cell M-10 avoids immediate impacts to oil and gas facilities and is consistent with the beneficial use plan formulated by the BUG. A combination of construction methods would be utilized to construct the levees for both the upland and beneficial use areas.

This would include hydraulic and mechanical placement of dredged materials. Materials would be mined from the HSC from Morgan’s Point to the Bayport Ship Channel down to a depth of approximately 80 feet and from areas adjacent to and between PAs 14 and 15. Material may also be obtained from the permitted construction of berths at the Bayport Terminal and from advanced maintenance of the Bayport Flare.

The expansion of PAs 14 and 15 is the Proposed Alternative because it is the most environmentally acceptable alternative in that it maintains proximity to the upper bay reach of the HSC, thus reducing potential impacts and costs by minimizing pumping distances during maintenance cycles. Long pumping distances require more pipeline and would require additional pumps, increasing cost associated with placement of maintenance material. Implementation of the Proposed Alternative would meet the purpose and need of the project as described in Section 1.4. Available PA capacity would be expanded and existing PAs would have sufficient capacity to allow for maintenance dredging activities during the development of an overall DMMP for the HSC and associated Federal channels.

2.3 Comparison and Evaluation of Alternatives

The purpose of the proposed project is to increase capacity of available PAs so that routine maintenance dredging activities could continue uninterrupted and safe navigation of the HSC could be maintained. Under Project Alternative 1 (No-Action Alternative), PAs 14 and 15 would not be expanded and PA capacity would remain at existing planned levels, leading to interruptions and delays in routine maintenance dredging activities. Under Project Alternative 2 (Expansion of PAs 14 and 15), the available PA capacity would increase. This increased capacity would significantly reduce the threat of interruptions and delays in routine maintenance dredging activities.

Because Project Alternative 1 (No-Action Alternative) does not adequately address the purpose and need of the project, it was not considered to be acceptable. Project Alternative 2 does address the purpose and need of the project and allows for beneficial use of dredged material. The recommended plan (Alternative 2) is to increase PA capacity by expanding PAs 14 and 15. This includes constructing a 169-acre upland PA, constructing a 305-acre BU marsh site (Cell M-10) and a previously authorized 392-acre BU marsh site (Cell M-7/8/9), and constructing a future BU marsh site of up to 424 acres (Cell M-11). A mitigation marsh of at least 88 acres would also be constructed.

3.0 AFFECTED ENVIRONMENT

Detailed discussions of the environmental components of the project study area that may be affected by the Project Alternatives proposed by this EA are presented in this section. Exhibit 1 depicts the location of the project study area.

3.1 Project Area

The project area is defined as the project footrpint and immediately adjacent areas. The 169-acre upland PA expansion area is located between existing PAs 14 and 15. The existing PAs are confined upland PAs located on the southern portion of Atkinson Island in upper Galveston Bay in Chambers County, Texas. These PAs have been utilized for the placement of dredged material associated with the ongoing HSC project. The project area includes the proposed footprint for up to three BU sites including Cell M-10 (305 acres), Cell M-7/8/9 (392 acres), and Cell M-11 (424 acres). Material for the construction of levees would be mined from the HSC to a depth of 80 feet between Morgan's Point and the Bayport Ship Channel, mined during advanced maintenance of the Bayport Ship Channel Flare and from the planned improvement at the Bayport terminal, or mined from within and/or between PAs 14 and 15. Exhibits 2 and 3 depict the location of the project area.

Although the project site is located entirely within Chambers County, for the purposes of assessing the affected environment and impacts in this EA, resources potentially affected in Chambers, Galveston, and Harris Counties were assessed. All three counties lie within the limits of the project study area as described in Section 1.2 of this EA.

3.2 Physical Environment

3.2.1 Topography and Soils

The topography of the project study area is relatively flat. The project study area is located on the Gulf Coastal Plain of Texas which is characterized by flat low-lands. Elevation within the project study area, according to a review of United States Geological Survey topographic maps, ranges from sea level within Galveston Bay to approximately 35 feet on the highest areas, located on the surrounding mainland.

The topography in the immediate vicinity of the proposed project has been altered by previous earth working activities on-site from the HSC project. Man-made levees have been constructed around the perimeter of the existing PAs and dredged material has been deposited in these confined areas. A shallow area of submerged land, the existing circulation channel, is currently located between PA 14 and PA 15. Shallow open water surrounds both PAs and the HSC is located immediately to the west. A man-made salt marsh, referred to Gorini Marsh, lies immediately to the north of PA 15. This marsh was previously constructed as a demonstration area for beneficial use of dredged material as part of the HSC project. The elevation of the salt marsh was established to ensure a semi-diurnal flushing of the marsh.

A review of the soil survey of Chambers County, Texas (USDA, 1976) was conducted to determine the existing soils within the project area. Ijam soils (Im) are mapped in the vicinity of the project area. Ijam soils are described as very deep, nearly level, clayey soils that are alkaline and saline. These soils are formed in alkaline, saline, clayey, marine, and alluvial sediment that was dredged or pumped from the floor of rivers, bays, and canals or was removed from the land surface during construction of canals or waterways. These soils are in areas where elevation ranges from sea level to 8 feet above sea level and slopes are plane to concave. Ijam soils are very poorly drained, permeability is very slow, and available water capacity is moderate. Ijam soils are typically man-made land. The areas surrounding the upland portions of the site do not have a soil classification assigned and are classified as "Water" (W) as these areas are submerged by the estuarine waters of Galveston Bay.

The dominant sediment types in Galveston Bay are comprised of mud, muddy sand, and sandy mud. Mud, comprised of silt and clay, is widely distributed in northwest Galveston Bay. Muddy sands and sandy muds flank bay margin sands, which are typically associated with shorelines and other higher energy areas.

3.2.1.1 Prime and Unique Farmlands

Prime farmland soils are defined by the Secretary of Agriculture in 7 CFR, Part 657 (Federal Register, Vol. 43, No. 21) as those soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The soil quality, growing season, and moisture supply are available to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. Some soils are considered prime farmland in their native state, and others are considered prime farmland only if they are drained or watered well enough to grow the main crops in the area.

According to county specific soil surveys (USDA 1976a, 1976b, and 1988), prime farmland soils are confined to mainland areas around Galveston Bay within the limits of the project study area. Based on the soil survey of Chambers County, Texas, soils that occur in the immediate vicinity of the project area are classified as water and Ijam soils. These soil types are not considered to be prime or unique farmlands (NRCS, 2009).

3.2.2 Geology

The geology within the project study area of the proposed expansion of PAs 14 and 15 are of the Quaternary Period. The Quaternary Period is subdivided into Pleistocene and Holocene ages. The deposition of materials during this time period formed distinct geological formations which are related to the several rises and falls of sea level during and after major advances of continental glaciers in North America over the past 1 to 3 million years.

The geology of the mainland areas within the project limits is mapped as Beaumont formation, which is the youngest formation of the Pleistocene age. Its origins are mainly fluvial and deltaic, but probably some small areas originated as coastal marsh and lagoonal deposits. The underlying geology in the immediate vicinity of the project is mapped as fill and spoil area that contains dredged material (Stoeser, web).

3.2.3 Hydrology and Drainage

Hydrological patterns in the project area are dominated by tidal forces within Galveston Bay. The project area experiences semi-diurnal tides with two high and two low tides each day. In the project vicinity, the mean tide typically ranges approximately 1 foot between high and low tides. Higher than normal tidal ranges in the project area may be observed during spring tides and storm events. Hydrological patterns in the project area may also be influenced by freshwater inputs from the Buffalo Bayou and San Jacinto River Basins. These freshwater influences generally result in a fresh/saltwater wedge to form in deeper areas of Galveston Bay and in dredged channels within the Bay, such as the HSC. Wind also plays an important role in circulation patterns within shallow water bays, such as Galveston Bay. Typically, currents in the central portions of the Bay are in the direction of the prevailing winds and countercurrent eddies form close to nearshore environments. During the winter months, prevailing winds are from the north and northwest, as fronts pass through the region, and piles up water against the barrier islands. During the summer months, prevailing winds are from the south and southeast, water pushes up close to the shoreline of the mainland (Britton and Morton, 1989).

Within the project area, storm water typically drains off existing PAs into the bay and/or permeates into the soil.

3.2.4 Climate and Relative Sea Rise

The climate of the project study area is subtropical. Winds are typically out of the southeast with an average speed of 10-15 miles per hour. Mean daily temperatures in the nearby town of Baytown, Texas, range from approximately 50 degrees Fahrenheit in January to approximately 83 degrees Fahrenheit in July and August. The average rainfall in the area is approximately 53 inches, with monthly precipitation averaging from approximately 3 to 6 inches (NOAA, 2009a). The project area is prone to flooding impacts from large tropical storms and hurricanes during late summer and early fall. Major named storms that have impacted the project area in the past few decades include Tropical Storm Claudette (July 1979), Tropical Storm Allison (June 2001), Hurricane Rita (September 2005), and Hurricane Ike (September 2008).

As a result of a global climate change and melting glaciers and polar ice caps, the National Oceanic and Atmospheric Administration (NOAA) has observed a general trend of rising sea levels in the Gulf of Mexico. On the outer coast of Galveston Island, from the years of 1957-2006, sea level was observed to be rising at a rate of 0.024 feet per year, or 2.24 feet in 100 years (NOAA, 2009b). General land subsidence in the Galveston Bay region is due to withdrawal of groundwater from the regional aquifers. This subsidence is also contributing to the rising sea level observations in the area. Many of the natural islands in Galveston Bay have been lost to subsidence and subsequent erosion. Sea level rise generally contributes to shoreline retreat and erosion. Sea level rise analysis was conducted based upon recent guidance from the USACE in Circular Number 1165-2-211. The results of this analysis are presented in Appendix H.

3.2.5 Water and Sediment Quality

Water quality is an indicator of the overall health of an aquatic resource and the environment that it surrounds. Numerous natural and anthropogenic factors can contribute to the water quality of an aquatic resource. The areas surrounding the Galveston Bay system are highly industrialized and urbanized; therefore non-point source pollution is an important factor affecting the Bay’s water quality. Twenty-one watersheds are immediately adjacent to the Galveston Bay system which encompasses approximately 4,000 square miles. Land use within any watershed directly correlates to the volume of non-point source discharge into the system. The existing and projected land use patterns in the vicinity of the Galveston Bay system make the water quality of the system highly susceptible to degradation from non-point sources. These non-point source loadings vary with climatological patterns as significant rainfall events typically produce an influx of pollutants from non-point sources.

The proposed project is located in the Upper Galveston Bay TCEQ assessment area. Upper Galveston Bay includes tidal waters within upper portions of the bay from a line drawn from Red Bluff Point to Five Mile Cut to Houston Point to Morgan’s Point. According to the TCEQ, Upper Galveston Bay is listed as an impaired water body due to multiple pollutants. Those pollutants by which the impairment has been caused include bacteria for oyster waters, dioxin in edible tissue, and polychlorinated biphenyls (PCBs) in edible tissue (TCEQ, 2008).

According to recent data obtained between 1999 and 2005, total fecal coliform levels are elevated around the periphery of the bay, with minimum values in the open bay and the largest concentrations at points of freshwater inflow and waste discharges within the upper tributaries of the bay (HARC, 2006). Elevated levels of fecal coliform contamination measured by the Texas Department of State Health Services have prompted the restriction and prohibition of a large portion of Galveston Bay waters to the harvest of shellfish.

Higher concentrations of dioxins and PCB’s are distributed in the upper tributaries of Galveston Bay, including the HSC, while lower concentrations are found in open bay waters (HARC, 2006). Due to elevated levels of dioxins in catfish and crab tissue and PCB's in catfish, spotted sea trout, and blue crab tissues, seafood consumption advisories have been issued by the Texas Department of State Health Services for Galveston Bay and its tributaries since 1990, including the project area. The advisory limits consumption of marine species from the upper reaches of Galveston Bay and the HSC.

Water quality in Texas bays and estuaries is monitored via a comprehensive water quality monitoring program supported by the Texas Water Development Board Datasonde Program. Although no datasondes are located in the immediate vicinity of the project area, four active datasondes are located within the project study area. One active datasonde is located along the HSC at State Highway 146 near Baytown (BAYT) approximately 6.75 miles up-channel of the project area. The second active datasonde is located in Mid-Galveston Bay (MIDG) at Marker 54 along the HSC near Redfish Bank approximately 9 miles down-channel of the project area. The third active datasonde is located at Bolivar Roads (BOLI) on the HSC beside Pelican Island approximately 23-miles down-channel of the project area. The fourth active datasonde is located in Trinity Bay (TRIN) to the northwest of Double Bayou Channel approximately 12.75-miles east-northeast of the project area.

Three historic datasondes that also provide historic water quality data were also located within the project study area before being removed. The first historic datasonde was located near Red Bluff (RED) in Upper Galveston Bay at Marker 71/72 along the HSC, approximately 4.25-miles down-channel of the project area, but was removed in 1999. The second historic datasonde was located in East Bay (EAST) at Hannah Reef, approximately 16.5-miles southeast of the project area, but was removed in 1996. The third historic datasonde was located at a range marker in the HSC off Dollar Point (DOLLAR) in Galveston Bay, approximately 13.5-miles down-channel of the project area, but was removed in 1999.

Data for the active and historic monitoring stations are reported in Table 1.

Table 1: Water Quality Data from TWBD†

Station	Data Range	Water Quality Parameters			
		Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)
BAYT	04/18/01 – 07/01/09	22.6	NR*	9.6	5.0
BOLI	05/15/90 – 08/21/09	22.3	8.1	19.5	5.3
DOLLAR	01/30/87 – 09/14/00	22.4	8.2	17.9	6.2
EAST	05/16/90 – 07/31/96	21.1	8.8	13.5	6.8
MIDG	02/08/01 – 07/21/09	22.2	6.8	16.0	5.8
RED	05/15/90 – 05/05/99	22.5	8.3	11.9	6.7
TRIN	12/17/86 – 08/26/09	22.2	8.2	8.6	6.4

†All values reported are mean values for the data ranges specified above.

*NR = Parameter Not Recorded at this sampling location.

Recent sediment sample data for the HSC were reviewed. Sediment samples were taken in the HSC in October 2009 from the reach of channel between Bayport and Morgan's Point and Bolivar Roads to Redfish Reef. Samples were analyzed for concentrations of inorganic chemicals. The chemical concentrations determined from sampling were compared against available sediment quality screening criteria commonly used in NOAA sediment screening assessment studies of saline environments. The results from this sampling event show all chemicals that were found above detection limits were determined to be at concentrations lower than NOAA Effects Range Low (ERL). The ERL designation means that contaminants in sediment are not likely to have adverse effects on organisms that live in sediment. Parameters that were tested for during this study include arsenic, chromium, copper, lead, nickel, and zinc. Sampling results are depicted in Table 2.

Table 2: Concentrations of Detected Compounds (dry weight) in Sediment Samples

				H-MR-09-							H-RB-09-			
Parameter	Units	Detection Limit	NOAA ERL	01	02	03	04	05	06	06 Dup	01	02	03	04
Arsenic	mg/kg	0.30	8.2	4.83	2.89	2.97	1.66	1.71	4.54	3.66	3.63	4.04	3.33	3.38
Beryllium	mg/kg	1.00	N/A	0.73J	0.57J	0.82J	0.32J	0.76J	0.29J	0.81J	0.59J	0.62J	0.47J	0.47J
Cadmium	mg/kg	0.10	1.20	0.12	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium, Total	mg/kg	1.00	81.0	11.0	9.39	11.1	5.21	7.94	13.7	11.8	9.44	10.0	8.18	8.21
Chromium III	mg/kg	1.00	N/A	11.0	9.39	11.1	5.21	7.94	13.7	11.8	9.44	10.0	8.18	8.21
Copper	mg/kg	1.00	34.0	8.73	6.90	7.57	3.64	4.44	9.28	7.75	5.45	5.95	4.49	4.46
Lead	mg/kg	0.30	46.7	12.8	9.97	13.3	6.61	7.83	13.6	13.0	10.5	10.2	8.60	9.35
Nickel	mg/kg	0.50	20.9	7.50	8.45	9.90	5.04	7.88	12.9	10.7	9.08	9.95	8.00	8.31
Selenium	mg/kg	0.50	N/A	0.12J	0.08J	BDL	BDL	BDL	BDL	0.17J	BDL	BDL	BDL	BDL
Silver	mg/kg	0.20	1.0	0.07J	0.05J	0.07J	BDL	BDL	0.06J	0.06J	0.04J	0.06J	BDL	0.03J
Thallium	mg/kg	0.20	N/A	0.12J	0.10J	0.13J	0.09J	0.10J	0.15J	0.15J	0.11J	0.13J	0.08J	0.10J
Zinc	mg/kg	2.00	150	27.2	33.6	38.6	21.9	19.2	43.7	39.4	35.3	37.6	30.9	30.3
Ammonia	mg/kg	0.10	N/A	62.0	56.9	146	47.1	21.0	108	100	76.6	76.5	78.5	75.4
TOC	%	0.10	N/A	0.94	0.92	1.11	0.44	0.36	1.32	0.81	0.91	1.12	0.96	0.96
Percent Solids	%		N/A	60.0	60.0	45.1	54.3	71.2	47.8	47.0	52.5	53.6	59.5	59.0
Gravel	%	N/A		15.4	15.4	0.0	0.6	6.3	4.5	5.6	0.0	0.7	0.0	0.0
Sand	%	N/A		33.6	32.4	15.9	60.7	39.6	15.6	18.5	43.1	33.6	53.8	32.5
Silt	%	N/A		18.4	19.7	20.8	11.2	18.1	23.5	25.0	6.0	16.3	4.6	29.9
Clay	%	N/A		32.6	32.5	63.3	27.5	36.0	56.4	50.9	50.9	49.4	41.6	37.6
D50	mm	N/A		0.071	0.067	N/A*	0.156	0.046	N/A*	0.004	0.004	0.006	0.142	0.033

DUP = Duplicate Sample

BDL = Below Detection Limit

N/A* For H-MR-09-03 and H-MR-09-06, the D50s could not be determined, D60s = 0.002 and 0.0073, respectively.

J = The value is an estimated concentration because one or more quality control criteria have not been met but the substance has been qualitatively identified in the sample.

3.3 Biological Resources

3.3.1 Vegetation

The project area is located within the Marsh and Barrier Island vegetation region of Texas (TPWD, 1984). More specifically, the vegetative type surrounding the project area is classified as subtype 3, or saline marsh (McMahan, 1984). Saline marsh vegetation types are distributed along tidally inundated shores of bays along the Gulf Coast.

Field investigations of the project area were conducted on October 6, 2009, to identify the vegetation/habitat types present. Currently, vegetation/habitat types found in the vicinity of the project footprint include saline marsh, existing upland PAs 14 and 15, shallow bay bottom tidal waters, and intertidal sand flats in the areas immediately adjacent to PAs 14 and 15. Exhibit 4 displays the distribution of vegetation/habitat types found in the vicinity of the project footprint. Delineation of habitat/vegetation types in Exhibit 4 are based upon observations made during a site assessment on October 6, 2009, along with aerial photographic interpretations. Table 3 lists the location and typical vegetation found within each vegetation type.

Table 3: Vegetation/Habitat Types Present Within the Proposed Project Area

Vegetation/Habitat Types	Location/Distribution	Typical Vegetation Found*
Saline marsh	North of PA 15 and fringe areas surrounding PAs 14 and 15	Smooth cordgrass *(Spartina alterniflora)* Saltmeadow cordgrass (*Spartina patens*) Gulf cordgrass (*Spartina spartinae*) Virginia glasswort (*Salicornia depressa*) Shoreline seapurslane (*Sesuvium portulacastrum*) Saltgrass (*Distichlis spicata*) Seashore dropseed (*Sporobolus virginicus*) Common sunflower (*Helianthus annuus*) Sea oxeye daisy (*Borrichia frutescens*) Seaside goldenrod (*Solidago sempervirens*) Salt cedar (*Tamarix spp.*)
Existing upland PAs 14 and 15	Contained within existing levees	Based upon a review of aerial photographs, color signatures indicate that vegetative species in these areas are likely dominated by various herbaceous species, likely similar to species found in the surrounding wetland areas
Shallow Bay Bottom Tidal Waters	Throughout the project area	No submerged aquatic vegetation observed
Intertidal Sand Flats	Fringe areas surrounding PAs 14 and 15	Smooth cordgrass *(Spartina alterniflora)* Saltmeadow cordgrass (*Spartina patens*)

*Observed on October 6, 2009

<u>Saline Marsh</u>

Saline marsh areas can be found along the fringe of the existing levees of PAs 14 and 15. Typical vegetative species occurring in these areas are dominated by herbaceous species and are noted in Table 3.

<u>Existing Upland PAs 14 and 15</u>

Two existing PAs are located in the project area (PAs 14 and 15). Based upon a review of aerial photographs, color signatures indicate that vegetative species in these areas are likely dominated by various herbaceous species, likely similar to species found in the surrounding wetland areas. These areas are periodically disturbed by the deposition of dredged material and pioneer herbaceous species continually re-vegetate areas of deposition.

<u>Shallow Bay Bottom Tidal Waters</u>

Tidal waters are located throughout the project area and include all inundated shallow waters surrounding Atkinson Island and the existing PAs. These areas are typically inundated. No submerged aquatic vegetation was observed within these areas.

<u>Intertidal Sand Flats</u>

Intertidal sand flats are located around the fringe of PAs 14 and 15. These areas are intertidal and may be covered by tidal waters during high tide and storm events. Some sand flat areas, particularly off the southeastern tip of PA 15, are beginning to vegetate with cordgrasses. Otherwise, these areas contain little vegetation as noted in Table 3.

3.3.2 Aquatic and Terrestrial Habitats

Both aquatic and terrestrial habitats are located in the project area. Aquatic habitats in the project area include shallow estuarine waters with a sandy bay bottom. These waters provide habitat for a variety of fish and water-dependant birds. The shallow sandy bay bottom provides habitat for both benthic epifaunal and infaunal species including mollusks, polychaetes, and crustaceans.

Oyster reefs have been historically located in the project study area, according to geospatial data obtained from the Texas GLO. Exhibit 5 displays historic GLO data for oyster reefs in the vicinity of the project area. Oyster reefs provide important habitat for numerous marine organisms and they assist in filtering water and suspended solids, thereby improving estuarine water quality. During the site assessment, no oyster reefs were observed in or around the project area.

Terrestrial habitats in the project area include the upland portions of the PAs. The upland portions of the PAs are not natural habitat as dredged materials have been placed in these areas. These areas have naturally vegetated over with herbaceous vegetation and do provide habitat for avifauna including migratory birds and small mammals. Avifauna and small mammals that may be present are listed in Section 3.3.3.

Salt marsh habitats are also found within the project area. The constructed demonstration marsh, Gorini Marsh, located immediately north of PA 15 is approximately 200 acres. This marsh provides habitat for a variety of water birds and water fowl, including species listed in Section 3.3.3. The meandering tidal waterways within the marsh area also provide habitat for a variety of fish species as listed in Section 3.3.4 and benthic species. Benthic species likely to be present in these areas include various species of crustaceans, gastropods, polychaete worms, and mollusks. In addition, salt marsh areas are found around the fringe of the existing PAs.

3.3.3 Wildlife Resources

The southern end of Atkinson Island where the existing PAs 14 and 15 are located is part of the Atkinson Island Wildlife Management Area (WMA) managed by the TPWD. The WMA's were established by TPWD to perform research on wildlife populations and habitats, conduct education on resource management, and provide the public with outdoor recreational activities such as fishing and wildlife viewing. According to the TPWD website for the Atkinson Island WMA, wildlife species that may be found on the island include shore and wading birds, water birds, water fowl, migrating raptors and neo-tropical passerines, raccoons, and rattlesnakes. In addition, coyotes and nutria can be found on islands and PAs along the HSC. During the site assessment on October 6, 2009, raccoon and rabbit tracks were observed in the wetlands fringing PAs 14 and 15.

Atkinson Island is known as being a historical nesting site for colonial water birds. The USFWS conducts an annual monitoring of each colony site along the Texas coast from May to early-June. The Atkinson Island site is identified by the USFWS as colony #600-181 and has been monitored annually since 1974. Bird species that have been observed nesting on Atkinson Island since 1974 include anhinga (*Anhinga anhinga*), black skimmers (*Rynchops niger*), black-crowned night heron (*Nycticorax nycticorax*), Caspian tern (*Sterna caspia*), cattle egret (*Bubulcus ibis*), Forster's tern (*Sterna forsteri*), great blue heron (*Andea erodias*), great egret (*Casmerodius albus*), gull-billed tern (*Gelochelidon nilotica*), laughing gull (*Larus atricilla*), least tern (*Sternula antillarum)*, little blue heron (*Egretta caerulea)*, neotropic cormorant (*Phalacrocorax brasilianus)*, reddish egret (*Egretta rufescens)*, roseate spoonbill (*Ajaia ajaia*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), snowy egret (*Egretta thula*), tricolored heron (*Hydranassa tricolor*), white ibis (*Eudocimus albus*), white-faced ibis (*Plegadis falcinellus*), and yellow-crowned night heron (*Nyctanassa violacea*) (USFWS, 2009d).

During the site assessment on October 6, 2009, numerous flocks of seabirds were observed on the sand flats between PAs 14 and 15. Seabirds observed during the site assessment include brown pelican (*Pelecanus occidentalis*), white pelican (*Pelecanus erythrorhynchos*), black skimmers, great egret, great blue heron, sandpiper species, and seagull species.

Newly constructed levees on Atkinson Island BU cells were heavily used by nesting colonial water birds for two years post-construction (2001-2002). Peak numbers of nesting pairs during this period included 1,427 Forster's tern, 128 least tern, and 87 black skimmer (TCWS, 2008). Negligible numbers have nested since, due to increased vegetation on levees.

3.3.4 Fisheries and Essential Fish Habitat

The areas surrounding the project site contain shallow tidal waters, intertidal flats, and salt marsh wetlands. These types of habitats provide nursery, foraging, and refuge opportunities for a variety of recreational and commercially important marine fisheries species including Atlantic croaker (*Micropogonias undulates*), blue crab (*Callinectes sapidus*), black drum (*Pogonias cromis*), brown shrimp (*Farfantepenaeus aztecus*), Gulf menhaden (*Brevoortia patronus*), oyster (Crassostrea virginica), spotted sea trout (*Cynoscion neulosus*), stripped mullet (*Mugil cephalus*), red drum (*Sciaenops ocellatus*), sheepshead (*Archosargus probatocephalus*), southern flounder (*Paralichthys lethostigma*), and white shrimp (*Litaepenaeus setiferus*) (GBEP, 2009).

Congress enacted amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) in 2005 (Public Law 94-265) that established procedures for identifying Essential Fish Habitat (EFH) and required interagency coordination to further the conservation of federally managed fisheries. Rules published by the NMFS (50 CFR Sections 600.805−600.930) specify that any Federal agency that authorizes, funds or undertakes, or proposes to authorize, fund, or undertake an activity which could adversely affect EFH is subject to the consultation provisions of the above-mentioned act and identifies consultation requirements.

The Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." When referring to estuaries, it is further defined as "all waters and substrates (mud, sand, shell, rock and associated biological communities) within these estuarine boundaries, including the sub-tidal vegetation (seagrasses and algae) and adjacent tidal vegetation (marshes and mangroves)" (GMFMC, 2004).

The Gulf of Mexico Fisheries Management Council (GMFMC) has identified the areas in the vicinity of the project area as EFH for juvenile and adult brown and white shrimp, juvenile pink shrimp (*Farfantepenaeus duorarum*), juvenile and adult red drum, juvenile and adult stone crab (*Menippe adina*), and adult Spanish mackerel (*Scomberomorus maculates*). More details regarding specific habitat requirements for each of these species follows in Table 4.

Table 4: Habitat Requirements of Species with EFH in the Project Study Area

Species	Location/Distribution
Brown Shrimp	Most abundant in central and western Gulf of Mexico; Found in estuaries and offshore waters to 360 feet; Post-larval individuals typically occur within estuaries; Adults typically occur outside of bay areas; Post-larval individuals and juveniles are associated with shallow vegetated habitats but are also found over silty-sand and non-vegetated mud bottoms.
White Shrimp	Offshore and estuarine dwellers; Pelagic or demersal depending on their life stage; Eggs are demersal and larval stages are planktonic, and both occur in nearshore marine waters; Post-larvae become benthic upon reaching the nursery areas of estuaries, seeking shallow water with muddy-sand bottoms that are high in organic detritus; Juveniles move from estuarine areas to coastal waters as they mature; Adults are demersal and generally inhabit nearshore Gulf of Mexico waters in depths less than 100 feet on soft mud or silty bottoms.
Pink Shrimp	Juveniles inhabit most estuaries in the Gulf of Mexico and are commonly found in estuarine areas with sea grass; Post-larval individuals, juveniles, and sub-adults may prefer coarse sand/shell/mud mixtures; Adults inhabit offshore marine waters, with the highest concentrations in depths of 30 to 144 feet; Use estuaries from the larval stage until the species matures to the late juvenile stage.

Table 4: Habitat Requirements of Species with EFH in the Project Study Area (Continued)

Species	Location/Distribution
Red Drum	Occur in a variety of habitats, ranging from depths of about 130 feet offshore to very shallow estuarine waters; Commonly occur in all of the Gulf's estuaries; Associated with a variety of substrate types including sand, mud, and oyster reefs; Estuaries are important for both habitat requirements and for dependence on prey species, which include shrimp, blue crab, striped mullet, and pinfish; The GMFMC considers all estuaries to be EFH for the red drum; Schools are common in the deep Gulf waters with spawning occurring in deeper water near the mouths of bays and inlets, and on the Gulf side of the barrier islands.
Stone Crab	Stone crabs inhabit jetties, dead shell, mud and grass flats and oyster reefs and occur in areas characterized by high salinities and live oyster beds. Although the stone crab may dwell on a variety of bottom types throughout its geographic range, the shell substrate of oyster reefs provides reinforcement for creation of stable burrows, as well as protection from predators. Adult stone crabs live in burrows below the low tide mark around oyster bars and mud flats.
Spanish Mackerel	Pelagic species, occurring in depths up to approximately 250 feet throughout the coastal zone of the Gulf of Mexico; Adults usually found in neritic waters and along coastal areas; Inhabits estuarine areas, especially the higher salinity areas, during seasonal migrations; Are considered rare and infrequent in many Gulf estuaries; Spawning grounds are offshore where spawning occurs from May to October; Nursery areas are in estuaries and coastal waters year-round; Larvae are most frequent offshore over the inner continental shelf in marine waters of depths from 29 to about 276 feet; Juveniles are found offshore, in beach surf, and sometimes in estuarine habitat where they appear to prefer marine salinity and generally are not considered estuarine dependent. Clean sand appears to be the substrate preference of juveniles.

EFH in the project area includes estuarine emergent marsh, estuarine mud, sand and shell substrate, and estuarine water column. The draft EA initiated EFH consultation under the MSFCMA.

3.3.5 Threatened and Endangered Species

Two biological assessments (BA) of the study area describing the federally-listed threatened and endangered species likely to occur and the potential impact associated with the proposed Federal actions were previously prepared in 1986 and 1993 for the HGNC project. The results of a 1986 BA were published in the 1987 GBANS Final Feasibility Report and Final Environmental Impact Statement. A new BA was prepared in 1993 for the SEIS to account for any species that had been added or deleted from the Federal list of endangered and threatened species since the publication of the 1986 BA. Both the USFWS and the NMFS concurred with the 1986 and 1993 BA determinations that populations of threatened and endangered species under their respective jurisdictions would not be adversely affected by the proposed action.

Due to the passage of time since the 1993 BA, an updated BA has been prepared and is attached as Appendix A. The 2010 BA accounts for any species that have been added to or deleted from the USFWS and NMFS Federal lists of endangered and threatened species, presents any new information regarding the previously assessed species, and provides an effects determination based on habitats available that may be affected by the proposed action. Table 5 includes a list of federally listed species under the jurisdiction of USFWS and/or NMFS. Of these federally listed species, only the brown pelican, piping plover, bald eagle, and sea turtles are likely to occur in areas adjacent to the project. The bald eagle has been delisted from the Federal list of endangered and threatened species yet still receives Federal protection under the Bald Eagle Protection Act and the Migratory Bird Treaty Act. The brown pelican was removed from the Federal list of endangered and threatened species on December 17, 2009 (74 Federal Register 59443), but still receives protection under the Migratory Bird Treaty Act and the Lacey

Act. There is no designated critical habitat for any species located within or adjacent to the project area. Refer to the 2010 BA in Appendix A for more details regarding the federally listed species that may be affected by the proposed project.

In addition to the federally protected species, the TPWD maintains a separate county-specific list of threatened and endangered species that may potentially occur as a resident or migrant in the project area. The TPWD protected species are listed in Table 5. Of the state listed species that are not also listed on the Federal list of protected species, only the reddish egret and white-faced ibis are likely to occur in the areas around the project. Those species with only a state listed status were not considered in further detail in the BA. All species listed in Table 5 were compiled from USFWS and TPWD county specific lists for Harris, Galveston, and Chambers Counties. Even though the project area is contained within Chambers County, due to its close proximity to surrounding counties and the transient nature of many of these species, Harris and Galveston County species lists were also reviewed.

Table 5: Federal and State List of Threatened and Endangered Species for Chambers, Galveston, and Harris Counties.

Common Name	Scientific Name	Listing Status		
		USFWS[1] County by County List[2]	TPWD[3]	NMFS[4] List for State of Texas
Amphibians				
Houston toad	*Bufo houstonensis*	NL	E	NL
Birds				
American peregrine falcon*	*Falco peregrinus anatum*	NL	T	NL
Arctic peregrine falcon	*Falco peregrinus tundris*	NL	NL	NL
Attwater's greater prairie-chicken	*Tympanuchus cupido attwateri*	E	E	NL
Bald eagle	*Haliaeetus leucocephalus*	DL	T	NL
Brown pelican[#, 5]	*Pelecanus occidentalis*	DL[5]	E	NL
Eskimo curlew*	*Numenius borealis*	E	E	NL
Peregrine falcon*	*Falco peregrinus*	NL	T	NL
Piping plover[#]	*Charadrius melodus*	T, CH[6]	T	NL
Red-cockaded woodpecker	*Picoides borealis*	NL	E	NL
Reddish egret	*Egretta rufescens*	NL	T	NL
Swallow-tailed kite*	*Elanoides forficatus*	NL	T	NL
White-faced ibis	*Plegades chihi*	NL	T	NL
White-tailed hawk*	*Buteo albicaudatus*	NL	T	NL
Whooping crane*	*Grus americana*	NL	E	NL
Wood stork*	*Mycteria americana*	NL	T	NL
Fishes				
Creek chubsucker*	*Erimyzon oblongus*	NL	T	NL
Smalltooth sawfish*	*Pristis pectinata*	NL	E	E
Mammals				
Blue whale*	*Balaenoptera musculus*	NL	NL	E
Fin whale	*Balaenoptera physalus*	NL	NL	E

Table 5: Federal and State List of Threatened and Endangered Species for Chambers, Galveston, and Harris Counties (Continued)

Common Name	Scientific Name	Listing Status		
		USFWS[1] County by County List[2]	TPWD[3]	NMFS[4] List for State of Texas
Humpback whale	*Megaptera novaeanglaie*	NL	NL	E
Louisiana black bear*	*Ursus americanus luteolus*	NL	T	NL
Rafinesque's big-eared bat*	*Corynorhinus rafinesquii*	NL	T	NL
Red Wolf*	*Canis rufus*	NL	E	NL
Sei whale	*Balaenoptera borealis*	NL	NL	E
Sperm whale	*Physeter macrocephalus*	NL	NL	E
West Indian manatee*	*Trichechus manatus*	NL	E	NL
Reptiles				
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	E	E	E
Green sea turtle#	*Chelonia mydas*	T	T	T
Kemp's Ridley sea turtle#	*Lepidochelys kempii*	E	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E	E
Loggerhead sea turtle#	*Caretta Caretta*	T	T	T
Northern scarlet snake*	*Cemophora coccinea copei*	NL	T	NL
Smooth green snake*	*Liochlorophis vernalis*	NL	T	NL
Texas horned lizard	*Phrynosoma cornutum*	NL	T	NL
Timber/canebreak rattlesnake*	*Crotalus horridus*	NL	T	NL
Plants				
Texas prarie dawn	*Hymenoxys texana*	E	E	NL

[1] USFWS 2009a, 2009b, and 2009c

[2] The Texas prairie dawn flower is only listed in Harris County. The Attwater's greater prairie-chicken is only listed in Galveston County. The bald eagle is listed for all three counties. All sea turtle species and piping plover are listed only in Chambers and Galveston Counties.

[3] TPWD 2009a, 2009b, and 2009c

[4] NOAA/NMFS, 2009. NMFS Species of Concern are listed in this table but not in the BA. These species are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future.

[5] The final rule for delisting the brown pelican became effective December 17, 2009.

[6] Critical Habitat is listed for the county, but not present within the project study area

E = Endangered; T = Threatened; DL = Delisted; PDL = Proposed for Delisting; CH = Critical Habitat has been designated; SOC = Species of Concern; NL = Not Listed

* Species not considered in 1986 or 1993 BA's

Federal listed species likely to be found in the project area.

Three federally endangered species (blue whale, Eskimo curlew, and smalltooth sawfish), five state endangered species (Eskimo curlew, whooping crane, red wolf, smalltooth sawfish, and West Indian manatee), and eleven state threatened species (American peregrine falcon, peregrine falcon, swallow-tailed kite, white-tailed hawk, wood stork, creek chubsucker, Louisiana black bear, Rafinesque's big-eared bat, northern scarlet snake, smooth green snake, and timber/canebreak rattlesnake) have been added to the list of species to be considered since the 1986 and 1993 BA's. Seventeen species mentioned in the 1986 and 1993 BAs were dropped off the current list because they were listed as USFWS "species of concern" (SOC) but are no longer listed as SOCs according to the USFWS county by county list of protected species. Species that exhibit evidence of vulnerability are defined as SOCs. There are insufficient data to support listing of SOCs and they are not protected under the Endangered Species Act (ESA), therefore they were not considered. State-listed species with "rare" designation were also not considered due to their non-regulatory status under the ESA.

Only those species with a federally endangered or threatened status were considered in further detail in the attached BA. Species with a Federal status of threatened or endangered that are likely to be present within the project area include the Kemp's ridley sea turtle, loggerhead sea turtle, green sea turtle, brown pelican, and the piping plover. All other species listed in Table 5 are not likely to be found within the project area. For further information regarding the delisting of the brown pelican, see Section 2.1.1 of the BA in Appendix A.

3.3.6 Invasive Species

The introduction of non-native, or invasive, species into a natural system can have dramatic impacts on the overall ecology of that system. Within the Galveston Bay system, both invasive plants and animals may be found including, but not limited to fire ants (*Solenopsis wagneri*), grass carp (*Ctenopharyngodon idella*), nutria (*Myocaster coypus*), hydrilla (*Hydrilla verticillata)*, water hyacinth (*Eichhoria crassipes)*, Chinese tallow (*Triadica serbifera*), salt cedar (*Tamarix spp.*), and Brazilian pepper (*Schinus terebenthifolius*).

The encroachment of fire ants into the estuarine ecosystem poses an increasing threat to colonial nesting bird populations. Grass carp are voracious herbivores and they have the ability to strip aquatic vegetation from large areas. Nutria are large beaver-like rodents that that can also strip vegetation from marshes. Both hydrilla and water hyacinth are aquatic plants that can proliferate quickly, outcompete native aquatic plants, and congest recreational waterways. Chinese tallow, salt cedar, and Brazilian pepper are terrestrial plants that can out-compete native terrestrial plants within uplands or wetlands and alter the viability of a habitat.

One invasive species, salt cedar, was observed within the project area during the site assessment on October 6, 2009. Salt cedar was observed within the wetlands that fringe existing PAs 14 and 15. Nutria have been documented by TPWD within Atkinson Island WMA although no nutria were observed during the site assessment.

3.4 Human Environment

3.4.1 Existing Facilities and Utilities Systems

Due to the remoteness of the project area from the mainland, minimal facilities are located in the vicinity of the existing footprint of the proposed project. One existing oil and gas production facility is located within the footprint of the proposed upland PA expansion area in the shallow waters between PA 14 and PA 15. Three additional oil and gas production facilities are located to the east of the project area within the proposed footprint of the BU sites. In addition, three pipelines traverse the bay bottom within the project area. One three inch, one four inch, and one six inch diameter pipeline parallel each other and run from the existing oil and gas production facility within the project footprint to the east. No other facilities or utilities are located within or adjacent to the project area. The approximate locations of existing facilities in the vicinity of the project are depicted in Exhibit 6.

3.4.2 Air Quality

The following sections discuss the applicable regulatory framework and existing ambient air quality within the study area. Due to the regional nature of air quality, although the project study area only encompasses Chambers, Harris, and Galveston Counties, the air quality study area consists of the

Houston-Galveston-Brazoria (HGB) Ozone Nonattainment Area defined by Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. The air quality analysis study area consists of this larger area because it includes the project study area and is classified by the EPA under the Clean Air Act (CAA) as a designated area.

The CAA requires the EPA to establish National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. NAAQS have been established for seven principal pollutants, called "criteria" pollutants, in 40 CFR, Part 50. The criteria pollutants are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), lead (Pb), inhalable particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns (PM_{10}), fine particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 microns ($PM_{2.5}$), and sulfur dioxide (SO_2).

The HGB Ozone Nonattainment Area is classified as a "severe" nonattainment area under the 1-hour ozone standard and as a "severe" nonattainment with the 8-hour NAAQS for ozone. Under the severe attainment designation, the HGB Ozone Nonattainment Area has a deadline of June 15, 2019, for attainment of the 8-hour ozone standard (Federal Register, 2008).

3.4.2.1 Air Quality Baseline Condition

Ambient air quality in the project study area is directly related to emissions from man-made sources such as from stationary sources (stacks, vents, etc.); emissions from mobile sources such as vehicles, ships, trains, etc.; chemical reactions in the atmosphere such as the formation of ozone; and natural sources such as trees, fires, and wind-blown dust. Since all of these sources must be considered in an assessment of air quality, the EPA has identified air emissions inventories and ambient air monitoring as key methods for assessing air quality.

Air pollutants within and near the project study area are measured by numerous air-monitoring stations. Most of the stations in the region measure the concentrations of criteria air pollutants, as well as temperature, wind velocity, wind direction, and other meteorological parameters. The monitors operate continuously and are routinely calibrated and maintained to assure quality data.

3.4.2.1.1 Existing Air Emissions Inventory

Baseline emissions were determined using data from the EPA's emissions inventory database (EPA, 2009). Table 6 is a summary of emissions for Chamber, Harris, and Galveston Counties for 2002, the most recent data available from the EPA's database. For comparison, the total emissions inventory for the HGB Ozone Nonattainment Area is also provided. The emissions information for each pollutant is broken out by category: area source, point source, highway, and off-highway emissions. These data provide a base from which to compare the proposed project emissions.

Table 6: Summary of 2002 Air Emissions Inventory for Study Area Counties Compared to the HGB by Source Category (tpy)

	Source Category	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Chambers County							
	Area	4,419	1,114	10,041	1,350	305	1,784
	Point	3,180	4,941	352	321	66	2,041
	Highway Vehicle	13,330	1,758	45	31	53	850
	Off-Highway Vehicles	3,528	870	70	66	172	744

Table 6: Summary of 2002 Air Emissions Inventory for Study Area Counties Compared to the HGB by Source Category (tpy) (Continued)

	Source Category	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
	Total	24,456	8,683	10,508	1,767	596	5,419
Harris County							
	Area	26,686	10,718	128,789	17,864	17,258	58,219
	Point	26,113	45,197	6,301	5,392	30,708	30,270
	Highway Vehicle	428,708	69,984	1,930	1,334	2,290	35,548
	Off-Highway Vehicles	282,110	74,154	4,548	4,267	7,368	22,529
	Total	763,617	200,053	141,568	28,857	57,625	146,566
Galveston County							
	Area	3,007	1,521	12,396	1,562	759	4,815
	Point	7,449	16,809	2,081	1,756	8,099	6,899
	Highway Vehicle	31,428	4,587	119	82	141	2,570
	Off-Highway Vehicles	19,256	28,536	1,755	1,620	7,315	3,308
	Total	61,140	51,453	16,351	5,020	16,314	17,591
HGB Ozone Nonattainment Area							
	Area	57,739	20,587	301,949	38,726	22,219	82,371
	Point	54,451	111,280	12,635	11,008	106,166	47,441
	Highway Vehicle	615,263	96,492	2,647	1,830	3,143	49,826
	Off-Highway Vehicles	374,240	128,993	8,123	7,591	20,490	34,490
	Total	1,101,693	357,353	325,353	59,155	152,017	214,128

Source: EPA, 2009.

3.4.3 Noise

Noise is broadly described as unwanted sound. Sound becomes unwanted when it interferes with normal activities or causes physical harm. Noise-sensitive receptors are facilities or areas where excessive noise may disrupt normal activity, or cause annoyance, or loss of business. Land uses such as residential, religious, educational, recreational, and medical facilities are more sensitive to increased noise levels than are commercial and industrial land uses. Numerous noise-sensitive receptors are located within the project study area, including churches, parks, and schools. The nearest residence to the project area (proposed project footprint and immediate vicinity) is approximately two miles southwest of the project area. The closest church to the project area is the Light of Christ Lutheran Church, located approximately five miles northwest of the project area. The closest park to the project area is Goldenacres Park, located approximately two miles southwest of the project area, adjacent to the nearest residence. The closest school to the project area is La Porte High School, which is located approximately eight miles northwest of the project area. There are no hospitals or cemeteries located within the project study area.

The existing noise environment within the project study area varies greatly and is generally influenced by the surrounding land uses concentrated in any particular area. Through the interpretation of aerial photography, it was determined that the project study area is a mixture of suburban residential and commercial development and industrial land uses. Along Galveston Bay, development is primarily residential, and includes the communities of Shoreacres, Bayside Terrace, and Morgan’s Point. The northern portion of Morgan’s Point includes heavy industrial development, which continues northwest along State Highway (SH) 225. Dense industrial development also exists around the Bayport Ship Channel and Bayport Turning Basin, and there is extensive industrial development in the eastern portion of the project study area, bounded by Fairmont Parkway to the north, Bay Area Boulevard to the east and south, and Red Bluff Road to the west. Residential and commercial developments, with some urban development around La Porte, comprise the remaining project study area.

The existing noise environment of the project study area communities is affected by a number of sources, most of which are transportation-related (i.e. waterways, roadways, etc.). Waterborne transportation activities that currently contribute to the region's ambient noise environment include the operation of ships, barges, commercial fishing vessels, and sport and recreation boats. Additionally, major roadways traverse the project study area, contributing to the existing noise environment. These are SH 146 and SH 225. The La Porte Municipal Airport is also located in the project study area, approximately nine miles from the project area.

3.4.4 Traffic and Transportation

There are no roadways within the immediate vicinity of the project area. The project area is surrounded by Galveston Bay and not accessible by roadway. Major highways within the project study area are located on the mainland and include SH 146 which connects the communities of Baytown, La Porte, Kemah, and Seabrook along the west side of Galveston Bay. In addition SH 225 intersects SH 146 in La Porte and heads west into Houston. Other secondary highways within the project study area provide alternate routes and congestion relief during periods of high traffic volume.

A major artery of marine shipping and navigation within the project study area flows through the HSC. The HSC is approximately 53 miles long from the Gulf of Mexico to the Turning Basin. Container ships and other large commercial vessels utilize the HSC to access the Ports of Houston, Galveston, Texas City, and Bayport from the Gulf of Mexico.

3.4.5 Airports and Aviation

Due to the increasing concern regarding aircraft-wildlife strikes, the Federal Aviation Administration (FAA) has implemented standards, practices, and recommendations for holders of Airport Operating Certificates issued under Title 14, CFR Part 139, Certification of Airports, Subpart D (Part 139), to comply with the wildlife hazard management requirements of Part 139. Airports that have received Federal grant-in-aid assistance must use these standards.

In accordance with the FAA Advisory Circular 150/5200-33B and the MOA with FAA to address aircraft-wildlife strikes, when considering proposed dredged material placement, BU features, and mitigation areas, USACE must take into account whether the proposed action could increase wildlife hazards. The FAA recommends minimum separation criteria for land-use practices that attract hazardous wildlife to the vicinity of airports. These criteria include land uses that cause movement of hazardous wildlife onto, into, or across the airport's approach or departure airspace or air operations area (AOA).

These separation criteria include:

- Perimeter A: For airports serving piston-powered aircraft, hazardous wildlife attractants must be 5,000 feet from the nearest AOA;
- Perimeter B: For airports serving turbine-powered aircraft, hazardous wildlife attractants must be 10,000 feet from the nearest AOA; and
- Perimeter C: Five-mile range to protect approach, departure and circling airspace.

The only airport within the study area that meets these standards is the La Porte Municipal Airport. The La Porte Municipal Airport is a city-owned public-use airport located three miles northwest of the central business district of La Porte, Texas. The proposed project features are not within five miles of the La

Porte Municipal Airport. The Baytown Airport and the Ellington Field Airport are located just outside the study area. Although the five-mile perimeters for these two airports do fall within the study area, the proposed project features are not within the five-mile perimeter. No airports are located within five miles of the proposed mitigation site at Bolivar Peninsula.

3.4.6 Cultural Resources

Galveston Bay has been a focus of historic activity since the early 1800s. Between 1817 and 1820, the bay was used for illicit smuggling and privateering by the Laffite brothers. During the Civil War, the Battle of Galveston was fought on the land, along the wharf area, and on the waters of the bay in December 1862 and January 1863. The HSC runs through the Bay as well.

The HSC achieved early significance as a link between interior Texas and the Gulf of Mexico. The HSC traces its origin to early trade on Buffalo Bayou, as the waterway proved to be dependably navigable. Cotton planters over a large area brought their cotton to Houston to be shipped to Galveston and goods destined for the interior came upstream.

The HSC leads to the Port of Houston, which in terms of tonnage was the third largest United States port by the 1980s. By that time, around 4,700 ships traversed Galveston Bay each year to and from its principal ports: Galveston, Texas City, and Houston.

The Texas state database was searched and no previously recorded archeological sites are located in the project area. A portion of the project area was previously surveyed as documented in the report entitled "Historical Research and Marine Remote-Sensing Survey of Proposed Oyster Reef Pads and Boaters' Cuts, Galveston Bay, Chambers and Galveston Counties, Texas", prepared by PBS&J, and dated May 2000 (PBSJ, 2000). No significant anomalies were identified as a result of this effort. Another portion of the project area was surveyed as documented in the report entitled "Beneficial Use Areas Survey Houston-Galveston Navigation Channel, Texas Project, Galveston, Harris, Liberty, and Chambers Counties, Texas, Galveston Bay", prepared by Espey, Huston & Associates, and dated July 1995 (Espey, 1995). As a result of this survey, four significant anomalies were identified within the project area. Through additional cultural resource investigations, the District received concurrence from the State Historic Preservation Officer (SHPO) regarding these significant anomalies (Appendix D).

3.4.7 Socioeconomic Resources

The location of the proposed project is remote and situated more than 2 miles from the mainland. Communities within the project study area include Baytown, at the north shore of upper Galveston Bay; and Kemah, La Porte, and Seabrook on the west shoreline of upper Galveston Bay. The latest socioeconomic data was obtained from Sperling's Best Places 2009 estimates (Sperling's, 2009). Socioeconomic data from the communities within the project study area are summarized in the tables below. Demographic data are summarized in Table 7, social data are summarized in Table 8, and economic data are summarized in Table 9.

Table 7: Demographic Data for Communities within the Project Study Area.

Community	Population	Ethnicity (%)					Median Age
		White	Black	Asian	Other	Hispanic[1]	
Baytown	71,993	61	18	1	20	36	32.6
Kemah	2,464	67	5	4	24	30	32.1
La Porte	37,141	83	9	2	6	25	34.7
Seabrook	11,483	88	2	3	7	13	36.6

[1]Hispanics may be of any race

Table 8: Social Data for Communities within the Project Study Area.

Community	Education (%)				Marital Status (%)	
	No Diploma	High School	Bachelor	Graduate/ Professional	Married	Divorced/Separated
Baytown	28	72	9	5	58	10
Kemah	15	85	21	8	54	16
La Porte	17	83	10	4	64	11
Seabrook	7	93	30	12	53	15

Table 9: Economic Data for Communities within the Project Study Area.

Community	Median Household Income ($)	Income per capita ($)	Top Industry Employment (%)					
			Management Business Financial	Professional	Service	Sales Office	Construction Extraction Maintenance	Production Transportation Material Moving
Baytown	42,548	20,165	8	18	13	25	17	17
Kemah	59,606	28,249	17	21	19	20	10	10
La Porte	63,913	24,176	11	16	12	27	14	19
Seabrook	65,983	35,017	17	30	10	25	8	9

The socioeconomic composition of the residents within the project study area is a generally educated population working professional jobs with an income well above the poverty line. The socioeconomic data depicted in Tables 7-9 show that the population within the study area is mostly white and relatively young. Approximately 83% of people in the project study area have a high school diploma and more than half of people are married. The median household income ranges from $42,548 in Baytown to $65,983 in Seabrook while the income per capita ranges from $20, 165 in Bayport to $35,017 in Seabrook. The 2009 poverty guidelines, per the US Department of Health and Human Services (HHS), is $10,830 for a one person family to $22,050 for a four person family (74 CFR, 2009). Household and per capita incomes for families and individuals within the project study area are well above 2009 poverty guidelines. Top industry employment consists of sales, office, and professional jobs.

3.4.8 Hazardous, Toxic, and Radioactive Wastes

A Hazardous, Toxic, and Radioactive Waste (HTRW) preliminary desktop assessment was conducted for the proposed project. The assessment methodology is designed to identify known and potentially unknown HTRW sites that could cause a release to the environment, endanger human health, and impact project costs and schedules. The methodology included a database search and review of aerial photos and maps.

The EPA online Enviromapper (USEPA, 2009) is a comprehensive database that was used to search for HTRW sites. Enviromapper searched multiple USEPA databases including:

- Aerometric Information Retrieval System (AIRS), which contains information on air releases;
- The Assessment, Cleanup and Redevelopment Exchange System (ACRES), which contains information on brownfields;
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), which contains information on Superfund Sites;
- Permit Compliance System (PCS), which contains information on companies which have been issued permits to discharge waste water into rivers;
- Radiation Information Database (RADINFO), which contains information about facilities that are regulated by EPA regulations for radiation and radioactivity;
- Resource Conservation and Recovery Act Information (RCRAInfo), which contains information on generators, transporters, treaters, storers, and disposers of hazardous waste; and

- Toxics Release Inventory (TRI), which contains information about more than 650 toxic chemicals that are being used, manufactured, treated, transported, or released into the environment.

Investigations of databases indicate that there are no known HTRW sites within the project footprint or in the immediate vicinity. Numerous HTRW sites were located within the project study area on the mainland in and around the communities of Baytown, La Porte, Kemah, and Seabrook.

A site investigation revealed oil and gas production facilities in the shallow waters in the footprints of the proposed upland PA expansion areas and the proposed BU sites. The presence of the oil and gas facilities may be a HTRW concern due to the risk associated with spills and/or leaks during any potential modification and/or removal activities. Numerous HTRW sites were located within the project study area on the mainland in and around the communities of Baytown, La Porte, Kemah, and Seabrook.

3.4.9 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," signed by the president on February 11, 1994, directs Federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse affects of Federal projects on the health of the environment of minority and low-income populations to the greatest extent practicable permitted by law. The Executive Order requires that minority and low-income populations not receive disproportionately high adverse human health or environmental impacts, and requires that representatives of any low-income or minority populations that could be affected by the proposed project be involved in the community participation and public involvement process.

Low-income persons are defined as "a person whose household income is at or below the HHS poverty guidelines." The 2009 HHS poverty guideline for a family of four is $22,050. Recent estimated median household income for the city of La Porte is $63,913; for the city of Kemah is $59, 606; for the city of Seabrook is $65,983; and for the city of Baytown is $42,548 (Sperlings, 2009); which are all well above the 2008 HHS poverty guideline.

The mainland surrounding the vicinity of the project area is either highly commercialized or consists of fairly affluent subdivisions. This area is not considered socially or economically disadvantaged based upon the socioeconomic data provided in Section 3.4.7.

3.4.10 Visual and Aesthetic Resources

The project area is located in upper Galveston Bay and surrounded by expansive bay views. Heavy urbanization and industrialization in the upper Galveston Bay region has impacted the visual and aesthetic resources of the area. Bridges and industrial structures from oil refineries and shipping operations are visible throughout the project study area. People from surrounding areas utilize upper Galveston Bay for recreational resources such as boating and fishing. This portion of the bay is easily accessible for public use due to the numerous public boat ramps which are located in the upper portion of Galveston Bay. Visitors come to Atkinson Island regularly due to its designation as a WMA.

Primary viewers of the project area include commercial/industrial boat traffic in the nearby HSC, recreational boaters in upper Galveston Bay, recreational fishermen in upper Galveston Bay, and visitors to Atkinson Island WMA.

Levees were constructed for the PAs and dredged material was deposited during previous construction activities in the vicinity of the project area. The visual aesthetics of the project area were affected by the previous construction of the PA levees.

3.4.11 Recreational Resources

Recreational resources within the project study area and the surrounding vicinity are primarily water-based activities such as boating, fishing, swimming, and wildlife viewing. Numerous public boat ramps in upper Galveston Bay provide access to the waters in and around the project area. Visitors to Atkinson Island WMA come for fishing and wildlife viewing. Visitors also come to canoe and kayak in the constructed marsh on the north side of PA 15.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Project Area

In 1995 the District prepared a LRR and SEIS for the HSC project (USACE, 1995). The depth of the HSC, between Morgan's Point and the Bayport Ship Channel was authorized to be dredged to a depth of 60 feet in the 1995 SEIS. The proposed project would authorize mining for new work materials up to 80 feet within the same reach of channel. The areas within the existing project limits were highly disturbed from the previous construction activities of PA 14 and PA 15. This section provides a discussion of the environmental impacts associated with both the No-Action and the Proposed alternatives.

4.1.1 No-Action Alternative

No construction activities are associated with the No-Action Alternative. Available capacity of PAs would remain at existing levels and capacities would be reached more rapidly. When capacities are reached, maintenance dredging activities would be halted within the reach of the HSC between Morgan's Point and the Bayport Ship Channel. Shoaling within this reach of the HSC, without maintenance activities, would result in unsafe navigational channels and could potentially lead to adverse effects to resources as described in subsequent sections.

4.1.2 Proposed Alternative

Construction of the Proposed Alternative is anticipated to result in minor environmental impacts, both permanent and temporary. These impacts are anticipated to occur within and in the immediate vicinity of the project footprint of the Proposed Alternative. Those impacts are described in further detail in subsequent sections. Construction of BU sites would replace and enhance the temporary and localized impacts to the surrounding environment that are anticipated to occur as a result of the Proposed Alternative.

Under the Proposed Alternative, the reach of the HSC between Morgan's Point and the Bayport Ship Channel would be mined to 80 feet; 20 feet deeper than previously authorized. The HSC would take longer to fill to authorized depths with shoaled sediments, thereby delaying future maintenance cycles. The use of the PAs would be delayed for several years as a result.

4.2 Physical Environment

4.2.1 Topography and Soils

4.2.1.1 No-Action Alternative

Under the No-Action Alternative, maintenance within the reach of the HSC between Morgan's Point and the Bayport Ship Channel would be halted as capacities of existing PAs are reached. Shoaling within this reach of the HSC, without maintenance activities, would result in sediments filling in the channel.

4.2.1.2 Proposed Alternative

Construction of the Proposed Alternative would result in permanent impacts to the topography of the area within the project footprint. Levees are proposed to be constructed and dredged material is proposed to be placed within the constructed levees. Levees are proposed to be constructed to 10 feet above the existing submerged bay bottom, intertidal sand flats, and wetland areas. The proposed levee heights would be constructed to match heights of existing levees for PAs 14 and 15. Dredged materials would be placed to within 3 feet of the top of the proposed levees.

Construction of the Proposed Alternative is not anticipated to adversely affect the soils within the project study area. Existing soils on the site are currently classified as dredged material. Additional dredged material proposed to be placed in the project area is not anticipated to adversely affect the character of the existing soil.

4.2.1.3 Prime and Unique Farmlands

4.2.1.3.1 No-Action Alternative

No prime or unique farmlands are in the project area. Adverse affects to prime or unique farmlands would not occur under the No-Action Alternative.

4.2.1.3.2 Proposed Alternative

Construction of the Proposed Alternative is not anticipated to adversely affect prime or unique farmlands in the project area. Prime or unique farmlands do not occur within the project area.

4.2.2 Geology

4.2.2.1 No-Action Alternative

No adverse affects to geology are anticipated to occur under the No-Action Alternative. Geology would remain as it currently exists and no alterations would occur.

4.2.2.2 Proposed Alternative

Construction of the Proposed Alternative is not anticipated to adversely affect geology in the project study area. The existing PAs consist of dredged materials from the HSC and the proposed action would involve similar geological materials.

4.2.3 Hydrology and Drainage

4.2.3.1 No-Action Alternative

Under the No-Action Alternative, no construction activities would occur, and shoaling action between existing PAs 14 and 15 would continue to deposit sediments in between the existing PAs. Tidal exchange would continue to diminish and these areas could completely shoal in. Tidal exchange in the surrounding areas of Galveston Bay would continue to function as normal, regardless of shoaling.

Maintenance within the reach of the HSC between Morgan’s Point and the Bayport Ship Channel would be halted as capacities of existing PAs are reached. Shoaling within this reach of the HSC, without maintenance activities, would result in sediments filling in the channel, and existing hydrological patterns could be altered.

4.2.3.2 Proposed Alternative

Construction of the Proposed Alternative is not anticipated to adversely affect the existing hydrology and drainage within the project footprint. After construction of the proposed project, the existing circulation inlet between PA 14 and PA 15 would be closed off by newly constructed levees and tidal water would not be allowed to be exchanged between the two PAs. The tidal exchange between the two PAs is currently limited due to the existing shoaling in this area. The permanent nature of the hydrological impact to the project site would be minimal and would not be anticipated to adversely affect the hydrological regime of the project study area. Daily tidal exchange surrounding Atkinson Island and in Galveston Bay would continue to function as normal. The design of the proposed action has taken into consideration hydrology and drainage and its potential effects to the surrounding area.

Under the Proposed Alternative, the reach of the HSC between Morgan's Point and the Bayport Ship Channel would be mined to 80 feet; 20 feet deeper than previously authorized. The deeper channel could result in a slightly different hydrological regime within this reach of the HSC.

After construction, the additional 169-acre expanded PA would detain storm water that had previously been deposited from the atmosphere directly into the bay. The newly created PA would contain drainage improvements such as swales and outfalls that would minimize sedimentation from the PAs into surrounding bay waters. Vegetation that is expected to recruit into the newly created PA would aid in removing suspended solids before water reaches outfall locations.

4.2.4 Climate and Relative Sea Level Rise

4.2.4.1 No-Action Alternative

Under the No-Action Alternative, no construction would occur. Effects from climate change and sea level rise would continue under current conditions.

4.2.4.2 Proposed Alternative

Under the Proposed Alternative, construction activities would proceed and the existing PA would be expanded and the BU areas and mitigation site would be constructed. All construction activities would occur in Galveston Bay. The proposed project is not expected to be significantly affected by future relative sea level rise.

4.2.5 Water and Sediment Quality

4.2.5.1 No-Action Alternative

No construction would occur under the No-Action Alternative. Periodic maintenance dredging would continue until placement capacity is reached. At that point temporary effects to water and sediment quality that occur during maintenance dredging would cease.

4.2.5.2 Proposed Alternative

Construction of the Proposed Alternative is anticipated to result in temporary and localized adverse effects to water quality due to an increase in turbidity. These temporary effects would only occur during construction of the PA and marsh beneficial use area perimeter levees. Once construction of the perimeter levees is complete and the side slopes have been stabilized, dredged material would be placed and contained within the levees. Drainage from the PA via constructed outfalls may result in a temporary and localized increase in turbidity during high flow, or storm, events. Vegetation that is expected to recruit into the newly created PA may aid in decreasing suspended solids before water reaches outfall locations.

The new UCPA will be designed and operated with the goal of achieving an effluent total suspended solids concentration of not more than 300 milligrams per liter. Best Management Practices (BMP) would be implemented during maintenance dredging and placement of dredged maintenance material activities to minimize impacts to water quality during construction. An environmental plan would be drafted by the contractor prior to construction that would include the appropriate BMPs to be utilized.

Construction of the Proposed Alternative is not anticipated to adversely affect sediment quality in the project study area. Sediments placed during construction of the levees would be of similar composition as sediments that exist in the surrounding areas. No contaminated sediments are expected to be used for construction of the Proposed Alternative. Maintenance dredging would continue through the life of the project although maintenance dredging cycles would be delayed due to the mining of the reach of the HSC from Morgan’s Point to the Bayport Ship Channel to 80 feet, 20 feet deeper than currently authorized. Sediments would take longer to shoal in the deeper channel, thereby delaying maintenance dredging cycles.

4.3 Biological Resources

4.3.1 Vegetation

4.3.1.1 No-Action Alternative

Under the No-Action Alternative, no construction activities would occur, and shoaling action between existing PAs 14 and 15 would continue to deposit sediments in between existing PAs. Emergent vegetation, typical of saline marsh would likely establish in these areas when the appropriate elevation is reached to support the growth requirements of this vegetation.

4.3.1.2 Proposed Alternative

Construction of the Proposed Alternative is anticipated to adversely affect vegetation types within the project footprint. Table 10 describes the proposed impacts to vegetation types that are expected to occur due to construction of the Proposed Alternative. Exhibit 7 depicts the location of the impacted habitat types.

Table 10: Approximate Anticipated Project Impacts to Vegetation Types

Vegetation/Habitat Types	Approximate Impact of PA Expansion (Acres)
Saline marsh	29
Shallow Bay Bottom Tidal Waters	113
Intertidal Sand Flats	27
Total	169

Approximately 29 total acres of saline marsh are anticipated to be permanently converted to upland PA by construction of the Proposed Alternative. These saline marsh areas are along the fringe of the existing PAs. The proposed marsh beneficial use area is anticipated to replace and enhance the ecological values and services of the saline marsh losses resulting from construction of the Proposed Alternative.

Approximately 113 acres of shallow bay bottom tidal waters and approximately 27 acres of intertidal sand flats are anticipated to be permanently converted to upland PA by construction of the Proposed

Alternative. The shallow bay bottom tidal waters and intertidal sand flats proposed to be impacted are between PAs 14 and 15. The proposed marsh beneficial use area is anticipated to replace and enhance the ecological values and services of the losses to shallow bay bottom tidal waters resulting from construction of the Proposed Alternative.

The proposed 1,121 acres of marsh beneficial use areas (Cells M-10, M-11, and M-7/8/9) and minimum of 88 acres of mitigation marsh are anticipated to offset and enhance the ecological values and services to Galveston Bay due to the habitat losses resulting from construction of the Proposed Alternative. Dredged maintenance materials would be placed in marsh beneficial use areas until the appropriate elevation to successfully grow intertidal saline marsh is attained. Once the appropriate elevation is attained, the beneficial use area would be planted with the appropriate plant species. An ecological time lag of approximately three years after vegetation planting is to be expected before the beneficial use marsh is fully productive. The three year time lag would allow vegetation to fully establish and provide optimal habitat to marsh dependent organisms. A detailed explanation of the proposed mitigation to offset unavoidable losses to vegetative communities can be found in Section 5 of this document.

4.3.2 Aquatic and Terrestrial Habitats

4.3.2.1 No-Action Alternative

Under the No-Action Alternative, no construction activities would occur, and shoaling action between existing PAs 14 and 15 would continue to deposit sediments. Emergent vegetation, typical of intertidal saline marsh would likely establish in these areas when the appropriate elevation is reached to support the growth requirements of this vegetation. The additional emergent marsh would provide additional cover and food source for aquatic organisms and would provide foraging habitats for terrestrial species living in nearby terrestrial habitats.

Periodic disturbances associated with maintenance dredging of the HSC would continue until dredged material placement capacity is reached. Once capacity is reached, sediments would fill in the channel and aquatic organisms, particularly benthic organisms at the bottom of the channel, could be affected.

4.3.2.2 Proposed Alternative

Approximately 113 acres of shallow bay bottom tidal waters and approximately 27 acres of intertidal sand flats would be permanently impacted by construction of the Proposed Alternative. Benthic habitat in these areas would be converted to levees and PAs. These habitat types are not unique to the project area. Approximately 1,121 acres of beneficial use marsh created adjacent to PAs 14 and 15 and a minimum of 88 acres of mitigation near Bolivar Peninsula as described in Section 5.0 are expected to provide habitat with a higher productivity than was previously found within the impacted project area. Habitat functionality in the BU marsh and mitigation areas would be expected to become optimal approximately three years after the planting of appropriate plant species. The three year ecological time lag would allow vegetation to fully establish and provide optimal habitat to marsh dependent organisms.

Minimal sedimentation may occur in adjacent benthic habitats during the initial construction of the levees as finer silt particles settle and migrate with mixing and reworking performed by the surrounding bay hydrodynamics. Benthos present in these areas may be temporarily affected but long term impacts to benthic communities within the Bay are not anticipated. Benthic communities are anticipated to reestablish within the project area.

Under the Proposed Alternative, the reach of the HSC between Morgan’s Point and the Bayport Ship Channel would be mined to 80 feet; 20 feet deeper than previously authorized. The HSC would take longer to fill to authorized depths with shoaled sediments, thereby delaying future maintenance cycles. The deeper channel could temporarily adversely affect benthic communities.

Oyster reefs that may be in the project area may be indirectly affected by temporary increases in turbidity during construction of the levees. A depiction of historic oyster reefs is included in Exhibit 5. An oyster-specific survey of the project area was not conducted. In the event that live shell and/or oyster reefs are discovered during proposed construction activities, avoidance and minimization measures will be implemented as recommended by USFWS through further consultation.

4.3.3 Wildlife Resources

4.3.3.1 No-Action Alternative

Under the No-Action Alternative, no construction activities would occur, and shoaling action between existing PAs 14 and 15 would continue to deposit sediments. Emergent vegetation, typical of saline marsh would likely establish in these areas when the appropriate elevation is reached to support the growth requirements of this vegetation. The additional emergent marsh would provide additional cover and food source for wildlife resources in the vicinity of the project area.

Periodic disturbances associated with maintenance dredging of the HSC would continue until dredged material placement capacity is reached. Once capacity is reached, sediments would fill in the channel and wildlife resources that utilize the channel could be affected.

4.3.3.2 Proposed Alternative

Construction of the Proposed Alternative is anticipated to adversely affect wildlife populations in the project footprint. However, these impacts would be minimal and localized. Small mammals in the project area would be adversely affected by construction of the Proposed Alternative. Depending on the small mammal species affected, construction of the Proposed Alternative may result in their displacement to surrounding areas. Similar habitat is located in the project area where displaced mammals could find suitable habitat. The proposed project is anticipated to temporarily disturb feeding behavior of wading birds inhabiting the project area; however, suitable feeding habitat is present within the project vicinity. Newly constructed levees would be expected to provide suitable nesting habitat for colonial waterbirds as described in Section 3.3.3. The suitability of this nesting habitat would decline over time with increased vegetation growth.

In addition, the proposed marsh beneficial use area is anticipated to replace and enhance the ecological values and services of the saline marsh losses resulting from construction of the Proposed Alternative. Marsh beneficial use areas would produce a more productive habitat than what currently exists in the project area and would ultimately produce beneficial impacts for wildlife within the project study area.

4.3.4 Fisheries and Essential Fish Habitat

4.3.4.1 No-Action Alternative

Under the No-Action Alternative, no construction activities would occur, and shoaling action between existing PAs 14 and 15 would continue to deposit sediments. Emergent vegetation, typical of saline marsh would likely establish in these areas when the appropriate elevation is reached to support the growth requirements of this vegetation. The additional vegetation would provide estuarine emergent marsh EFH.

Periodic disturbances associated with maintenance dredging of the HSC would continue until dredged material placement capacity is reached. Once capacity is reached, sediments would fill in the channel and fisheries and EFH associated with these areas could be affected.

4.3.4.2 Proposed Alternative

Construction of the Proposed Alternative may adversely affect fisheries resources in the project study area due to turbidity. Juvenile and larval life stages of certain fisheries species that are dependent upon saline marsh and/or intertidal habitats are more likely to be adversely affected by turbidity than more mobile species. More mobile species such as fish are able to move away from those areas where turbidity may be temporarily increased. No long-term adverse impacts to fisheries populations are anticipated due to construction of the Proposed Alternative.

The proposed project would result in impacts to EFH. EFH that are likely to be impacted by construction of the proposed project includes estuarine water column and estuarine mud, shell, and sand substrate. The estuarine water column is likely to be impacted by increased turbidity that is expected to be localized and short term. Approximately 140 acres of EFH (estuarine mud, shell, and sand substrate and estuarine water column), including intertidal sand flats and submerged bay bottom areas, in the project area would be permanently lost due to construction of the proposed project. In addition, approximately 29 acres of saline marsh would be permanently lost due to construction of the Proposed Alternative. Species with EFH present in the project area likely to be affected include juvenile brown, white, and pink shrimp, adult brown and white shrimp, juvenile and adult red drum, and juvenile and adult stone crab.

Based on the District's Habitat Evaluation Procedure (HEP) analysis (Appendix E), it has been determined that the proposed construction of the mitigation marsh at Bolivar would provide compensation for the ecological values and services of the losses to EFH resulting from construction of the new upland PA. In addition, the construction of the marsh BU sites would provide a net benefit to the bay ecosystem by providing higher value habitat for managed fish species. Dredged maintenance material would be placed in marsh beneficial use areas until the appropriate elevation to successfully grow saline marsh is attained. Once the appropriate elevation is attained, the beneficial use area would be planted with vegetation. An ecological time lag of approximately three years after vegetation planting is to be expected before the beneficial use marsh is fully productive. The three year time lag would allow vegetation to completely establish and give organisms time to migrate into the area and utilize the newly created marsh as habitat.

Tidal exchange would be prohibited between the two existing PAs after construction of the perimeter levees. Tidal exchange in these areas is currently limited due to shoaling; therefore the discontinuation of tidal exchange due to construction of the proposed project would prohibit further shoaling and its effect to EFH would be minimal.

Under the Proposed Alternative, the reach of the HSC between Morgan's Point and the Bayport Ship Channel would be mined to 80 feet; 20 feet deeper than previously authorized. The HSC would take longer to fill to authorized depths with shoaled sediments, thereby delaying future maintenance cycles. The deeper channel could develop conditions that might affect fisheries and/or EFH.

Overall a short term, minimal impact to fisheries and EFH would be expected during construction. Over the long term, a net benefit to fisheries and EFH resources is anticipated as a result of construction of the Proposed Alternative.

4.3.5 Threatened and Endangered Species

4.3.5.1 No-Action Alternative

Under the No-Action Alternative, no construction activities would occur and threatened and endangered species would not be affected.

4.3.5.2 Proposed Alternative

An assessment of the construction of the Proposed Alternative's potential to affect federally listed threatened and endangered species and critical habitat was conducted in a BA (Appendix A). Of the 15 threatened and endangered species identified in the project vicinity, the proposed project may affect, but is not likely to adversely affect, the brown pelican, piping plover, Kemp's ridley sea turtle, green sea turtle, and loggerhead sea turtle. The BA concludes that the project would not impact any other federally listed or endangered species or their critical habitat. Concurrence was received from USFWS and NMFS in letters dated January 7, 2010 and January 15, 2010, respectively. Consultation correspondence with the USFWS and NMFS are included in Appendix A. The NMFS concurrence letter included construction conditions for avoiding and minimizing impacts to sea turtles and smalltooth sawfish.

4.3.6 Invasive Species

4.3.6.1 No-Action Alternative

No adverse affects to invasive species within the project footprint is anticipated to occur under the No-Action Alternative. Salt cedar, which was observed on site, may benefit from the No-Action Alternative and could potentially out-compete native vegetation within the project area.

4.3.6.2 Proposed Alternative

Initially, salt cedar within the project impact area would be eradicated by placement of dredged material. However, invasive species typically thrive in disturbed environments, and construction of the PAs would contribute additional disturbed areas into the environment, providing opportunity for additional invasive species, including salt cedar, to establish. Areas with risk of colonization after project completion include the proposed footprint of the expanded PA area and beneficial use areas. These newly created upland areas may be readily colonized by other upland dependant invasive species such as fire ants, Chinese tallow, and Brazilian pepper.

4.4 Human Environment

4.4.1 Existing Facilities and Utilities Systems

4.4.1.1 No-Action Alternative

No adverse affects to existing facilities and utilities systems are anticipated to occur under the No-Action Alternative. Existing facilities and utilities systems would remain. Removal or modification of oil and gas production facilities would not be required.

4.4.1.2 Proposed Alternative

Construction of the Proposed Alternative may adversely affect existing facilities and utilities systems in the project area. Construction of the Proposed Alternative would require the removal or modification of existing oil and gas production facilities. In order to allow sufficient time for the oil and gas production facilities and associated pipelines to be removed, modified, or plugged and abandoned per Texas Railroad Commission regulations (Texas Administrative Code Title 16, Part 1, Chapter 13, Rule §3.14), the upland

PA expansion area would temporarily remain partially open on its western side. No other impacts to existing facilities and utilities systems are anticipated.

4.4.2 Air Quality

This section provides a discussion of the air quality impacts associated with the No-Action and the Proposed alternatives. The evaluation of air quality impacts was based on the identification of air contaminants and estimated emission rates for the Proposed Alternative. The air contaminants considered are those covered by the NAAQS (except for lead, which is not relevant to project emissions). Air emissions associated with construction activities and employee-related vehicular traffic associated with construction and material placement activities were considered.

4.4.2.1 No-Action Alternative

No construction or new operating emission sources are associated with the No-Action Alternative. However, it is expected that air contaminant emissions would increase in the vicinity due to anticipated increased ship traffic in the HSC. Additional emissions could occur as the channel shoals in, potentially causing shipping delays. Eventually, as port users shift to other locations, these emissions are expected to decrease.

4.4.2.2 Proposed Alternative

The evaluation of air quality impacts associated with the Proposed Alternative was based on the identification of air contaminants and estimated emission rates for this project alternative. Emissions inventories were estimated for project-related activities based on the anticipated schedule, representative equipment use, capacity, and other construction related assumptions developed for this project.

4.4.2.2.1 Air Quality Analysis Results – Proposed Alternative

The estimated construction emissions associated with the Proposed Alternative would be considered one-time activities; i.e., these activities would not continue past the date of completion. The emission sources will consist of marine vessel and land-based mobile sources that will be used during the material mining and placement activities, as follows:

- Marine Vessels – dredges (cutterhead), barges, and support equipment (tugboats, runabouts, and tenders); and
- Land-based – off-road (bulldozers,) and on-road (employee vehicles).

Air contaminant emissions associated with these emission sources would be primarily combustion products from fuel burned in these types of equipment. Marine vessel emission sources would be primarily diesel-powered engines. Off-road equipment was assumed to be all diesel-powered and on-road vehicles all gasoline-powered.

The basis for emissions included the following:

- The project is expected to begin in 2010 with an expected duration span of about 1 year. As the exact schedule for construction has not been established, it is assumed that half of the estimated total project emissions will occur in 2010 and half in 2011.
- The basis for emissions estimates consisted of the operating hours for each specific type of equipment engine, engine load factor, and engine horsepower. Load factors and emission factors for the different marine equipment were determined based on the EPA report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data," February 2000.

- The EPA, NONROAD emission factor model, 2005 Version, was used to predict emissions resulting from landside, off-road construction equipment used for material placement with inputs for assumed equipment usage developed for this alternative. The NONROAD model was run model year of 2010 to generate an emission factor for the criteria air contaminants resulting from the use of land-side construction equipment in Galveston County during the project time period. These emission factors were then used to estimate the total emissions from the use of off-road construction equipment in material placement activities associated with the project.
- Mobile on-road emissions associated with employee vehicles were calculated with the use of the EPA MOBILE6.2 emission factor model. This model is recommended by the EPA for modeling of motor vehicle emission factors. A mix of light duty gasoline vehicles and light duty gasoline trucks was assumed for the makeup of the employee vehicles. An average commute of 25 miles each way was assumed for each vehicle. The total number of miles traveled equaled the number of miles per trip multiplied by the total number of days of activity times the number of vehicles.

A summary of the total estimated emissions in tons resulting from the Proposed Alternative is presented in Table 11.

Table 11: Proposed Alternative – Total Estimated Construction Emissions by Source

Air Contaminant	Dredging/Barge Equipment Emissions (tons)	Non-road Vehicle Emissions (tons)	On-road Vehicle Emissions (tpy)
CO	5.01	3.89	2.18
NO_X	36.38	8.30	0.83
$PM_{2.5}$	0.91	0.70	0.00
PM_{10}	0.95	0.72	0.00
SO_2	6.78	0.11	0.00
VOC	0.72	0.95	0.19

For a discussion of air quality impacts, the total air contaminant emissions from the Proposed Alternative were compared to the 2002 emissions inventory for Galveston County. The comparison is presented in Table 12.

Table 12: Proposed Alternative – Total Estimated Project Emissions Compared with Galveston County Emissions (2002)

Air Contaminant	Total Maximum Estimated Project Emissions (tpy)	Galveston County Emissions (tpy)	Site Emissions % of Galveston County Emissions
CO	11.07	61,140	0.02%
NO_X	45.51	51,453	0.09%
$PM_{2.5}$	1.61	5,020	0.03%
PM_{10}	1.67	16,351	0.01%
SO_X	6.88	16,314	0.04%
VOC	1.86	17,591	0.01%

As shown in Table 12, air contaminant emissions from the Proposed Alternative would result in a relatively small increase in emissions above those from existing sources in the county. As a result, it is expected that air contaminant emissions from the combustion of fuel in equipment used for dredging and placement activities would also result in correspondingly minor short-term impacts on air quality in the immediate vicinity of the project area. Due to the anticipated short-term duration of the channel deepening and widening activities, there would be no long-term impacts, and therefore emissions from these activities are not expected to adversely impact the long-term air quality in the area.

4.4.2.2.2 General Conformity Applicability – Proposed Alternative

For comparison with the thresholds defined in the General Conformity Rule, the estimated emissions of NO_x and VOC for the Proposed Alternative are summarized in Tables 13 and 14 for each year during which the project activities are anticipated to occur.

As shown in Table 13, direct and indirect emissions of VOC are exempt from a General Conformity Determination because they are below the 25 tpy threshold.

Table 13: Proposed Alternative – Summary of VOC Emissions (tpy)

Activity	2010	2011
Dredging Activities – Dredging Vessel Equipment and Support Vessels	0.24	0.24
Barge /Tugboat Vessels	0.12	0.12
Land-side Dredged Material Placement Equipment	0.47	0.47
On-Road – Employee Commuter Vehicles	0.10	0.10
Totals	**0.94**	**0.94**

As shown in Table 14, direct and indirect emissions of NO_x are also exempt from a General Conformity Determination because they are below the 25 tpy threshold.

Table 14: Proposed Alternative – Summary of NO_X Emissions (tpy)

Activity	2010	2011
Dredging Activities – Dredging Vessel Equipment and Support Vessels	15.71	15.71
Barge /Tugboat Vessels	2.48	2.48
Land-side Dredged Material Placement – Bulldozing Equipment	4.15	4.15
On-Road – Employee Commuter Vehicles	0.42	0.42
Totals	**22.76**	**22.76**

Therefore, a General Conformity Determination for NO_x and VOC emissions would not be required for the Proposed Alternative. Detailed air emissions calculations are available upon request from the District.

4.4.3 Noise

Project-related noise impacts were evaluated by considering the noise emissions related to dredge and placement operations of the proposed PA expansion project at noise-sensitive receivers. Impacts were assessed by comparing the predicted noise emitted by typical dredge and construction equipment with the existing ambient noise levels in the vicinity of the project area. For the project, dredging would take place in the channel and would be consistent with current maintenance activities. Rock material would be brought in by barge, and some off-road construction activities would take place on the newly created levees. Because project-related dredging and construction would be consistent with current activities in the project area, and sensitive noise receptors are located at a significant distance from the proposed project area, no noise related impacts are anticipated.

4.4.4 Traffic and Transportation

4.4.4.1 No-Action Alternative

Periodic disturbances associated with maintenance dredging of the HSC would continue until dredged material placement capacity is reached. Once capacity is reached, sediments would fill in the channel and marine-based traffic could be adversely affected by unsafe draft depths in these areas.

4.4.4.2 Proposed Alternative

Construction of the Proposed Alternative is not anticipated to adversely affect land-based traffic and transportation in the project study area. There are no roadways located in the vicinity of the project area; therefore no impacts to traffic would occur. There are major and secondary highways within the project study area but no impacts are anticipated to occur to traffic in these areas due to construction of the Proposed Alternative.

Marine-based traffic and transportation may be temporarily affected by construction of the Proposed Alternative; specifically activities associated with maintenance dredging located between Morgan’s Point and Bayport Ship Channel of the HSC. Marine-based traffic within the HSC may encounter stationary dredging vessels, requiring these vessels to use caution when navigating through this particular stretch of channel. Under the Proposed Alternative, the HSC would remain open and no permanent impacts to marine-based traffic would result.

4.4.5 Airports and Aviation

The HSC PA Expansion Project was evaluated to determine if the proposed action could increase wildlife hazards to aircraft using public use airports with a five-mile approach, departure, and circling radius in the project study area: the La Porte Municipal Airport, the Bayport Airport, and the Ellington Field Airport. The proposed project features do not occur within five miles of any of these three airports.

Project features of the proposed action that could serve as attractants are PAs and marsh creation sites. Current PAs would be expanded and marsh created adjacent to PA 14 and at Bolivar Peninsula (as mitigation for the proposed action). The PAs are existing designated PAs for the HSC Project. Although they are designated PAs, at times during the dredging cycle they provide habitat for birds and wildlife species that pose a strike hazard. Thus, expansion of the PAs and marsh creation in the area would not result in a change of land use or introduce a new attractant. Additionally, none of the project features are located within the Angle of Arrival separation perimeters (up to five miles) for the La Porte Municipal Airport, the Baytown Airport, or the Ellington Field Airport. Therefore, the proposed action is not expected to increase wildlife hazards to aircraft using any of these three airports.

4.4.6 Cultural Resources

A portion of the proposed project, connecting PAs 14 and 15, was coordinated with the SHPO (Appendix D). The SHPO concurred that no additional survey was needed in the area between PAs 14 and 15. The District surveyed the remaining portion of the project area (Exhibit 8) and conducted further testing on four significant anomalies. The District coordinated the results of this work with the SHPO and received concurrence with the findings of the additional testing (Appendix D). Should any historic properties be identified during construction that would be adversely affected by the proposed project, the District would develop a Memorandum of Agreement in coordination with the SHPO to mitigate the adverse effects. Additionally, the District would coordinate any unanticipated discoveries with the SHPO, as necessary.

4.4.7 Socioeconomic Resources

4.4.7.1 No-Action Alternative

No construction activities are associated with the No-Action Alternative. Available capacity of PAs would remain at existing levels and capacities would be reached more rapidly. When capacities are reached, maintenance dredging activities would be halted within the reach of the HSC between Morgan's Point and the Bayport Ship Channel. Delays in maintenance activities may result in unsafe navigation in this portion of the HSC leading to adverse effects to the commercial shipping industry and ultimately loss of jobs.

4.4.7.2 Proposed Alternative

The HGNC Project as a whole would have beneficial impacts on the socioeconomics of the entire Galveston Bay region due to the business and jobs sustained and created from shipping activities. As part of the HGNC Project, expansion of PAs 14 and 15 would also contribute beneficial impacts to socioeconomics of the region. Construction of the Proposed Alternative would permit routine maintenance dredging activities to continue without delays or interruptions, thereby avoiding a disruption of commerce activities within the HSC. Mitigation efforts and construction of beneficial use areas would produce positive socioeconomic benefits due to the net positive benefits to shrimp and finfish species with additional habitat added to the ecosystem. Adverse impacts to the socioeconomics within the project study area would not occur and economy would not be affected under the Proposed Alternative.

4.4.8 Hazardous, Toxic, and Radioactive Wastes (HTRW)

4.4.8.1 No-Action Alternative

Periodic disturbances associated with maintenance dredging of the HSC would continue until dredged material placement capacity is reached. Once capacity is reached, sediments would continue to deposit in the channel and marine-based navigation could be adversely affected by unsafe draft depths. Unsafe draft depths within the HSC could potentially result in accidents that could release oil and or chemicals into the environment.

4.4.8.2 Proposed Alternative

No impacts to HTRW listed sites are anticipated due to construction of the Proposed Alternative. It should be noted that construction of Proposed Alternative would impact an existing oil and gas production facility currently located between PA 14 and 15. The proposed plan allows access to the facility owner/operator after initial construction of the PA levees. Discussions between the District and the owner/operators of the facilities regarding future plans are on-going. A risk of spills associated with the removal or modification of the facilities has the potential to adversely affect the surrounding environment. All prudent precautions would be undertaken during removal or modification of the facilities to minimize the risk associated with spills or releases to the maximum extent possible.

4.4.9 Environmental Justice

4.4.9.1 No-Action Alternative

No impacts to environmental justice are anticipated to occur under the No-Action Alternative.

4.4.9.2 Proposed Alternative

No minority or low-income populations would be disproportionately affected due to construction of the Proposed Alternative.

4.4.10 Visual and Aesthetic Resources

4.4.10.1 No-Action Alternative

No adverse affects to visual and aesthetic resources are anticipated to occur under the No-Action Alternative.

4.4.10.2 Proposed Alternative

Due to the fact that levees have been previously constructed for existing PAs within the project study area and existing urbanization and industrialization are visible within the project study area, minimal adverse impacts to visual and aesthetic resources are anticipated to occur from construction of the Proposed Alternative.

4.4.11 Recreational Resources

4.4.11.1 No-Action Alternative

No adverse affects to recreational resources are anticipated to occur under the No-Action Alternative.

4.4.11.2 Proposed Alternative

Impacts to recreational resources as a result of construction of the Proposed Alternative are anticipated to be minimal. Recreational boating, fishing and swimming would continue within in the project study area. Construction activities would prohibit recreational activities in the actual footprint of the project, but areas for these types of activities are abundant throughout Galveston Bay. In addition, proposed mitigation would increase beneficial marsh habitat, thereby likely increasing recreational fishing and wildlife viewing opportunities in the project study area.

5.0 MITIGATION

All practicable means to avoid or minimize environmental impacts due to construction of the Proposed Alternative have been considered per 40 CFR §1505.2(c). The project has been designed with the smallest practicable footprint to still meet dredged material capacity requirements of this particular project. In addition, 40 CFR §1505.2(c) states that a monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation.

Construction of the Proposed Alternative would impact approximately 169 acres of habitat. Approximately 113 acres of shallow bay bottom tidal waters, 29 acres of saline marsh, and 27 acres of intertidal sand flats would be impacted. In order to compensate for the loss of habitat related to construction of the Proposed Alternative, the subsequent mitigation plan would be implemented.

Mitigation is proposed to be comprised of saline marsh habitat that would be constructed within the Galveston Bay system. The location of the proposed mitigation is north of the western end of Bolivar Peninsula. Exhibit 9 depicts the approximate location of the proposed mitigation. The Bolivar Peninsula site was selected for use as a mitigation area due to its potential to contribute to significant commercial and recreational fisheries gains as noted by NMFS (Zimmerman et al., 1992).

Based upon studies conducted by NMFS, the replacement of open water bay bottom habitat with intertidal brackish and salt marsh habitats would provide a net positive benefit to the Galveston Bay ecosystem (Zimmerman et al., 1992). In addition, the study determined the areas within the Bay most likely to provide the greatest potential for marsh establishment by comparing various habitats and locations in Galveston Bay. The NMFS study concluded that marshes created in the lower and eastern sides of the bay have the best chance of achieving commercial and recreational fisheries gains. In addition, the study concluded that abundance and biomass were usually significantly higher in the marsh than the open bay. Additional marsh creation design studies by NMFS concluded that greater emphasis would be given to constructing low marsh edge habitat by creating large areas of smooth cordgrass, and perhaps small cordgrass (*Spartina maritima*), marsh interspersed with a dense network of shallow channels and interconnected ponds due to the findings that migratory species (marine fishes and invertebrates which migrate into marshes during favorable conditions or which utilize marsh as nursery habitats) use marsh edge much more frequently than marsh interior. Based upon the NMFS study, mitigation for this project is proposed to be located in the lower and eastern side of the Bay so that mitigation efforts provide a high success of contributing to significant commercial and recreational fisheries gains. By constructing saline marsh, the mitigation project would also contribute habitat to the bay which yields significantly higher abundance and biomass of marine organisms. Design principles that would increase utilization of marine species, such as creation of a large amount of marsh edge, would be incorporated into mitigation design.

HEP analysis was performed on the impact area for the proposed upland PA to determine the appropriate amount of mitigation that would be required to replace the values and functions of the aquatic habitat lost due to construction of upland PA. Project specific HEP analysis is included in Appendix E. Based upon the HEP analysis, 88 acres of mitigation would be required to fully mitigate for impacts from the construction of the new upland PA. Mitigation for this project would be added to existing plans for another on-going project that involves the creation of a 200-acre beneficial use marsh at the Bolivar Marsh Site behind Bolivar Peninsula. With 88 acres of mitigation for the proposed project, the total marsh to be created at the Bolivar Marsh Site would be up to 288 acres.

Mitigation project design would incorporate a series of marsh mounds, designed to increase the amount of available marsh edge habitat. Work material for construction of the mitigation area would be derived from dredging on-site sediments from borrow areas. The borrow areas may not exceed 6 feet in depth and shall be done in a way to pre-sculpt the bay bottom for variation in topography. Excavation would be prohibited in the vicinity of any pipelines.

Marsh would be created using the following preliminary design criteria:

- 30% - 40% of the marsh area above +1 contour
- 60% - 70% of the marsh area below +1 contour
- Individual marsh mounds are to be no more than 2 acres
- Separation between marsh mounds would be 50-100 feet (measured from +1 contours)

The mitigation area would be constructed in a location that would be relatively protected from wave and wind energy, thus increasing the likelihood of success. The mitigation area would be protected to the south by Bolivar Peninsula and to the west by an existing marsh cell levee. A new levee comprised of either rocks or geotextile tubing would be constructed to the north of the mitigation area for protection. Sacrificial berms are proposed to be constructed to the east of the mitigation area and are intended to contain the work material during construction.

Vegetation to be planted would be comprised of plants that grow well and reproduce easily with minimum care and remain free of disease or pest infestation in the specific environmental conditions in which they would be planted. Considerations regarding the means and methods to vegetate the site are availability and costs, collection and handling ease, storage ease, and planting ease. Species likely to be utilized include smooth cordgrass, marshhay cordgrass (*Spartina patens*), saltwort (*Batis maritima*), sea oxeye (*Borrichia frutescens*), shoregrass (*Monanthochloe litoralis*), glasswort (*Salicornia* sp.), bulrush (*Scirpus maritimus)*, needlegrass rush (*Juncus roemerianus*), and Carolina wolfberry (*Lycium carolinianum*).

Type of propagule to be used (seed versus transplant) and the method(s) of planting would be considered for each species. The uniqueness of planting large quantities of plant material on maintenance dredging materials would be a primary consideration of the planting method. Economically feasible mechanical and hand planting methods would be considered although seeding may be more cost effective than any other method.

The Draft Marsh Monitoring and Management Plan, or M3 Plan, (Turner, Collie, and Braden, Inc. and Gahagan and Bryant Associates, Inc.) previously developed for the BUG Plan provided a framework to guide monitoring, management, and maintenance of created marsh sites in Galveston Bay associated with the HGNC Project. These methodologies would be modified as needed to provide functional tools for monitoring the mitigation sites.

The local sponsor, the Port of Houston Authority (PHA) would be responsible for the implementation and costs of monitoring activities at the mitigation site, under the oversight of the District. Monitoring of the mitigation site would be conducted by qualified environmental scientists from or contracted by the PHA. Parameters to be monitored include hydrology, vegetation, and species utilization. Table 15 describes the objectives, performance standards, monitoring methods, and remedial actions associated with monitoring these parameters.

Table 15: Summary of Objectives, Performance Standards, Monitoring Methods, Remedial Action, and Schedule for Monitoring the Proposed Mitigation Site.

Category	Monitoring Parameters			
	Hydrology		Vegetation	Species Utilization
Objectives	Create marshes with water depths similar to those found in nearby natural marshes.	Create marshes with water quality similar to those found in nearby natural marshes.	Support Vegetation Communities similar to those typical of nearby natural marshes.	Develop habitat for native wildlife.

Category	Monitoring Parameters					
	Hydrology		Vegetation			Species Utilization
Performance Standards	The depth of open water areas and inlet areas should be at least 80% of those found in nearby natural marshes within 5 years of marsh fill placement	Measurements of water temperature, dissolved oxygen, and salinity of sub-tidal habitats in the mitigation area should be within 10% of the mean values measure in a nearby natural marsh.	Created marshes should not support undesirable plant species.	80% of the total vegetation cover should be low edge marsh supporting smooth cordgrass communities.	No more than 20% of the vegetative cover, exclusive of bare ground, should be high marsh species such as marshhay cordgrass, saltwort, sea oxeye, shoregrass, glasswort, bulrush, needlegrass rush, and Carolina wolfberry.	Mean overall density of transient and resident wildlife are not significantly different from nearby marshes.
Monitoring Methods	Survey water depths of tidal inlets at specified distances away from the main inlet within the mitigation area.	Utilize water quality monitoring devices at pre-established stations.	Visual observation along transects.	Visual observation along transects with photo-documentation.	Visual observation along transects with photo-documentation.	Visual observation along transects and recording of species observed.
Remedial Action	Excavate tidal inlets to depths comparable with nearby natural marshes.	Increase tidal exchange by enlarging tidal inlet and/or excavating additional creeks.	Manual removal or herbicide.	Consider re-contouring to support appropriate vegetation.	Consider additional planting if not enough high marsh. Consider excavation and planting if too much high marsh.	Investigations should be undertaken to determine why difference exists between the created marsh and the reference marsh. Replant proper vegetation or control unwanted vegetation. Address erosion, predators, human disturbance, and invasive species if necessary.
Schedule	Monitor annually for 5 years.	Monitor one continuous week per quarter for 5 years.	Annually for 5 years or until performance standards are met.	Annually for 5 years or until performance standards are met.	Annually for 5 years or until performance standards are met.	Annually for 5 years or until performance standards are met.

Vegetative planting would be delayed until a stable circulation network is self-maintained. The initial monitoring event would occur immediately after the initial planting of the mitigation site has occurred to document the baseline conditions of the mitigation site. Subsequent monitoring events would as described in Table 15. Annual monitoring events would occur after completion of the growing season in order to capture the previous year’s growth.

The mitigation site would be determined to be successful if all the performance standards are met. If performance standards are not met, remedial actions would be conducted as described in Table 15 in order to correct any potential problems. Annual monitoring reports would be compiled and presented to appropriate agencies. These reports would specify the results of monitoring activities and recommend specific remedial actions that would aid in the mitigation area in meeting performance standards.

Section 2036(a) guidance of Water Resources Development Act of 2007 (Mitigation for Fish and Wildlife and Wetlands Losses), issued August 31, 2009, requires that the mitigation plan contain an adaptive management plan which includes the cost of such actions. Remedial actions which are proposed as part of the adaptive management plan for the proposed project are described in Table 15 and the total estimated cost for monitoring and remedial actions at the proposed mitigation site is $21,400. These cost estimates include field sampling by qualified biologists, sampling equipment, data management and analysis, and report preparation for a total of five years. Remedial action costs would be dependent upon the ecological success of the project. A Mitigation Cost Effectiveness and Incremental Cost Analysis for the project is included in Appendix F.

6.0 CUMULATIVE IMPACTS

A cumulative effect is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR Part 1508.7). The following analysis abides by the CEQ’s *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997), and *Memorandum and Guidance on the Consideration of Past Actions in Cumulative Effects Analysis* (CEQ 2005).

Past, present, and future development in the project study area has had both adverse and beneficial cumulative effects to the surrounding environment. Potential adverse effects resulting from past, present and future development includes loss of bay bottom habitat and air and water quality impacts. Beneficial effects of development in the project study area include conversion of bay bottom to emergent marsh, new economic opportunities, and new employment opportunities.

Additional housing, infrastructure, and commercial and public land uses required to serve the future population would result in continued development in the region surrounding Galveston Bay. As development continues, transportation improvements would be needed. The conversion of natural wildlife habitat and agricultural lands into commercial, residential or industrial land uses would continue to disrupt and disperse fish and wildlife populations. The loss of wetlands in the area would continue to affect natural resources. Development of sites that can be used beneficially for the environment would preserve, restore, and create habitat to ensure the ecosystem's sustainability.

The proposed project is anticipated to result in both adverse and beneficial impacts to the surrounding physical, biological, and human environments. All adverse impacts that are anticipated to occur due to construction of the proposed project would be minimal. Adverse impacts to environmental resources are not expected to be significant.

Adverse impacts to the physical environment include those impacts associated with moving sediments from one location to another. The topography or footprint of the proposed expansion PA would be permanently impacted by raising the height of this area to match the height of the existing PAs 14 and 15. Minimal impacts to hydrology are expected as a result of deepening the HSC to 80 feet leading to slightly different hydrological regimes. Although dredging would affect water quality, the impacts, primarily due to turbidity increases, would be temporary and localized. Use of best management practices and spill prevention measures would result in minimal adverse impacts to water quality and aquatic resources in the project study area.

Adverse impacts to the biological environment include those impacts associated with the alteration of the existing habitats within the project area. Vegetation would be permanently affected in the footprint of the proposed expansion PA by the construction of levees and placement of dredged material. Minimal and localized adverse affects to aquatic habitats, fisheries, and EFH would be expected due to the potential increase in turbidity within the water column and the potential fallout of sedimentation on the bay bottom. Minimal, temporary, and localized impacts to wildlife resources are expected. Wildlife in the vicinity of the project area may be temporarily displaced due to the presence of construction activities.

Adverse impacts to the human environment are anticipated to occur to existing facilities and utilities systems. The existing oil and gas production facilities within the footprint of the proposed PA expansion and BU sites would need to be removed or modified. Marine based transportation could be adversely affected by the addition of stationary dredging and construction equipment working within and nearby the HSC. Visual and aesthetic resources would be minimally impacted as construction of levees would result in existing view-fields being interrupted, although existing PAs in the project area have previously impacted the view-fields. Impacts to recreational resources are expected to be minimal. Construction activities would prohibit recreational activities within the proposed expansion PA and BU sites, although ample opportunities for similar recreational activities exist within Galveston Bay.

Beneficial impacts as a result of the proposed project are anticipated to enhance the productivity of biological resources and provide an increase to the socioeconomics of the surrounding area. The construction of BU sites and mitigation areas would contribute a net gain of vegetation and wetlands to the ecosystem of Galveston Bay. The biological productivity of the bay would be enhanced and benefits to aquatic habitats, fisheries, EFH, and wildlife resources would be provided. The ecological benefits to shrimp and finfish species would result in a positive economical benefit to both commercial and recreational fisheries. The proposed project would prohibit delays in maintenance dredging cycles and allow the HSC to remain open. Existing jobs would be kept and potential jobs would be created, enhancing the socioeconomic wellbeing of the communities surrounding the project area.

Previous projects within Galveston Bay include projects associated with navigational channel improvements to various segments of shipping channels. Navigational channel improvements have involved dredging activities which have produced material that could be used beneficially for the creation of marsh. Numerous projects in the bay have resulted in the construction of marsh BU sites, thus enhancing the overall biological productivity of the bay. The HGNC Project includes a plan that would create 4,250 acres of BU marsh throughout Galveston Bay over the 50 year project life, ending in 2050, through the use of materials dredged during maintenance of the HSC. The demonstration marsh project on Alexander Island was undertaken by the Port of Houston Authority in 1993 to demonstrate the feasibility of constructing large scale ecologically stable salt marsh areas using materials dredged from the HSC. The demonstration marsh, later renamed Gorini Marsh, is a 200 acre marsh located on Alexander Island. Marsh construction in Galveston Bay has created highly productive ecosystems that serve as vital habitat for numerous estuarine dependant species of recreational and commercial fisheries importance.

Current and future dredging projects in Galveston Bay have included The Texas City Channel Deepening Project, the Shoal Point Container Terminal Project, the Bayport Container Terminal Project, the Cedar Bayou Navigation Chanel Project, the Bayport Flare widening, and the HGNC Project. Impacts associated with such current and future dredging projects include adverse effects to submerged bay bottom and temporary and localized impacts to water quality, aquatic habitats, and wildlife. Beneficial effects of these projects have included a net increase in more productive salt marsh habitat throughout the bay. The maintenance of safe and reliable shipping routes as a result of these projects has benefited the socioeconomics of the surrounding communities including increasing employment opportunities.

The Texas City Channel Deepening project calls for deepening the current 40-foot channel to 45-foot and maintaining the current 400-foot bottom width for approximately 7 miles of channel including the Texas City Channel Turning Basin. The environmental consequences of this project include 1,162 acres of impact to bay bottom for the construction of PAs. Although 1,162 acres of bay bottom will be impacted, the bay bottom will be replaced by 999 acres of emergent marsh, benefiting fisheries and the aquatic environment. No impacts to oyster beds and wetlands will result from the construction of this project (USACE, 2007).

The Shoal Point Container Terminal Project is a three phase project. Phase I includes the construction of an access road, a 125-acre container yard and two berths with associated dredging. Phase II doubles the size with a second 125-acre container yard, two berths and a turning basin and the deepening of the Texas

City Channel. Phase III includes building a 150-acre container yard and the final two berths. Full build-out of the facility may be completed by 2016. The terminal facility will be constructed on approximately 400 acres of an active, levee-contained dredged material PA known as Shoal Point, which is the primary PA used for placing dredged material from the Texas City Channel. Construction of a BU site of approximately 357 acres, will replace the portion of the Shoal Point dredged material placement area that would be utilized for the development. Another approximately 1,353 acres of BU sites will be built during the next 50 years. The proposed project also includes the construction of a 45-acre intertidal marsh area as mitigation for the loss of approximately 13.3 acres of saltwater wetland during the project's construction (USACE, 2002).

The Bayport Container Terminal Project includes plans for container terminals and cruise ship facilities, ultimately encompassing 1,100 acres for a container terminal complex including wharves, container yards, intermodal yards, and ancillary facilities, plus 7,000 feet of wharves and berths for the container facility and 5,000 feet of wharves and berths for the cruise operations. Dredging activities would impact 127.3 acres of submerged bay bottom and 2.2 acres of intertidal flats and shallow bay bottom. Dredged material will be put to beneficial use, resulting in the creation of approximately 200 acres of intertidal marsh. Development of the terminal complex will result in the fill or excavation of 146.4 acres of freshwater wetlands. A 173.5 acre mitigation site will be utilized to compensate for the wetland losses resulting from construction of the project. The mitigation area includes 66.8 acres of created freshwater emergent wetlands, enhancement of 12.0 acres of existing jurisdictional wetlands, preservation of 23.7 acres of forested and shrub uplands and 71 acres of restored coastal prairie. Mitigation will also include the preservation of a 456-acre tract at Banana Bend of the San Jacinto River and a 500-acre tract of primarily coastal prairie, mostly within the floodway or floodplain of the Cypress Creek watershed (USACE, 2003).

As part of the Cedar Bayou Navigation Channel Project, the USACE maintains the lower three miles of the channel at a depth of 10-foot and a width of 100-foot. This project will create a channel of the same dimensions above the currently maintained channel to SH 146. The potential environmental consequences of this project include 208.1 acres of impact to bay bottom and 3.8 acres of impact to emergent marsh for dredging activities. In addition, 131.8 acres of upland habitats will be impacted due to construction of the channel. Mitigation for environmental impacts associated with this project includes the creation of 80.1 acres of emergent marsh and the preservation of 157.5 acres of upland habitats. No impacts to oyster beds will result from the construction of this project (USACE, 2005).

The Bayport Flare widening project is currently in the conceptual planning stage. This would be a dredging project that would result in additional maintenance dredged material that would be placed in PA or BU sites within the bay (Steve Ireland, USACE, Personal Communication).

The HGNC Project dredged material placement plan calls for the continued use of maintenance material for construction of BU sites within the bay. The HGNC Project was designed to create approximately 4,250 acres of BU intertidal salt marsh, a 6-acre bird nesting and habitat island, and 118 acres of oyster reefs in Galveston Bay over the course of the 50-year plan (USACE, 1995). In addition, Redfish Island and Goat Island, which had been adversely impacted due to land subsidence have been restored. The creation of intertidal marsh BU sites at Atkinson Island, Mid-Bay Marsh, and Bolivar Marsh were planned. Due to higher than anticipated shoaling rates, however, many of the BU placement areas that were to be constructed years from now have already been constructed. Consequently, the District is initiating a new DMMP study, with the anticipation that additional BU placement areas will need to be constructed.

Development impacts associated with normal growth in the region are expected to result in conversion of wetland, riparian, and upland habitats and agricultural lands into commercial, residential or industrial land uses, as well as additional infrastructure and services as people continue to move into the area. Habitat fragmentation from infrastructure construction or changes in land use have disrupted and dispersed fish and wildlife populations. Both natural and artificial processes, including historical, human-induced subsidence and relative sea level rise as well as draining and filling wetlands for development have resulted in the conversion of wetland habitats to open water or upland habitat. However, some losses have been partly offset by gains in emergent wetlands that took place in transitional areas peripheral to wetlands (related to subsidence or water management programs). Although there have been significant losses to wetlands and other habitats since the 1950s and the continued urbanization and industrialization of the Houston-Galveston area will cause continued pressure on these habitats and the ecosystem, efforts to preserve, restore and create valuable habitat are underway that would ensure the ecosystem's sustainability despite continuing pressure of development of the region. The use of dredged material beneficially in Galveston Bay would aid in this effort by creating emergent wetlands to support plant growth, fisheries, and wildlife.

Although historical water quality problems have been concentrated in the western urban tributaries, Galveston Bay has maintained good water quality overall. Water quality effects of dredging activities throughout the project area would result primarily from turbidity associated with dredging activities; however, these impacts tend to be temporary and localized. Various existing and planned developments in the area have a potential cumulative water quality impact on the receiving water bodies due to wastewater discharges and urban runoff. Use of best management practices for controlling runoff and thereby limiting potential contamination of the open bay habitat, and spill prevention and control measures for minimizing impacts of accidental spills would result in minimal adverse impacts to water quality and aquatic resources.

In conclusion, the anticipated adverse impacts of the proposed project to the surrounding environment are minimal and would not significantly contribute to the cumulative effects of past, present, and future projects within Galveston Bay and the surrounding areas. The result of the project would allow for the HSC to remain open and operational, allowing for the economy of the region to continue to thrive. Construction of the project along with previous similar projects are anticipated to cumulatively contribute beneficial effects to the Galveston Bay system through the conversion of submerged bay bottom to emergent salt marsh, a more productive ecosystem type. The proposed project would cumulatively contribute beneficial effects to commercial and recreational fisheries. The addition of salt marsh to the ecosystem would create higher productivity and allow for shrimp and finfish species to flourish.

7.0 RELATIONSHIP OF PROJECT TO OTHER FEDERAL PROJECTS

This EA is interrelated with the GBANS and its associated Final Feasibility Report and Final EIS published by the District in July 1987 (USACE, 1987). This study investigated the need for improving deep draft navigation on the HSC and its ancillary channels, and the Galveston Channel. Improvements recommended in the GBANS report were widening and deepening the HSC and deepening of the Galveston Chanel. These improvements are evaluated under the HGNC study and are described in the accompanying LRR. The SEIS for the HGNC study was prepared by the District in November 1995 (USACE, 1995). The HGNC project was a multipurpose project designed to provide navigation improvements to the ports of Houston and Galveston and to provide environmental restoration through beneficial uses of dredged materials. The SEIS provided environmental analysis for the LRR of the HGNC study. The recommended plan from the LRR consisted of deepening and widening the HSC to 45 feet and 530 feet respectively, for most of its length. The environmental restoration plan in the SEIS includes incorporating the beneficial uses of dredged material providing for the creation of 4,250 acres of marsh and one bird island, the restoration of existing bay islands, the construction of boater cuts, and the construction of offshore beneficial use sites. The recommended restoration and placement plan provides for the placement of 79.08 million cubic yards of new work material and 270.18 million cubic yards of maintenance material over the 50 year project life.

This EA addresses modifications to previously permitted PAs as described and evaluated in the aforementioned reports. Environmental impacts associated with the expansion of PAs 14 and 15 are described within this EA.

The proposed project is closely related to the Federal maintenance of the Bayport Ship Channel. Maintenance dredged material from the Bayport Ship Channel is currently placed within PAs 14 and 15. The levees for the PAs of the proposed project and subsequent placement material for both upland PAs and BU sites could be mined from the advanced maintenance of the Bayport Ship Channel flare and from the planned dredging of berths at the Bayport Terminal.

Another Federal project related to the HGNC Project was Barbours Terminal Channel. The purpose of the project was to mine new work material from the channel to repair levees at Spillman's Island PA and to construct levees for the creation of beneficial use Cell M5/M6 at Atkinson Island (USACE, 2006).

8.0 COMPLIANCE WITH PLANNING AND ENVIRONMENTAL REQUIREMENTS

The planning of the proposed project is in accordance with the "USACE Campaign Plan" goals. Plan formulation has been based on collaboration with partners and stakeholders. Potential direct and indirect affects inside and outside the project areas have been considered. Risk and uncertainty have been considered in evaluating alternatives, which are discussed in this document. The proposed plan has been selected based on inter-disciplinary coordination that utilizes the best professional and technical expertise available during the planning process.

This EA has been prepared to satisfy the requirements of all applicable environmental laws and regulations, as listed in Table 16, and has been prepared using the CEQ's National Environmental Policy Act regulations (40 CFR Part 1500) and the USACE ER 200-2-2 (Environmental Quality: Policy and Procedures for Implementing NEPA, 33 CFR 230). The following sections present a summary of environmental laws, regulations, and coordination requirements applicable to this EA.

Table 16: Compliance with Environmental Laws and Regulations

Applicable Law/Regulation	Reviewing Agency	Law Complied With	Location of Concurrence Coordination
National Environmental Policy Act	N/A	Yes	N/A
National Historic Preservation Act of 1966, As Amended	Texas Historical Commission	Yes	Appendix D
Endangered Species Act, As Amended	USFWS, NMFS	Yes	Appendix A
Fish and Wildlife Coordination Act of 1958, As Amended	USFWS, TPWD	Yes	Appendix G
Magnuson-Stevens Fishery Conservation Management Act	NMFS	Yes	Appendix G
Coastal Zone Management Act of 1972	Texas Coastal Management Program	Yes	Appendix B
Clean Water Act of 1977, As Amended	TCEQ	Yes	Appendix C
Clean Air Act, As Amended	EPA, TCEQ	Yes	Section 3.4.2

Table 16: Compliance with Environmental Laws and Regulations (Continued)

Applicable Law/Regulation	Reviewing Agency	Law Complied With	Location of Concurrence Coordination
Executive Order 11990, Protection of Wetlands	N/A	Yes	Section 4.3.1
Executive Order 12898, Environmental Justice	N/A	Yes	Section 4.4.9
Executive Order 11988, Floodplain Management	N/A	Yes	N/A
Farmland Protection Policy Act of 1981 and the CEQ Memorandum, Prime or Unique Farmlands	NRCS	Yes	Section 4.2.1.3
Galveston Bay National Estuary Program	Galveston Bay National Estuary Program	Yes	Appendix I
Memorandum of Agreement (MOA) with the FAA to Address Aircraft Wildlife Strikes	FAA	Yes	Section 4.4.5

9.0 CONCLUSIONS

The Proposed Alternative includes construction of approximately 169 acres of PA, up to 1,121 acres of BU area, and at least 88 acres of saline marsh for mitigation to compensate for project related impacts. Construction of the Proposed Alternative is anticipated to result in direct, indirect, and cumulative effects to the environment. The following conclusions summarize the findings of the EA:

- Physical Environment
  - Topography and Soils: Minimal impacts to topography are anticipated to occur within the footprint of the PA expansion area. Adverse impacts to soils are not anticipated to result from the construction of the proposed project. No significant impacts to these resources are anticipated.
  - Prime and Unique Farmland: There are no prime or unique farmlands in the study area; therefore no significant impacts to these resources are anticipated.
  - Geology: No significant impacts to geology are anticipated.
  - Hydrology and Drainage: Minimal adverse impacts to hydrology and drainage are anticipated inside the project footprint. No significant impacts to hydrology and drainage are anticipated to occur within the project study area.
  - Climate and Sea Level Rise: Climate and sea level rise are not anticipated to adversely affect the project.
  - Water and Sediment Quality: Temporary and localized adverse impacts to water quality inside of and immediately surrounding the project footprint are anticipated. Water quality impacts are anticipated to be minimal and no significant impacts to the water quality of the project study area are anticipated to occur. No adverse impacts to sediment quality are anticipated within the project study area. Significant impacts to sediment and water quality within the project study area are not anticipated.

- Biological Resources

  - Vegetation: Minimal adverse impacts to vegetation are anticipated inside the project footprint. The impacts would be mitigated through creation of habitat within the bay. Vegetation in the project study area is not anticipated to be adversely affected. Beneficial use and mitigation areas would provide additional vegetation to the Galveston Bay estuarine system. Significant impacts to vegetation within the project study area are not anticipated.
  - Aquatic and Terrestrial Habitats: Temporary and localized adverse impacts to aquatic and terrestrial habitats are anticipated in the project area. Affected habitats are not unique to the study area and suitable habitat for displaced species would be readily available. Significant impacts to aquatic and terrestrial habitats within the project study area are not anticipated.
  - Wildlife Resources: Temporary and localized adverse impacts to wildlife resources are anticipated in the project area. Affected habitats are not unique to the study area and suitable habitat for displaced wildlife would be readily available. Significant impacts to wildlife resources within the project study area are not anticipated.
  - Fisheries and Essential Fish Habitat: Temporary and localized adverse impacts to fisheries and essential fish habitat are anticipated in the project area. Affected aquatic environments are not unique to the study area and suitable habitat for displaced species would be readily available. Significant impacts to aquatic habitats, including EFH, within the project study area are not anticipated.
  - Threatened and Endangered Species: The proposed project may affect but is not likely to adversely affect five species of threatened and endangered species within the project study area. Significant impacts to threatened and endangered species within the project study area are not anticipated.
  - Invasive Species: Invasive species are anticipated to be adversely affected inside the project footprint. Adverse affects inside of the project footprint are expected to be temporary. Invasive species would likely re-colonize impacted areas. Significant impacts from invasive species within the project study area are not anticipated.

- Human Environment

  - Existing Facilities and Utilities Systems: Localized impacts to existing facilities and utilities systems are anticipated inside the project area. Existing oil and gas production facilities would need to be removed or modified. Significant impacts to existing facilities and utilities systems within the project study area are not anticipated.
  - Air Quality: Significant impacts to air quality within the project study area are not anticipated.
  - Noise: Significant impacts to noise within the project study area are not anticipated.
  - Traffic and Transportation: Vessel traffic within the HSC would be temporarily affected during construction. Significant impacts to traffic and transportation within the project study area are not anticipated.
  - Cultural Resources: Through continued coordination with the Texas Historical Commission, significant impacts to cultural resources within the project study area are not anticipated.
  - Socioeconomic Resources: Continued maintenance of the HSC would benefit local economies. Significant impacts to socioeconomic resources within the project study area are not anticipated.
  - Hazardous, Toxic, and Radioactive Wastes (HTRW): No significant impacts associated with the HTRW sites within the project study area are anticipated.

- Environmental Justice: Significant impacts to environmental justice within the project study area are not anticipated.
- Visual and Aesthetic Resources: Minimal and localized impacts to visual and aesthetic resources are anticipated in the project area. Significant impacts to visual and aesthetic resources within the project study area are not anticipated.
- Recreational Resources: Minimal and localized impacts to recreational resources are anticipated in the project area. Significant impacts to recreational resources within the project study area are not anticipated.

In summary, construction of the Proposed Alternative is anticipated to result in minimal localized and temporary adverse affects to the surrounding environment. No significant impacts to the environment within the project study area are anticipated. Therefore, the preparation of an Environmental Impact Statement is not required.

10.0 LIST OF PREPARERS

Name	Affiliation	Title	Expertise	Experience
Steve Ireland	USACE-Galveston	Environmental Lead	Natural Resources and Environmental Studies	17 years
Jerry Androy	USACE-Galveston	Staff Archaeologist	Archeological, Historic and Cultural Resources Studies	15 years
Angela Bulger	PBS&J	Project Manager	NEPA Compliance	10 years
Ruben Velasquez	PBS&J	Senior Engineer IV	Air Quality Studies	27 years
Jill Schwager	PBS&J	Planner II	Noise Studies	3 years
Lisa Vitale	PBS&J	Senior Scientist I	FAA Studies	11 years
Casey Hall	PBS&J	Project Manager	Habitat Modeling and Cost Effectiveness/ Incremental Cost Analysis	9 years
David Buzan	PBS&J	Senior Scientist III	Sea Level Rise Analysis	25 Years
Kay Crouch	Crouch Environmental Services, Inc.	President	Environmental Studies	34 years
David Young	Crouch Environmental Services, Inc.	Environmental Consultant	Environmental Studies	16 years
Ryan Robol	Crouch Environmental Services, Inc.	Environmental Consultant	Environmental Studies	7 years
Matt Chastain	Crouch Environmental Services, Inc.	Environmental Consultant	Environmental Studies	2 years
Patrick Forrest	Crouch Environmental Services, Inc.	GIS Specialist	Geographic Information Systems	2 years

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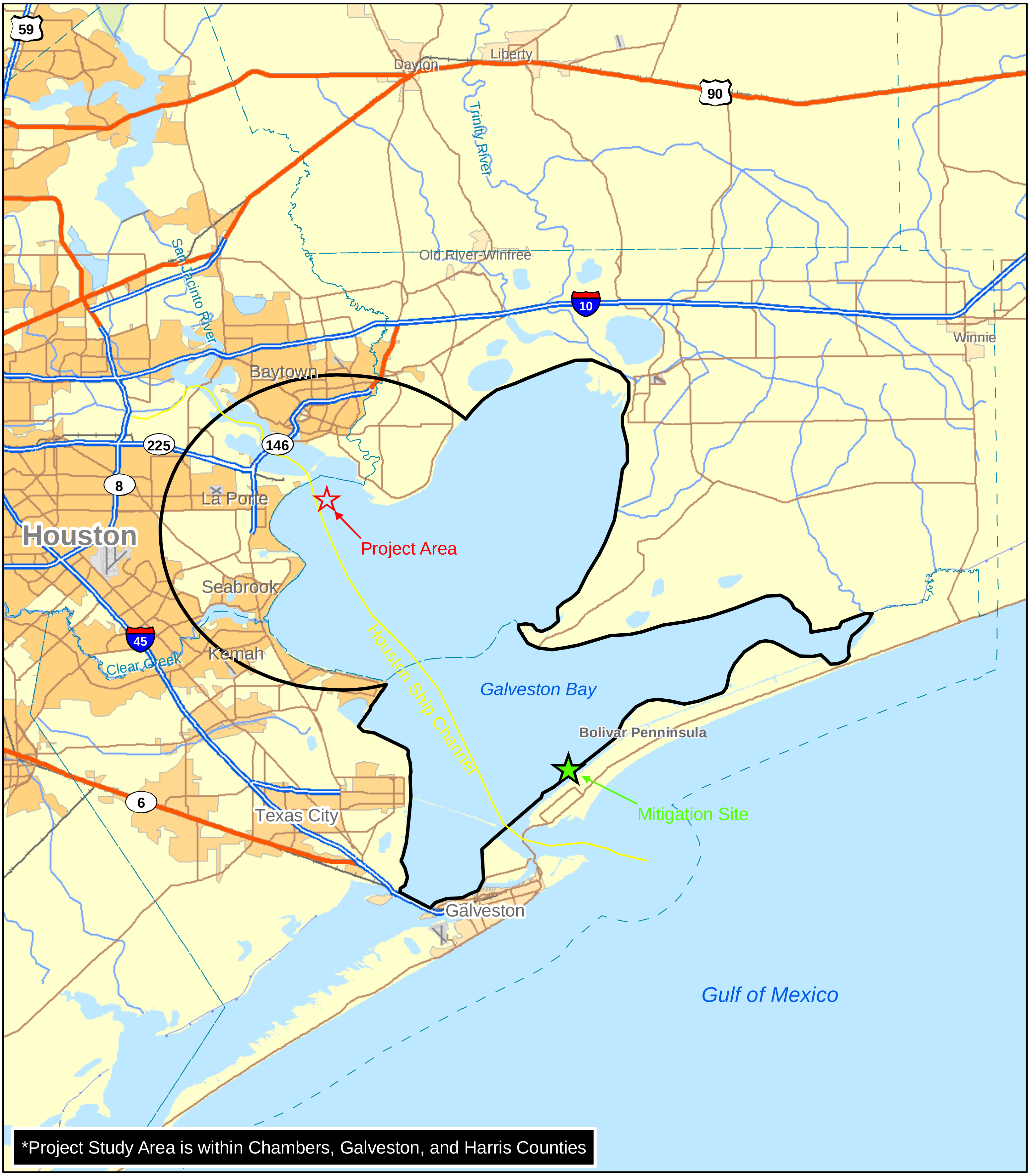
Exhibits



Project Study Area — Houston Ship Channel
County Border

N

0 4 8 Miles

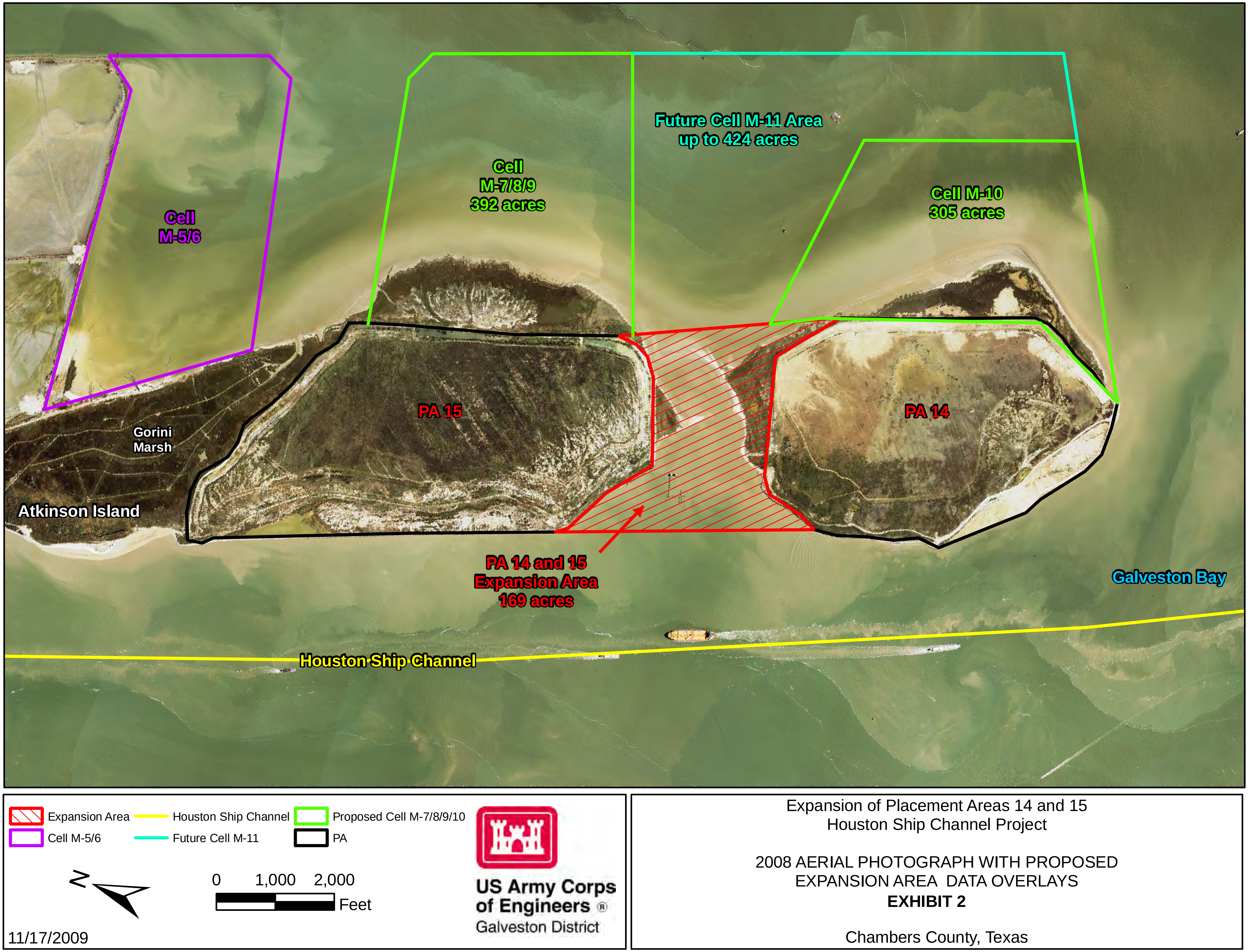
11/17/2009

US Army Corps of Engineers ®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel

VICINITY MAP WITH PROJECT
STUDY AREA DATA OVERLAY
EXHIBIT 1

Chambers, Galveston, Harris and Liberty Counties, Texas



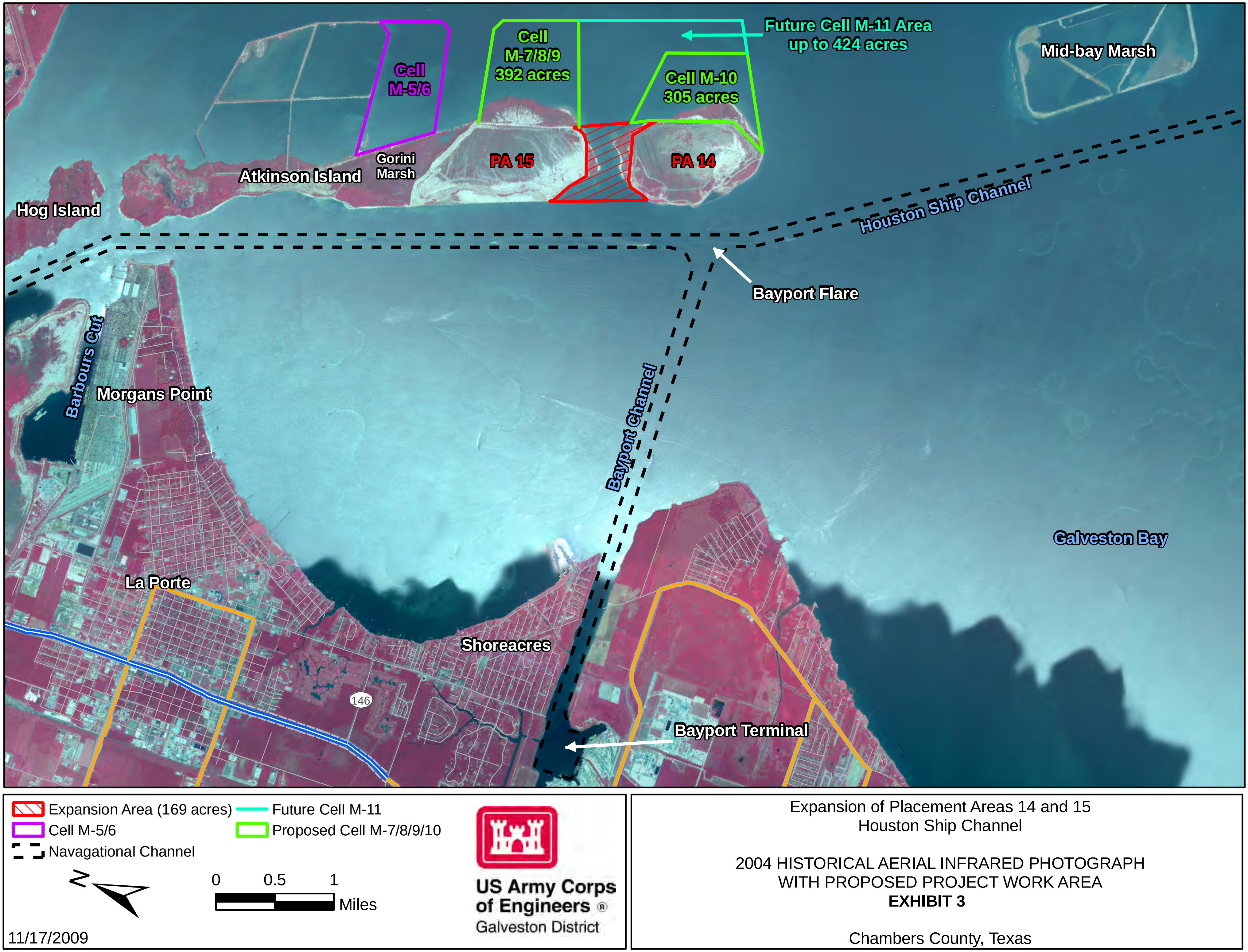
11/17/2009

US Army Corps of Engineers ®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED
EXPANSION AREA DATA OVERLAYS
EXHIBIT 2

Chambers County, Texas



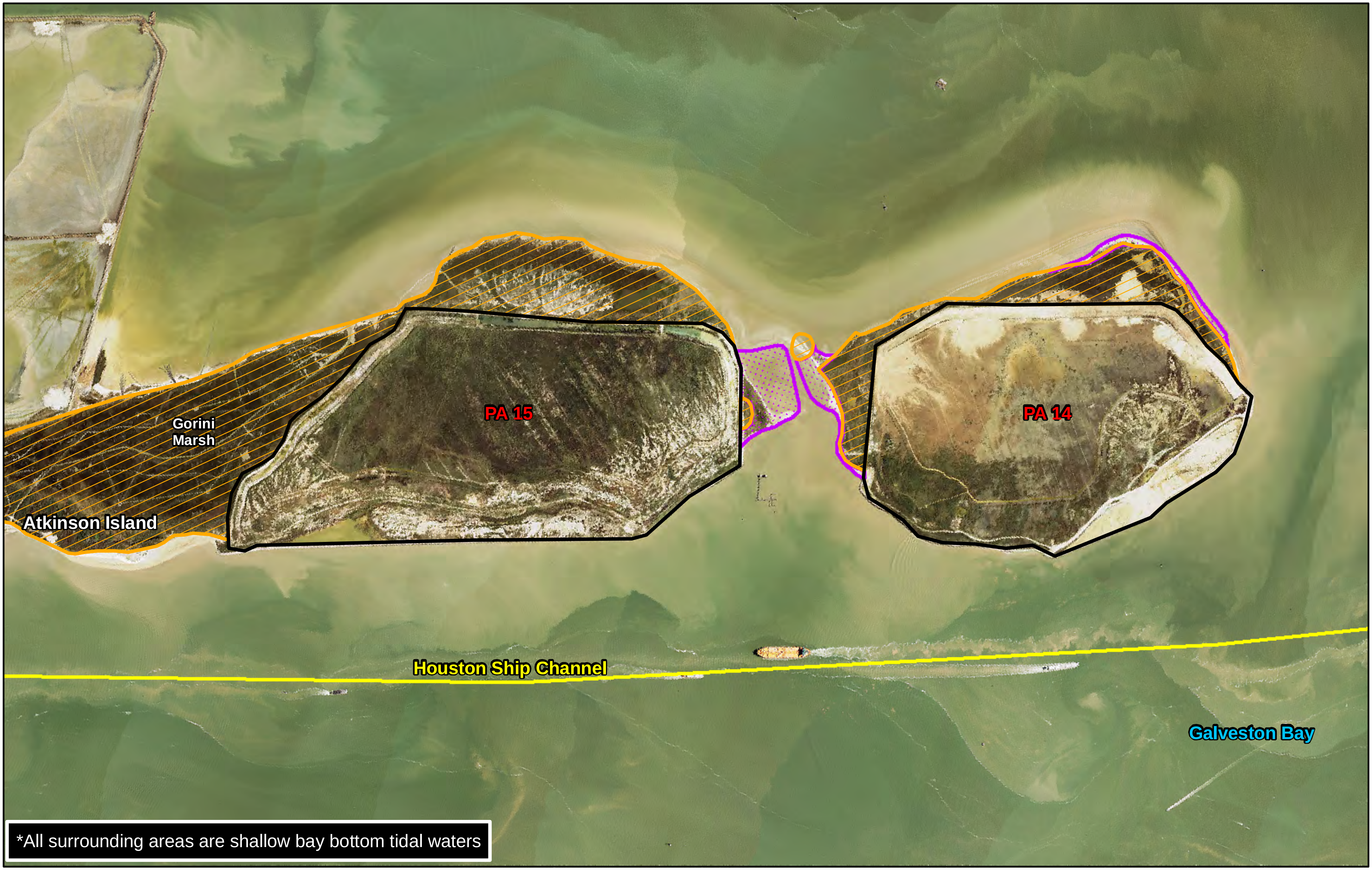
US Army Corps of Engineers ®
Galveston District

11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel

2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH
WITH PROPOSED PROJECT WORK AREA
EXHIBIT 3

Chambers County, Texas



PA
Saline Marsh
Intertidal Sand Flat
Houston Ship Channel

N

0 1,000 2,000 Feet

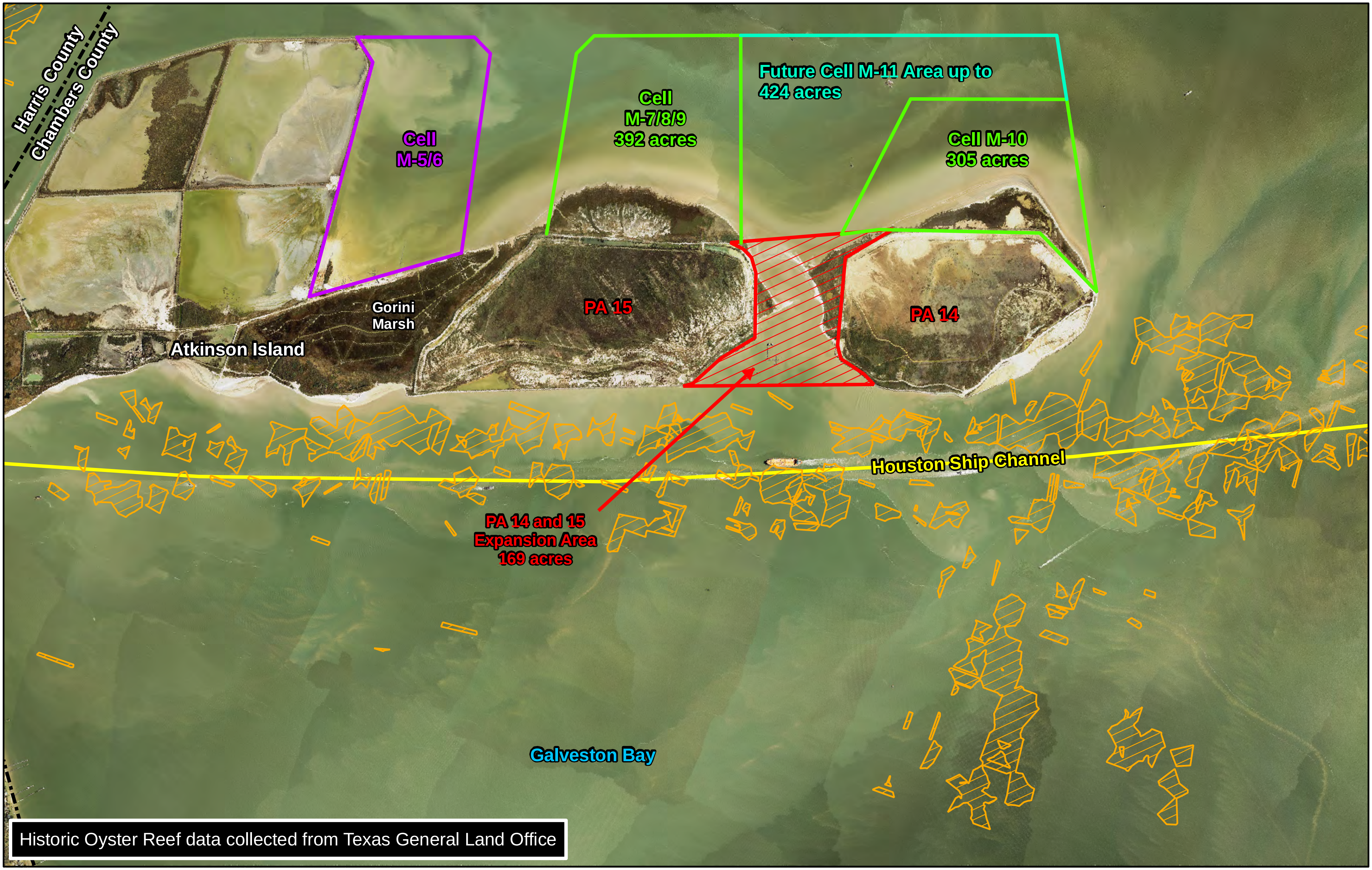
11/17/2009

US Army Corps of Engineers ®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH
EXISTING HABITATS DATA OVERLAY
EXHIBIT 4

Chambers County, Texas



Expansion Area
Cell M-5/6
Proposed Cell M-7/8/9/10
County Line
Houston Ship Channel
Historic Oysters Reefs
Future Cell M-11

N

0 1,500 3,000 Feet

11/17/2009

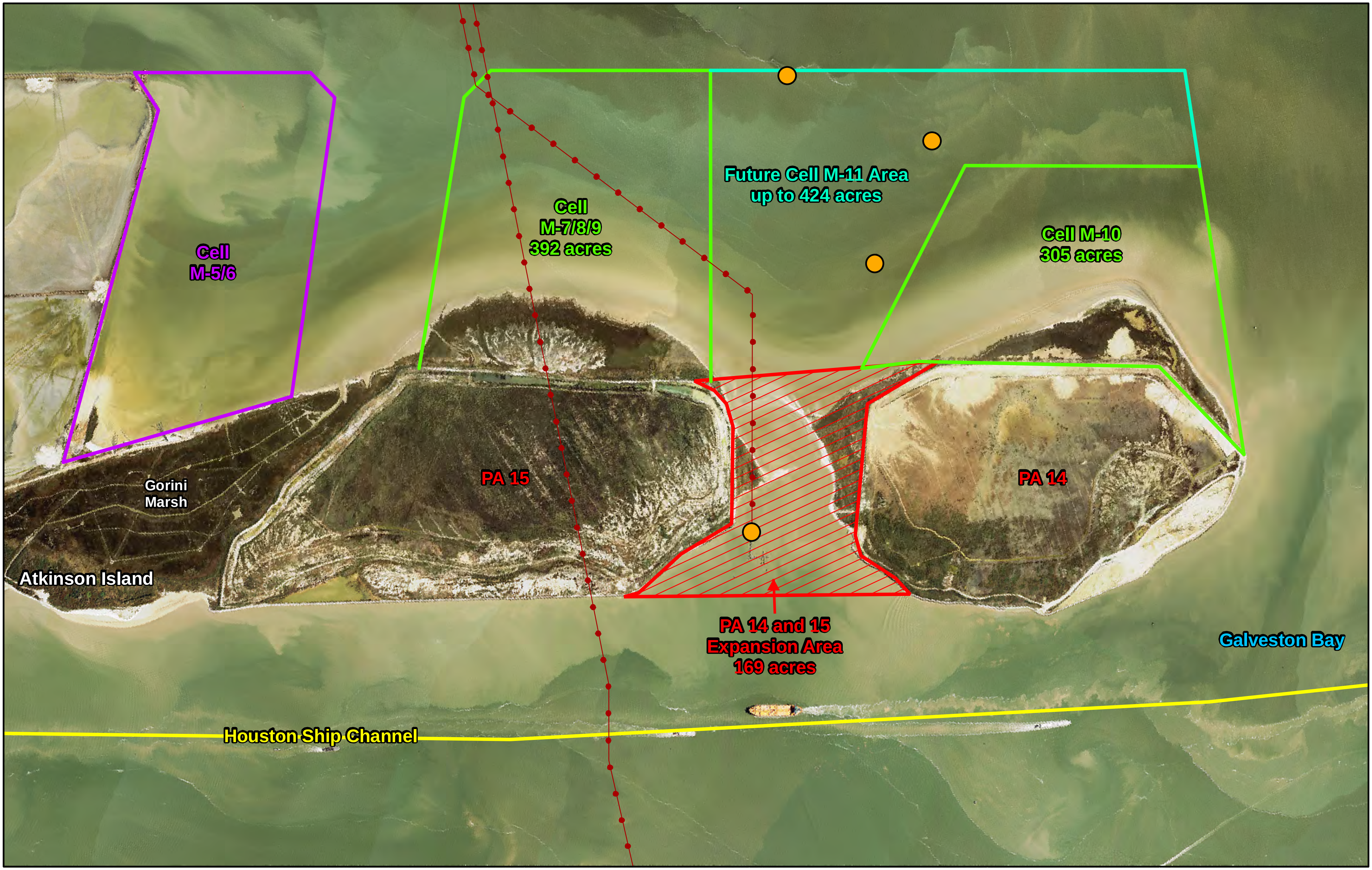
US Army Corps of Engineers ®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA AND HISTORIC OYSTER REEF DATA OVERLAYS

EXHIBIT 5

Chambers and Harris Counties, Texas



Expansion Area
Proposed Cell M-7/8/9/10
Cell M-5/6
Future Cell M-11
Houston Ship Channel
Approximate Pipeline Locations
Existing Oil and Gas Production Facilities

N

0 1,000 2,000 Feet

US Army Corps of Engineers ®
Galveston District

11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA AND EXISTING OIL AND GAS PRODUCTION FACILITIES LOCATION DATA OVERLAYS

EXHIBIT 6

Chambers County, Texas

PA
Houston Ship Channel
Saline Marsh
Intertidal Sand Flat
Impacted Saline Marsh (29.38 acres)
Impacted Intertidal Sand Flat (27.09 acres)
Impacted Shallow Bay Bottom (112.67 acres)

N

0 1,000 2,000 Feet

11/17/2009

US Army Corps of Engineers ®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA AND IMPACTED HABITATS DATA OVERLAYS

EXHIBIT 7

Chambers County, Texas

Survey Area
Expansion Area (No Survey Needed)
Houston Ship Channel

N

0 1,000 2,000 Feet

11/17/2009

US Army Corps of Engineers ®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED STUDY AREA
AND CULTURAL RESOURCES SURVEY AREA DATA OVERLAYS
EXHIBIT 8

Chambers County, Texas

★ Approximate Location of Proposed Mitigation Area

N

0 1,500 3,000 Feet

US Army Corps of Engineers ®
Galveston District

11/17/2009

Expantion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH APPROXIMATE
LOCATION OF PROPOSED MITIGATION AREA
EXHIBIT 9

Galverston County, Texas

Appendix A

Biological Assessment and Endangered Species Act Consultation

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

REPLY TO
ATTENTION OF

November 30, 2009

Environmental Section

Mr. Steve Parris
Field Supervisor
U.S. Fish and Wildlife Service
17629 El Camino Real, Suite 211
Houston, Texas 77058

Dear Mr. Parris:

The Galveston District is developing plans to expand Houston Ship Channel Placement Areas 14 and 15 in Chambers County, Texas. A major portion of the work would be performed under the American Recovery and Reinvestment Act of 2009. The proposed work is described in detail in Section 1.3 of the enclosed Draft Environmental Assessment (EA).

The District is requesting that the U. S. Fish and Wildlife Department review the enclosed Draft EA and provide any comments your agency may have regarding this proposed project. We are also requesting your concurrence with the enclosed Biological Assessment (BA), which is included as Appendix A of the EA The BA addresses the project's potential to affect federally-listed threatened and endangered species and species of concern. The overall conclusion of the BA is that the project is not likely to adversely affect federally-listed threatened or endangered species, nor will it adversely modify critical habitat. We appreciate your continued cooperation in coordinating the proposed project. If you or your staff have any questions regarding this project, please contact Steve Ireland at (409) 766-3131.

Sincerely,

Richard Medina
Chief, Planning & Environmental. Branch

Enclosures

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

REPLY TO
ATTENTION OF

November 30, 2009

Environmental Section

Mr. David M. Bernhart
Assistant RA for Protected Resources
Southeast Regional Office
National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

The Galveston District is developing plans to expand Houston Ship Channel Placement Areas 14 and 15 in Chambers County, Texas. A major portion of the work would be performed under the American Recovery and Reinvestment Act of 2009. The purpose of this letter is to request the National Marine Fisheries Service's concurrence with the Biological Assessment (BA) for the expansion of the Placement Areas. The BA, which is included as Appendix A of the enclosed Draft Environmental Assessment, addresses the project's potential to affect federally-listed threatened and endangered species and species of concern. The overall conclusion of the assessment is that the project is not likely to adversely affect any federally-listed threatened or endangered species, nor will it adversely modify critical habitat.

Pursuant to 50 CFR 402.13, I am hereby requesting your written concurrence with the BA's conclusion. We appreciate your continued cooperation in allowing us to fulfill our responsibilities under the Endangered Species Act. If you or your staff has any questions regarding this activity, please contact Steve Ireland at (409) 766-3131.

Sincerely,

Richard Medina
Chief, Planning & Environmental Branch

Enclosures

Biological Assessment

United States Army Corps of Engineers
Galveston District
PO Box 1229
Galveston, Texas 77550

January 2010

TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF TABLES

1.0 INTRODUCTION

1.1 Purpose of the Biological Assessment

This Biological Assessment (BA) has been prepared to fulfill the United States Army Corps of Engineers (USACE), Galveston District requirements as outlined under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended. The Federal action requiring this assessment is the proposed expansion of Placement Areas (PA) 14 and 15 of the Houston Ship Channel (HSC) project. The HSC project, which included PAs 14 and 15, was authorized by Congress in the Water Resources Development Act of 1996 (Public Law 104-303). The project sponsor for the proposed action is the Port of Houston Authority.

This BA evaluates the potential impacts the proposed expansion of PAs 14 and 15 may have on federally listed threatened and endangered species identified by the United States Fish and Wildlife Service (USFWS) for Chambers, Galveston, and Harris Counties, Texas and the National Marine Fisheries Service (NMFS) for the State of Texas. Species included in this BA (Table 1) were identified from lists obtained from databases managed by the USFWS and NMFS (USFWS, 2009a, 2009b, and 2009c; NMFS, 2009). Additional federally protected species are listed by the Texas Parks and Wildlife Department (TPWD) as potentially occurring in Chambers, Galveston, and Harris Counties. However, these additional species are not covered in this BA as they were not identified on the lists obtained from the databases managed by the jurisdictional Federal agencies (USFWS and NMFS).

The bald eagle was recently removed from the Federal list of threatened and endangered species in 2007. The bald eagle still remains federally protected under both the Bald and Golden Eagle Protection Act (16 United States Code (U.S.C. 668-668c) and the Migratory Bird Treaty Act (16 U.S.C. 703-712). The bald eagle is not included in this BA as they are no longer protected under the ESA.

The brown pelican was removed from the Federal list of endangered and threatened species on December 17, 2009 (74 Federal Register 59443), but still receives protection under the Migratory Bird Treaty Act and the Lacey Act (16 U.S.C. 3371-3378). Because its delisting is more recent, details regarding the brown pelican are included in this BA.

Table 1: Federally-Listed Threatened and Endangered Species in Chambers, Galveston, and Harris Counties, Texas

Common Name	Scientific Name	Listing Status	
		USFWS[1] County by County List[2]	NMFS[3] List for State of Texas
Birds			
Attwater's greater prairie-chicken	*Tympanuchus cupido attwateri*	E	NA
Bald eagle	*Haliaeetus leucocephalus*	DL	NA
Brown Pelican	*Pelecanus occidentalis*	DL[4]	NA
Eskimo curlew	*Numenius borealis*	E	NA
Piping plover	*Charadrius melodus*	T, CH	NA
Fishes			
Smalltooth sawfish	*Pristis pectinata*	NA	E

Table 1: Federally-Listed Threatened and Endangered Species in Chambers, Galveston, and Harris Counties, Texas (Continued)

Common Name	Scientific Name	Listing Status	
		USFWS[1] County by County List[2]	NMFS[3] List for State of Texas
Mammals			
Blue whale	*Balaenoptera musculus*	NA	E
Fin whale	*Balaenoptera physalus*	NA	E
Humpback whale	*Megaptera novaeanglaie*	NA	E
Sei whale	*Balaenoptera borealis*	NA	E
Sperm whale	*Physeter macrocephalus*	NA	E
Reptiles			
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Green sea turtle	*Chelonia mydas*	T	T
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Loggerhead sea turtle	*Caretta Caretta*	T	T
Plants			
Texas prairie dawn	*Hymenoxys texana*	E	NA

[1] USFWS 2009a, 2009b, and 2009c
[2] The Texas prairie dawn flower is only listed in Harris County. The Attwater's greater prairie-chicken is only listed in Galveston County. The bald eagle is listed for all three counties. All sea turtle species and piping plover are listed only in Chambers and Galveston Counties.
[3] NOAA/NMFS, 2009
[4] The final rule for delisting the brown pelican became effective December 17, 2009.
E = Endangered; T = Threatened; DL = Delisted; CH = Critical Habitat has been designated; PDL = Proposed for delisting

1.2 Description of the Proposed Project and Existing Habitats

1.2.1 Proposed Project Description

The proposed action includes the expansion of HSC PAs 14 and 15 to provide additional capacity for placement of dredged material generated during maintenance dredging activities along the HSC and the Bayport Ship Channel. This work would involve the construction of an approximate 169-acre upland PA between PAs 14 and 15 and the construction of up to three marsh PAs, or beneficial use (BU) sites. A mitigation marsh site of at least 88 acres would be constructed adjacent to the Bolivar Marsh Site in lower Galveston Bay near Bolivar Peninsula. This mitigation area would provide compensation for the conversion of estuarine habit to uplands as a result of the construction of the proposed upland PA expansion. The project area and vicinity are shown on Exhibit 1.

The BU sites would be designed to create intertidal marsh. Dredged material from on-going channel maintenance operations would be placed into BU sites and they would be planted with marsh vegetation when the elevations of the sites reach an appropriate height. Exhibit 2 shows the project construction features. The material for constructing the containment levees for the PA expansion and BU sites would be obtained by mining (dredging) clay material from the HSC between Morgan's Point and the Bayport Ship Channel, down to a maximum depth of 80 feet. In addition, material may be obtained from the advanced maintenance of the Bayport Ship Channel flare and from the planned dredging of berths at the

Bayport Terminal. For the eastern levee of the new upland PA, suitable material from PAs 14 and 15 would be used for mechanical construction to an initial elevation of 10 feet. The west levee initially would be constructed of rock material barged to the site and mechanically placed to an elevation of 6 feet. This rock material would be subsequently used for armoring of an earthen levee that would be constructed in 2020. Both levees would be sequentially raised during dredging cycles to match the elevations of PA 14 and 15 levees.

The new upland PA would connect the existing upland PAs 14 and 15 and would be constructed and operated in a similar manner as the existing upland PAs. The initial construction of the levees would begin in 2010 and is expected to take approximately one year to complete. Approximately 89,000 cubic yards of rock and 167,000 cubic yards of earthen material would be used for the initial construction, which would cover an area of about 31 acres. A temporary opening would be incorporated into the west levee to allow continued vessel access to existing oil and gas production facilities located between PAs 14 and 15. It is expected that these facilities would either be relocated or modified sometime within the next 10 years to accommodate the proposed upland PA. The District anticipates that the levees would be functionally completed and the expansion area ready to receive maintenance dredged material around 2020. The capacity of the new upland PA would be approximately 10 million cubic yards.

The construction of the levees for two of the BU marsh sites, Cells M-10 and M-7/8/9, would be conducted concurrent with the initial construction work for the upland PA levees, beginning in 2010. Filling with maintenance material would be done according to need during future maintenance dredging cycles. It is expected that the first placement of material into these sites would occur during the next dredging cycles after construction, which would be 2012 for the Bayport Ship Channel and 2013 for the HSC. Cell M-10, an approximate 305-acre BU site, would require approximately 400,000 cubic yards of material to construct 11,000 linear feet of levees that would cover an area of approximately 35 acres. The initial capacity of Cell M-10 would be at least 4 million cubic yards. Cell M-7/8/9, an approximate 392-acre BU site, would require approximately 408,000 cubic yards of material to construct 12,000 linear feet of levees that would cover an area of approximately 37 acres. Cell M-7/8/9 would have an initial capacity of at least 5 million cubic yards.

Although the construction of Cell M-7/8/9 is being implemented as part of the proposed project, this work was previously authorized as part of the HGNC channel deepening and widening project and the environmental impacts were assessed in a 1995 Supplemental Environmental Impact Statement (USACE, 1995). This BU site was originally planned as three marsh cells but these cells are being combined into one large cell contained by one perimeter levee in the proposed project.

Marsh Cell M-11 is a future BU site that would be constructed within the 424-acre area shown in Exhibit 2. The size, configuration, and timing of construction of this BU site have not been determined at this time. As in the upland PA expansion area, there are existing oil and gas facilities located within the proposed site. These facilities would be subject to relocation or modification to accommodate this BU site, depending on the final size and configuration. The District will coordinate the development of plans for Cell M-11 with the BUG and appropriate resource agencies.

The mitigation work at Bolivar Marsh would consist of the creation of intertidal marsh by constructing a mosaic of mounds, excavated circulation channels, and sacrificial berms. The details of the mitigation work are described in Section 5.0 of the Environmental Assessment. The construction of the mitigation site would begin in 2010 during the initial levee construction for the upland PA expansion area. Since the initial funding for the proposed project is limited, the mitigation work would be completed either all at once or in two phases, depending on the cost. If the work is done all at once, the total acreage of mitigation marsh would be somewhat more, due to habitat value being provided later. If completed in phases, the portion of the work necessary to provide compensation for the impacts of construction of the levees for the PA expansion area (approximately 15 acres) would be completed in the first phase and the remainder of the work would be completed concurrent with filling the upland PA expansion area, beginning in 2020.

For the purposes of evaluating impacts within this BA, the project area is defined as the footprint of the project features and immediately adjacent areas. The study area includes all of Galveston Bay.

1.2.2 Existing Habitat

The existing environment within the footprint of the proposed PA expansion area consists of shallow estuarine waters, intertidal sand flats, and saline marsh. Pertinent natural resources databases were consulted to determine if significant natural resources may be located in or around the project area. According to Geographic Information Systems (GIS) data obtained from the Texas General Land Office (GLO), historic oyster reefs have been located in the general vicinity of the project area, but no historic oyster reefs were located in the project area footprint. In addition the GLO-GIS database does not depict submerged aquatic vegetation (SAV) in or around the project area. No oyster reefs or SAV were observed during a site assessment of the impact areas on October 6, 2009.

2.0 STATUS OF THE LISTED SPECIES LIKELY TO OCCUR IN THE PROJECT AREA

Of the species listed in Table 1, brown pelican, piping plover, and sea turtles are most likely to occur in and around the project area. Other species listed in Table 1 are not likely to occur in the vicinity of the project due to lack of suitable habitat, known range limits, or presumed extinction (e.g. Eskimo Curlew). There is no designated critical habitat for any of the listed species within the project area. Descriptions of the species most likely to occur in the project area follow.

2.1 Brown Pelican

Brown pelican are large, heavy (weighing about 9 pounds) water birds with wingspans up to 6 feet, with large bills up to 18 inches deep, and huge throat pouches. Their wings and body are mostly grayish brown. Non-breeding adults have a whitish head and neck, often washed with yellow. In breeding adults, their hind neck becomes a dark chestnut color. The head and neck of immature brown pelican are grayish brown and under-parts are whitish. Groups of pelican are often observed gliding low over water, often in lines. They are also known to soar high overhead, circling on thermal drafts.

2.1.1 Reasons for Status

The brown pelican population in Texas suffered a decline in the early part of the 1900s when fishermen regarded the birds as competition. Adult birds and nesting colonies were destroyed by fishermen to eliminate competition for fish. It is estimated that the brown pelican population declined by more than 80% in the 1920s and early 1930s. Subsequent and more damaging anthropogenic effects to the brown pelican population were caused by the use of DDT and other similar chemicals in the late 1940s (TPWDa, web). These products were used as insecticides for crops across the United States and for mosquito control in low-lying coastal areas. These chemicals were carried by rain events into local watersheds across the country where brown pelicans ate fish that had bio-accumulated these toxic chemicals. The ingestion of toxic chemicals by the pelican resulted in the laying of thin shelled eggs which could easily break, thus leading to a decrease in successful hatching. These chemicals were banned in the early 1970s and recovery of these species has been steady since.

The brown pelican was originally listed by the USFWS as endangered in June of 1970 (USNFWL, 1980) and currently remains federally endangered in Texas. This species is currently proposed to be delisted. The final rule for delisting of the brown pelican was published on November 17, 2009 (74 Federal

Register 59443). The effective date of the final rule was December 17, 2009. With removal of the brown pelican from the list of threatened and endangered species, Federal agencies will no longer be required to consult with the USFWS to ensure any action they authorize, fund, or carry out will not harm the species. However, additional Federal laws, such as the Migratory Bird Treaty Act and the Lacey Act, will continue to protect the brown pelican, its nests and its eggs.

The USFWS has developed a Post-Delisting Monitoring Plan, designed to monitor and verify that the recovered, delisted population remains secure from the risk of extinction once the protections of the ESA are removed. The Service can relist the brown pelican if future monitoring or other information shows it is necessary to prevent a significant risk to the brown pelican.

2.1.2 Habitat

Brown pelican are coastal birds found in warm coastal marine and estuarine environments. Brown pelicans generally nest in the spring in colonies on small isolated coastal islands away from the threat of natural predation from coyotes and raccoons. Part of the Texas population spends the non-breeding season along the Texas coast while others migrate south and winter on the east coast of Mexico (TPWDa, web). Nesting habitats are varied and include mud banks, dredged material islands, and offshore islands covered with woody vegetation. Nests are typically constructed from sticks and reeds and lined with grasses and leaves. The female builds the nest with material gathered by the male. The nest is either a simple scrape lined with a few twigs and feathers or a large stick nest in a tree. The female lays one brood of 2-4 eggs (usually 3) each year. Both parents incubate. The altricial young are fed semi-digested fish by both parents. Young may leave the ground nest after 5 weeks, but young in tree nests remain an additional 2 weeks. After fledging, the young gather in groups, but the parents recognize and continue to feed their own young.

Brown pelican forage in open marine and estuarine waters by using their large extended pouches to catch fish. While foraging, brown pelicans dive from 30 feet or more in the air, plunging headfirst into the water to catch fish. If successful, they throw their heads back to swallow prey. Brown Pelicans feed and roost together. The brown pelican's diet consists almost entirely of fish but they also eat some crustaceans and occasionally scavenge or take handouts from fishermen.

2.1.3 Range

Brown pelican are found from central North America south through Central America and into northern South America. In North America, brown pelican are found along the Atlantic and Gulf coasts from the Carolinas to Florida and west to Texas. Brown pelican are also found along the southern coast of California.

2.1.4 Distribution in Texas

Brown pelican are currently found in Texas along the upper coast of Jefferson County to the lower coast of Cameron County. Two of the largest active nesting colonies on the Texas coast are found on Pelican Island in Corpus Christi Bay and Sundown Island, near Port O'Connor, Texas, both of which are National Audubon Society Sanctuaries. Smaller groups or colonies nest on Bird Island in Matagorda Bay, a series of older PA islands in West Matagorda Bay, Dressing Point Island in East Matagorda Bay, and islands in Aransas Bay (TPWDa, web).

In Galveston Bay, nesting brown pelicans have been observed during the annual Texas Colonial Waterbird survey conducted by the USFWS on HGNC Mid Bay Island, Evia Island, Mustang Bayou Island (PA 67), Little Pelican Island, North Deer Island, Jig Saw Island, Marker 52 PA Island, and Rollover Pass.

2.1.5 Presence in Study and Project Area

According to the Texas Colonial Water bird survey, no observations of nesting brown pelicans on Atkinson Island have been noted since the inception of the annual survey in 1973. Nesting sites have been observed in other areas of Galveston Bay. Although they have not been seen nesting in the project area in three previous decades, they are commonly seen foraging in the vicinity. During a field assessment on October 6, 2009, brown pelican were observed standing on intertidal sand flats and flying overhead within the project area.

2.2 Piping Plover

The Piping Plover is a small, stocky shorebird about 7 inches long with a wingspan of about 15 inches. Adults have a sand-colored upper body, white undersides, and orange legs throughout the year. A white rump, which is visible in flight, distinguishes this species from other small plovers. During the breeding season, adults acquire a dark narrow breast band, a dark strip across the forehead, and a black-tipped orange bill. The breast band is sometimes incomplete, especially in females. Juveniles are similar to non-breeding adults in appearance (TPWDb, web). Piping plover may occur within the project area.

2.2.1 Reasons for Status

Populations of piping plover are in jeopardy due to habitat alteration and destruction. Sandy beaches and lakeshores are being developed for recreational, residential, and commercial uses, thus leading to a decrease in sandy beaches, which provide suitable habitat for piping plover. River flow patterns are being modified by reservoir construction and channel excavation, thus leading to a decrease in sandbars in major rivers, which provide important nesting habitat. Wintering habitat along the Gulf coast is being threatened by industrial and urban expansion along with maintenance activities in commercial waterways. Just the mere presence of humans due to vehicular and foot traffic and changes in surrounding land use can alter the breeding behavior and the nesting success of piping plover. Wintering plovers are also disturbed by the presence of human activity. Piping plover were originally listed as threatened on the Endangered Species Act in January of 1986 and currently remain threatened in the State of Texas.

2.2.2 Habitat

Piping plovers are shorebirds commonly found on sandy beaches and lakeshores. Piping plover breed on sandy beaches from Canada to North Carolina, along sand and gravel shores of the Great Lakes, on river sandbars and islands and shorelines of inland lakes, and alkali wetlands in the northern Great Plains of Canada and the United States. Piping plover winter primarily along Gulf Coast beaches from Florida to Mexico, along Atlantic Coast beaches from North Carolina to Florida, and along shorelines of Caribbean Islands. Wintering habitats include beaches, sand flats, mud flats, algal mats, emergent sea grass beds, wash-over passes, small dunes, and PA islands (TPWDb, web).

Critical habitat was designated for piping plover in 2001 and critical habitat was revised for wintering populations of piping plover in Texas in 2009. The designation of critical habitat identifies areas that are important for piping plovers on their wintering grounds and provides both public and resource agencies with information that can be used to minimize impacts to these areas.

2.2.3 Range

Piping plover are migratory bird species that occur in North America. Historically piping plover have been found along the Atlantic and Gulf Coasts, in river systems and lakes in the northern Great Plains and Great Lakes region, and in the Bahamas and West Indies. Although populations have declined historically, remnant populations occur throughout the historic range (TPWDb, web).

2.2.4 Distribution in Texas

In Texas, piping plover are found along the entire coast. Thirty-seven critical habitat units are designated along the Texas Coast from Bolivar Peninsula on the upper Texas coast to the mouth of the Rio Grande River on the south Texas coast. Piping plover utilize the Texas coast as wintering habitat between late-July and late-February.

2.2.5 Presence in Study and Project Area

Piping plover may potentially occur in the project area. Intertidal sand flats, a suitable wintering habitat type for piping plover, are located within the project footprint. One critical habitat unit (TX-37) is located within the project study area. The location of TX-37 is located in Rollover Bay, approximately 28 miles to the southeast of the project area.

2.3 Sea Turtles

Sea turtles may occur within the study and project areas. Of the five turtle species that are listed by NMFS and USFS, only the Kemp's ridley, green, and loggerhead sea turtles are likely to occur in bay waters in the vicinity of the project area. The hawksbill and leatherback sea turtles are not likely to be found within the project area due to a lack of suitable habitats. Hawksbill sea turtles are unlikely to occur in the project study area as they prefer clear offshore waters where coral reef formations are present (TPWDf, web). Leatherback sea turtle are unlikely to occur in the project study area as they primarily inhabit the upper reached of the ocean, but they also frequently descend into deep waters from 650 feet to 1650 feet in depth (TPDWg, web).

2.3.1 Reasons for Status

The largest threat to populations of sea turtles comes from man and mans alteration of the existing environment. Historically, the worldwide decline of turtles was due to the harvest of both sea turtles and their eggs from nesting grounds. Although turtle harvesting continues in some parts of the world, it is illegal to harvest sea turtles or their eggs in the United States and in many other parts of the world. Other threats to sea turtles include entanglement in commercial fishing gear, ingestion of or entanglement in marine debris, environmental contamination from industrial areas, and degradation of nesting habitat due to beach re-nourishment or beach armoring activities. The green sea turtle was designated as threatened in July of 1970 and currently remains threatened in Texas. The Kemp's ridley sea turtle was designated as endangered in December of 1970 and currently remains endangered in Texas. The loggerhead sea turtle was designated as threatened in July of 1978 and currently remains threatened in Texas.

2.3.2 Habitat

Green sea turtles are found in three distinct marine habitat types: oceanic beaches where females deposit eggs, convergence zones in pelagic habitat where juveniles take refuge and feed, and benthic feeding grounds in relatively shallow waters where sub-adults feed on sea-grasses, coral, and rocky bottoms (TPWDc, web).

Kemp's ridley adults prefer open ocean and Gulf of Mexico waters and females prefer to nest on sandy beaches of Mexico. The post-pelagic stages are commonly found feeding over crab rich sandy or muddy bottoms and juveniles are frequently found feeding in bays, coastal lagoons, and river mouths (TPWDd, web).

Loggerhead sea turtles are capable of living in a variety of environments including brackish waters of coastal lagoons, river mouths, and tropical and temperate waters above 50 degrees Fahrenheit.

Loggerhead sea turtles also are found in three distinct marine habitats: oceanic beaches, pelagic convergence zones, and benthic feeding grounds of shallow waters and bays (TPWDe, web).

2.3.3 Range

Green sea turtles are distributed around the globe in tropical and sub-tropical waters. On the east coast of the United States, green turtles are found in waters from Texas to Massachusetts. In the United States, major nesting beaches for green turtles include Atlantic beaches along the southeast coast of Florida in addition to the beaches of Puerto Rico and the US Virgin Islands (TPWDc, web).

Kemp's ridley sea turtles have one of the most restricted distribution of any species of sea turtle. This species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. The major nesting beach for the Kemp's ridley is on the northeastern coast of Mexico near Rancho Nuevo in southern Tamaulipas (TPWDd, web).

Loggerhead sea turtles are distributed worldwide throughout temperate and tropical seas. Their major nesting beaches in the United States are found primarily in the southeast along the Atlantic coasts of North Carolina, South Carolina, Georgia, and Florida (TPWDe, web).

2.3.4 Distribution in Texas

Green sea turtles in Texas are primarily found in the Gulf of Mexico and sub-adults are occasionally found feeding in shallow bays and estuaries where marine sea grasses, its principle food source, grow. They may also be found in bays devoid of sea grasses. The green sea turtle population in Texas once flourished but suffered a decline due to commercialized overfishing in the mid to late nineteenth century. Green sea turtles still remain in the bays and estuaries of Texas today but in much-reduced numbers (TPWDc, web).

The Kemp's ridley migrates along the Texas coast and commonly utilizes Texas bays and estuaries to feed on shrimp, crab, and other invertebrates (TPWDd, web). Although almost the entire population of Kemp's ridley turtles nest near Rancho Nuevo, Tamaulipas, Mexico, an increasing number of nests have been found along the Texas coast. According to personal communications with Donna Shaver of the United States National Park Service (NPS) at Padre Island National Seashore, 10 Kemp's ridley nests have been documented on the Bolivar Peninsula and 37 Kemp's ridley nests have been documented on Galveston Island since 1999.

Loggerhead sea turtles are transient species along the Texas coast and in Texas bays and estuaries. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico. Only one nest has been documented since 1999 between both Bolivar Peninsula and Galveston Island (D. Shaver, personal communication, August 5, 2009). Sub-adult loggerheads commonly enter Texas bays and estuaries to feed.

2.3.5 Presence in Study and Project Area

Although there have been no documented green sea turtle nests on the Bolivar Peninsula or Galveston Island since 1999 (D. Shaver, personal communication, August 5, 2009) and although the project area is devoid of sea grasses, it remains likely that the green sea turtle may occur as a transient species in the project area.

Because the study area contains and is surrounded by a warm estuarine bay, it is likely that green sea turtles, Kemp's ridley sea turtles, and loggerhead sea turtles may be found in or near the project area as a transient species. It is unlikely that leatherback or hawksbill sea turtles may be found in or near the study area. The study area does not contain suitable nesting habitat for any sea turtle species.

3.0 EFFECTS ANALYSIS

3.1 Brown Pelican

No nesting sites are located in the project area. The open water areas on the project site and areas surrounding the project site are likely used by brown pelicans foraging and resting. These birds are highly mobile and able to easily relocate from foraging or resting areas to avoid any disturbance from the result of the proposed construction activities. Although there may be a disturbance to foraging and resting brown pelicans during construction, these activities are localized and would not negatively affect their overall feeding, nesting, or resting activities.

Effect Determination: *May affect, but not likely to adversely affect.*

3.2 Piping Plover

No designated critical habitat is located in the project area. The closest designated critical habitat to the project area includes Bolivar Beach on Bolivar Peninsula (Critical Habitat Unit TX-36), which is located approximately 21 miles to the south-southeast; Rollover Pass (Critical Habitat Unit TX-37), which is located approximately 28 miles to the southeast; and Big Reef on Galveston Island (Critical Habitat Unit TX-35), which is located approximately 24 miles to the south-southeast. Although no critical habitat is located in the project area, beach accretion within the project area on the south end of Atkinson Island's PA 15 and the north end of PA 14 could potentially be used as wintering/foraging habitat for piping plover. Construction of the proposed project and subsequent placement of dredged material within the expanded placement area would remove this wintering/foraging habitat from the environment. Although this impact is permanent in nature, the high mobility of the piping plover would allow them to easily relocate to other more suitable wintering/foraging habitats. Construction activities from the proposed project should not negatively affect this species' overall wintering/foraging activities.

Effect Determination: *May affect, but not likely to adversely affect.*

3.3 Sea Turtles

It is unlikely that the leatherback and hawksbill sea turtles would occur in the project area. Turtles that may occur in the bay waters in or near the project area include green, Kemp's ridley, and loggerhead sea turtles. Dredging operations for the proposed project would be conducted using cutterhead dredges, which move at slow enough speeds that turtles would be able to move out of the way of the cutterhead. It is anticipated that the project would not cause any impacts to sea turtle nesting since there is no suitable nesting habit in the project area.

Effect Determination: *May affect, but not likely to adversely affect.*

4.0 SUMMARY

The proposed project may effect, but is not likely to adversely affect brown pelican, piping plover, and green, Kemp's ridley, and loggerhead sea turtles. Appropriate avoidance, minimization, and conservation measures should be taken to ensure these species are not adversely affected. The project would have no effect on any other federally-listed threatened and endangered species or their critical habitat indentified in this BA.

5.0 LITERATURE CITED

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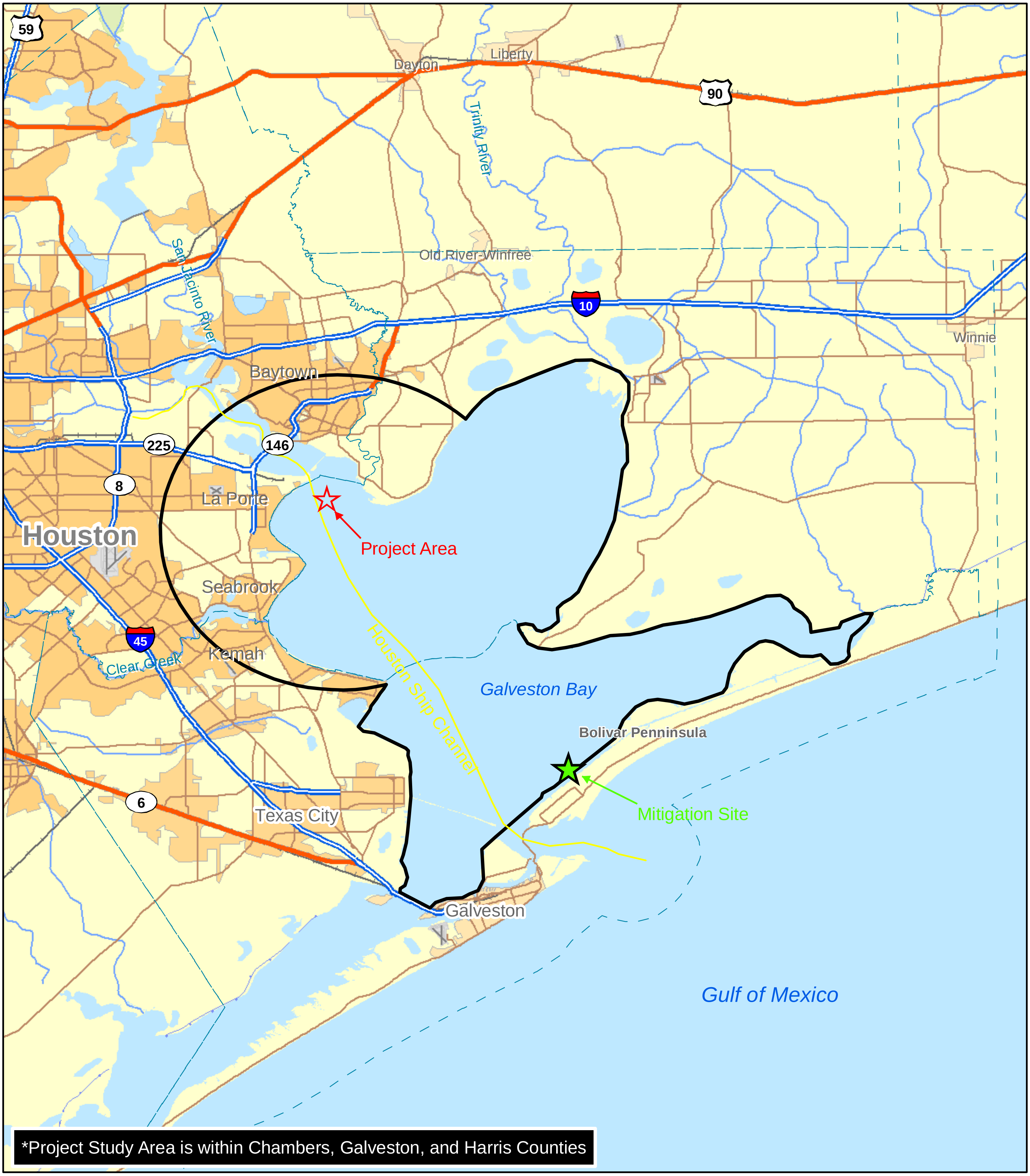
Exhibits



Project Study Area — Houston Ship Channel

County Border

N

0 4 8 Miles

US Army Corps of Engineers ®
Galveston District

11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel

VICINITY MAP WITH PROJECT
STUDY AREA DATA OVERLAY
EXHIBIT 1

Chambers, Galveston, Harris and Liberty Counties, Texas

Expansion Area (169 acres)
Future Cell M-11
Cell M-5/6
Proposed Cell M-7/8/9/10
Navagational Channel

N

0 0.5 1 Miles

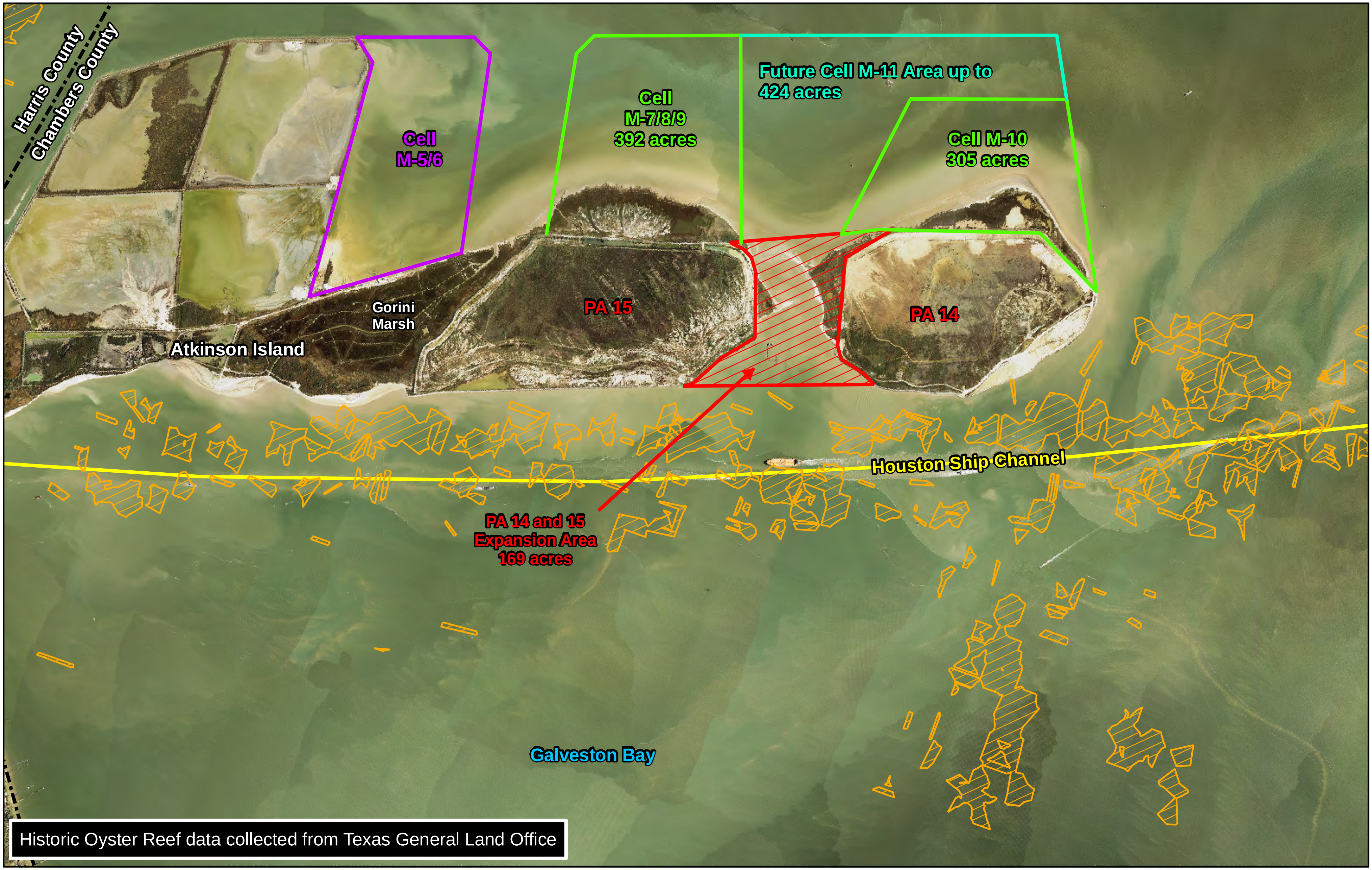
US Army Corps of Engineers®
Galveston District

11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel

2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH
WITH PROPOSED PROJECT WORK AREA
EXHIBIT 2

Chambers County, Texas



Expansion Area
Cell M-5/6
Proposed Cell M-7/8/9/10
County Line
Houston Ship Channel
Historic Oysters Reefs
Future Cell M-11

N

0 1,500 3,000 Feet

US Army Corps of Engineers ®
Galveston District

11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA AND HISTORIC OYSTER REEF DATA OVERLAYS

EXHIBIT 3

Chambers and Harris Counties, Texas

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real #211
Houston, Texas 77058-3051
281/286-8282 FAX: 281/488-5882

January 7, 2010

Colonel David Weston
Attn: Chief, Environmental Branch
US Army Corps of Engineers
PO Box 1229
Galveston, Texas 77553-1229

Dear Colonel Weston,

Thank you for your letter, dated December 2, 2009, requesting concurrence with the U.S. Army Corps of Engineers' determination that the proposed expansion of Placement Areas (PA) 14 and 15, located in the Houston Ship Channel, Chambers County, Texas, is not likely to adversely affect federally listed threatened and endangered species.

The U.S. Fish and Wildlife Service (Service) concurs that the proposed expansion of PA 14 and 15 is not likely to adversely affect any federally listed species under our jurisdiction. This concurrence is based upon a review of your project information and Service files. In the event the project changes or additional information on the distribution of listed or proposed species or designated critical habitat becomes available, the project should be reanalyzed for effects not previously considered.

Our comments are provided in accordance with the provisions of the Endangered Species Act of the 1973 (87) Stat. 884, as amended; 16 U.S.C. 703 et seq.

Please contact either me or Donna Anderson, staff biologist, at 281/286-8282 if you have any questions or if we can be of further assistance.

Sincerely,

Edith Erfling

for Stephen D. Parris
Field Supervisor, Clear Lake ES Field Office

TAKE PRIDE IN AMERICA

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
(727) 824-5312 FAX 824-5309
http://sero.nmfs.noaa.gov

F/SER31:RGH

Mr. Steve Ireland
Galveston District Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

JAN 15 2010

Dear Mr. Ireland:

This responds to your November 30, 2009, letter, draft environmental assessment, and biological assessment (BA) submitted pursuant to section 7 of the Endangered Species Act (ESA) for the Army Corps of Engineers' (COE) proposed expansion of Houston Ship Channel Placement Areas 14 and 15. The proposed project site is located within upper Galveston Bay, east of Houston Ship Channel (HSC), at the southern extent of Atkinson Island. The National Marine Fisheries Service's (NMFS) requested additional project information, including characteristics of the project site and construction methods, from the COE via e-mail on December 14, 2009. A response was received via e-mail on December 16, 2009. You determined that the proposed project is not likely to adversely affect swimming sea turtles and requested NMFS' concurrence with your determination. NMFS' determinations regarding the effects of the proposed action are based on the description of the action in this informal consultation. You are reminded that any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS.

The proposed project includes the expansion of HSC Placement Areas (PA) 14 and 15 to provide additional capacity for placement of dredged material during maintenance dredging activities along the HSC and Bayport Ship Channel. This work would involve the construction of a 169-acre upland placement area between PAs 14 and 15, and the construction of up to three marsh placement areas, or beneficial use (BU) sites. The BU sites would be constructed east of PAs 14 and 15 and would include a 392-acre site (Cell M-7/8/9), a 305-acre site (Cell M-10), and up to a 424-acre site (Cell M-11). The BU sites would be designed to create intertidal marsh. Dredged material from ongoing channel maintenance operations would be placed into BU sites and they would be planted with marsh vegetation when the elevations of the sites reach an appropriate height.

The levees for the new upland PA would be mechanically constructed using heavy, earthmoving construction equipment. The equipment used will be up to the contractor but could include equipment such as trackhoes, frontloaders, bulldozers, and dump trucks. The material for the east levee for the new upland PA would be excavated from the existing upland PAs 14 and 15.

The west levee would initially consist of a rock levee, behind which an earthen levee would be constructed using material from the existing upland PAs. Clean rock material would be barged to the site and mechanically placed to construct the rock levee to an elevation of 6 feet. Approximately 89,000 cubic yards of rock and 167,000 cubic yards of earthen material would be used for the initial construction, which would cover 31 acres. After completion of the earthen levee, the rock material would be used for armoring the face of the levee to protect it from erosion from ship wakes. Material for constructing the containment levees for the BU sites would be obtained by mining (dredging) clay material from the HSC between Morgan's Point and the Bayport Ship Channel, down to a maximum depth of 80 feet, and placed by dredge pipeline. Additional material may be obtained from the advanced maintenance of the Bayport Ship Channel flare and from the planned dredging of berths at the Bayport Terminal. Final shaping would likely be done with heavy earthmoving equipment such as bulldozers and trackhoes. The intertidal marsh areas inside the containment levees would be brought up to elevation by placing hydraulically dredged maintenance material during channel maintenance operations. The COE expects that the levees will be functionally completed and the expansion area ready to receive maintenance-dredged material around 2020.

The approximately 75-acre mitigation marsh site would be constructed adjacent to the Bolivar Marsh Site in lower Galveston Bay near Bolivar Peninsula to provide compensation for the conversion of estuarine habitat to uplands as a result of the proposed upland PA expansion. Mitigation work at Bolivar Marsh would consist of the creation of intertidal marsh by constructing a mosaic of mounds, excavated circulation channels, and sacrificial berms. The mitigation area would be constructed using small cutterhead dredges and earthmoving equipment. Marsh construction material would be obtained from the creation of creek and pond features in previously constructed BU cells. Alternatively, material may be obtained from the adjacent Gulf Intracoastal Waterway by cutterhead dredge and pipelines. Depending on funding, work will be completed all at once or in two phases. It is most likely that this work will be done all at once. The construction work for the mitigation marsh is expected to take approximately one year. If the work is completed in phases, the first phase would likely take about 2 to 3 months, mitigating for the construction of the levees for the new upland PA (approximately 15 acres). The second phase (approximately 60 acres) would begin after completing and filling the upland PA (about 2020), and would take about 10 to 11 months.

Five ESA-listed species of sea turtles (the endangered leatherback, Kemp's ridley, and hawksbill; the threatened/endangered[1] green; and the threatened loggerhead) may occur at the project sites. NMFS has analyzed the routes of potential effects from the proposed project and concurs that listed sea turtles are not likely to be adversely affected. Effects to sea turtles from dredging are discountable due to the use of a hydraulic cutterhead dredge. NMFS has previously determined that non-hopper-type dredging activities are unlikely to adversely affect sea turtles. Sea turtles may also be affected by dredging activities if they were to be struck by the transit and anchoring of the dredge at the project site or by the placement of dredged material below mean high water. However, these effects are discountable because sea turtles are highly mobile and can avoid the area during dredging and sand placement activities, and through the implementation of NMFS' Sea Turtle and Smalltooth Sawfish Construction Conditions dated March 23, 2006 (enclosed).

1 Green turtles are listed as threatened, except for breeding populations in Florida and the Pacific coast of Mexico, which are listed as endangered.

We believe there will be no significant effects due to loss of foraging habitat on leatherback, hawksbill, and green sea turtles. Leatherbacks are pelagic feeders; dredging and the placement of sand in the intertidal zone will not affect pelagic resources. Hawksbill and green turtles are specialist feeders that target sponges and seagrass or macroalgae. Substrate at the dredging and disposal sites consists of unvegetated sandy bottom and does not support those resources; hence, hawksbill and green sea turtles will not be affected. The effects due to loss of foraging habitat on Kemp's ridley and loggerhead sea turtles are insignificant. These species are generalist carnivores, typically preying on benthic mollusks and crustaceans in the nearshore environment. Both species can be found foraging in shallow sandy habitat. However, any impacts to foraging habitat for Kemp's ridleys and loggerheads would only affect a small area (1290 acres) relative to the foraging habitat available in the nearshore marine environment off Texas.

In summary, we believe the proposed action is not likely to adversely affect listed sea turtles. This concludes your consultation responsibilities under the ESA for species under NMFS' purview. Consultation must be reinitiated if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action. We have enclosed additional information on other statutory requirements that may apply to this action, and on NMFS' Public Consultation Tracking System (PCTS) to allow you to track the status of this and other ESA consultations.

If you have any questions on this consultation or PCTS, please contact Ryan Hendren at (727) 824-5312, or by e-mail at Ryan.Hendren@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Southeast Regional Administrator

Enclosure (2)

File: 1514-22.F.1.TX
Ref: I/SER/2009/06513

PCTS Access and Additional Considerations for ESA Section 7 Consultations (Revised 7-15-2009)

Public Consultation Tracking System (PCTS) Guidance: PCTS is an online query system at **https://pcts.nmfs.noaa.gov/** that allows federal agencies and U.S. Army Corps of Engineers' (COE) permit applicants and their consultants to ascertain the status of NMFS' Endangered Species Act (ESA) and Essential Fish Habitat (EFH) consultations, conducted pursuant to ESA section 7, and Magnuson-Stevens Fishery Conservation and Management Act's (MSA) sections 305(b)2 and 305(b)(4), respectively. Federal agencies are required to enter an agency-specific username and password to query the Federal Agency Site. The COE "Permit Site" (no password needed) allows COE permit applicants and consultants to check on the current status of Clean Water Act section 404 permit actions for which NMFS has conducted, or is in the process of conducting, an ESA or EFH consultation with the COE.

For COE-permitted projects, click on "Enter Corps Permit Site." From the "Choose Agency Subdivision (Required)" list, pick the appropriate COE district. At "Enter Agency Permit Number" type in the COE district identifier, hyphen, year, hyphen, number. The COE is in the processing of converting its permit application database to PCTS-compatible "ORM." An example permit number is: SAJ-2005-000001234-IPS-1. For the Jacksonville District, which has already converted to ORM, permit application numbers should be entered as SAJ (hyphen), followed by 4-digit year (hyphen), followed by permit application numeric identifier with no preceding zeros. For example: SAJ-2005-123; SAJ-2005-1234; SAJ-2005-12345.

For inquiries regarding applications processed by COE districts that have not yet made the conversion to ORM (e.g., Mobile District), enter the 9-digit numeric identifier, or convert the existing COE-assigned application number to 9 numeric digits by deleting all letters, hyphens, and commas; converting the year to 4-digit format (e.g., -04 to 2004); and adding additional zeros in front of the numeric identifier to make a total of 9 numeric digits. For example: AL05-982-F converts to 200500982; MS05-04401-A converts to 200504401. PCTS questions should be directed to Eric Hawk at Eric.Hawk@noaa.gov. Requests for username and password should be directed to PCTS.Usersupport@noaa.gov.

EFH Recommendations: In addition to its protected species/critical habitat consultation requirements with NMFS' Protected Resources Division pursuant to section 7 of the ESA, prior to proceeding with the proposed action the action agency must also consult with NMFS' Habitat Conservation Division (HCD) pursuant to the MSA requirements for EFH consultation (16 U.S.C. 1855 (b)(2) and 50 CFR 600.905-.930, subpart K). The action agency should also ensure that the applicant understands the ESA and EFH processes; that ESA and EFH consultations are separate, distinct, and guided by different statutes, goals, and time lines for responding to the action agency; and that the action agency will (and the applicant may) receive separate consultation correspondence on NMFS letterhead from HCD regarding their concerns and/or finalizing EFH consultation.

Marine Mammal Protection Act (MMPA) Recommendations: The ESA section 7 process does not authorize incidental takes of listed or non-listed marine mammals. If such takes may occur an incidental take authorization under MMPA section 101 (a)(5) is necessary. Please contact NMFS' Permits, Conservation, and Education Division at (301) 713-2322 for more information regarding MMPA permitting procedures.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701-5505

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

Appendix B

CZMA Consistency Determination

REPLY TO
ATTENTION OF

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

November 30, 2009

Environmental Section

Ms. Tammy Brooks
Coastal Coordination Council
P.O. Box 12873
Austin, Texas 78711-2873

Dear Ms. Brooks:

The Galveston District is developing plans to expand Houston Ship Channel Placement Areas 14 and 15 in Chambers County, Texas. A major portion of the work would be performed under the American Recovery and Reinvestment Act of 2009. The proposed work is described in detail in Section 1.3 of the enclosed Draft Environmental Assessment (EA).

Under the Coastal Zone Management Act (CZMA) of 1972, Federal actions are required to be consistent, to the extent practicable, with approved state coastal management plans. The District's consistency determination is included in Appendix C of the Draft EA. The District is requesting that the Coastal Coordination Council review the enclosed information to ensure that the proposed project is consistent with the Texas Coastal Management Plan.

If you or your staff have any questions regarding this project, please contact Steve Ireland at (409) 766-3131.

Sincerely,

Richard Medina
Chief, Planning & Environmental. Branch

Enclosures

COMPLAINCE WITH GOALS AND POLICIES – SECTION 501.25(a)-(f)
DREDGING AND DREDGED MATERIAL DISPOSAL AND PLACEMENT
TEXAS COASTAL MANGMENT PROGRAM
EXPANSION OF PLACEMENT AREAS 14 AND 15
HOUSTON SHIP CHANNEL PROJECT
CHAMBERS COUNTY, TEXAS

Section 501.25 Dredging and Dredged Material Disposal and Placement

(a) Dredging and the disposal and placement of dredged material shall avoid and otherwise minimize adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf beaches to the greatest extent practicable. The policies of this subsection are supplemental to any further restrictions or requirements relating to the beach access and use rights of the public. In implementing this subsection, cumulative and secondary adverse effects of dredging and the disposal and placement of dredged material and the unique characteristics of affected sites shall be considered.

Compliance: The proposed project is to deposit dredged material in an area between two existing dredged material placement areas; Placement Area (PA) 14 and 15 within the Atkinson Island complex. The placement of this material has avoided and minimized adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas and Gulf beaches by placing material in an area that historically been used for dredged material placement. The proposed project also includes a component to create beneficial use of the dredged material to the east of the existing PAs. The beneficial use areas have been design to avoid oyster reef habitat located on both sides of the Houston Ship Channel, west of the project area. The placement of material within this existing PA complex would avoid placement of material in unconfined open and non-previously disturbed areas of the Bay.

Material for project construction would be dredged from the Houston Ship Channel from approximately Morgan's Point to south of the Bayport Ship Channel, dredged from the permitted construction of the Bayport facilities, and beneficial re-use of dredged materials from PAs 14 and 15. Materials would be pumped by pipeline and hydraulic pipeline dredge to PA 14/15 Expansion, a levee confined, placement area atop existing submerged land. Construction of the PA would impact approximately 169 acres of submerged bay bottom, saline marsh, and intertidal sand flat areas. In addition to PA expansion, dredged materials would be utilized for beneficial uses east of PA 14. An approximately 305 acre beneficial use marsh cell (M-10), 392 acre beneficial use marsh cell (M-7/8/9), and up to 424 acre future beneficial use marsh cell area (M-11) would be constructed in this area. A mitigation area of at least 88 acres of salt marsh would be constructed near Bolivar Peninsula to compensate for the losses associated with the construction of the 169 acre expanded placement area. The beneficial use cells and the mitigation area would create saline marsh area, thus contributing a net gain of important estuarine habitat within the Galveston Bay system.

(1) Dredging and dredged material disposal and placement shall not cause or contribute, after consideration of dilution and dispersions, to violation of any applicable surface water quality standards established under §501.21 of this title.

Compliance: No water quality standards would be violated by this project. Temporary elevations of turbidity may be caused as a result of construction; however, given the turbid nature of the Bay

within the project study area, it is not anticipated these elevations would have a detrimental effect to fish and wildlife values within the project vicinity.

(2) Except as otherwise provided in paragraph (4) of this subsection, adverse effects on critical areas from dredging and dredged material disposal or placement shall be avoided and otherwise minimized, and appropriate and practicable compensatory mitigation shall be required, in accordance with §501.23 of this title.

Compliance: "Critical area", per Texas Natural Resources Code, §33.203(8), means a coastal wetland, an oyster reef, a hard substrate reef, submerged aquatic vegetation, or a tidal sand or mud flat. Approximately 29 acres of coastal wetlands and 27 acres of tidal sand flats would be impacted by the proposed project. An approximately 305 acre beneficial use marsh cell (M-10) would be constructed to the east of PA 14. The beneficial use cell would create saline marsh area, thus contributing a net gain of important estuarine habitat within the Galveston Bay system. Mitigation for project specific impacts would also be provided off-site. At least 88 acres of salt marsh would be created near Bolivar Peninsula to mitigate for project related impacts.

(3) Except as provided in paragraph (4) of this subsection, dredging and the disposal and placement of dredged material shall not be authorized if:

(A) there is a practicable alternative that would have fewer adverse effects on coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf beaches, so long as that alternative does not have other significant adverse effects;

Compliance: No practicable alternative exists that would have fewer adverse effects on coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf Beaches. The currently proposed project footprint is located in areas that have been disturbed by previous construction of PAs. In addition, the current project footprint is designed to avoid impact to potential oyster reef habitat that may be located in nearby waters.

(B) all appropriate and practicable steps have not been taken to minimize adverse effects on coastal waters, submerged lands, critical areas, coastal shore areas, and Gulf beaches; or

Compliance: All practicable steps have been taken to minimize adverse affects on these resources. The project impact area is situated adjacent to existing PAs, thereby avoiding impact to locations in the bay with no prior environmental impacts. The project is located in an area that has been previously disturbed by construction of other PAs and the project footprint avoids impact to oyster reefs in the area.

(C) significant degradation of critical areas under §501.23(a)(7)(E) of this title would result.

Compliance: No significant degradation of critical areas would result from this project. Approximately 29.38 acres of saline marsh, 27.09 acres of intertidal sand flat, and 112.67 acres of open bay habitat would be impacted. Resource impacts are more than offset by the environmental benefits of the project, including up to 1,121 acres of beneficial use area east of PA 14 and at least 88 acres of saline marsh creation behind Bolivar Peninsula.

(4) A dredging or dredged material disposal or placement project that would be prohibited solely by application of paragraph (3) of this subsection may be allowed if it is determined to be of overriding importance to the public and national interest in light of

economic impacts on navigation and maintenance of commercially navigable waterways.

Compliance: The project has overriding importance to the public and national interest because it would allow for the uninterrupted maintenance of and safe commercial navigation conditions within the Houston Ship Channel (HSC), which provides access to one of the largest ports in the country.

(b) Adverse effects from dredging and dredged material disposal and placement shall be minimized as required in subsection (a) of this section. Adverse effects can be minimized by employing the techniques in this paragraph where appropriate and practicable.

Compliance: Adverse effects of dredging as described in this EA have been minimized as described under "Compliance" for paragraph (a2) of this section. The project has been cited and sized to optimize plan performance while minimizing environmental impacts and cost.

(1) Adverse effects from dredging and dredged material disposal and placement can be minimized by controlling the location and dimensions of the activity. Some of the ways to accomplish this include:

(A) locating and confining discharges to minimize smothering of organisms;

Compliance: Discharge has been confined to the area between PAs 14 and 15 and beneficial use areas to minimize impacts to benthic habitat.

(B) locating and designing projects to avoid adverse disruption of water inundation patterns, water circulation, erosion and accretion processes, and other hydrodynamic processes;

Compliance: The project is not anticipated to have adverse effects to water inundation patterns, water circulation, erosion and accretion processes, or other hydrodynamic processes.

(C) using existing or natural channels and basins instead of dredging new channels or basins, and discharging materials in areas that have been previously disturbed or used for disposal or placement of dredged material;

Compliance: Materials are proposed to be discharged in close proximity to areas that have been previously disturbed by placement of dredged materials. Materials are proposed to be discharged in between existing PAs 14 and 15.

(D) limiting the dimensions of channels, basins, and disposal and placement sites to the minimum reasonably required to serve the project purpose, including allowing for reasonable overdredging of channels and basins, and taking into account the need for capacity to accommodate future expansion without causing additional adverse effects;

Compliance: The proposed project has been sized to maximize PA capacity, while minimizing environmental impacts. The placement of this material has avoided and minimized adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas and Gulf beaches by placing material in an area that has historically been used for dredged material placement. The project would increase capacity of PAs to accommodate for future maintenance dredging activities.

(E) discharging materials at sites where the substrate is composed of material similar to that being discharged;

Compliance: Material would be discharged at sites of comparable substrate. Material for project construction would be dredged from the Houston Ship Channel from approximately Morgan's Point to south of the Bayport Ship Channel, dredged from the permitted construction of the Bayport facilities, and beneficial re-use of dredged materials from PAs 14 and 15.

(F) locating and designing discharges to minimize the extent of any plume and otherwise control dispersion of material; and

Compliance: Placement has been designed to minimize environmental impacts. Perimeter levees would be constructed initially in order to contain dredged materials that would subsequently be deposited within the levees, thus minimizing and controlling the dispersion of materials. Best Management Practices would be utilized during construction of the levees to minimize dispersion of sediments.

(G) avoiding the impoundment or drainage of critical areas.

Compliance: There would be no impoundment or drainage of critical areas.

(2) Dredging and disposal and placement of material to be dredged shall comply with applicable standards for sediment toxicity. Adverse effects from constituents contained in materials discharged can be minimized by treatment of or limitations on the material itself. Some ways to accomplish this include:

(A) disposal or placement of dredged material in a manner that maintains physicochemical conditions at discharge sites and limits or reduces the potency and availability of pollutants;
(B) limiting the solid, liquid, and gaseous components of material discharged;
(C) adding treatment substances to the discharged material; and (iv) adding chemical flocculants to enhance the deposition of suspended particulates in confined disposal areas,

Compliance: Material to be dredged complies with applicable standards for sediment toxicity. Recent sediment studies within the HSC have found metals above detection limits, but below NOAA Effects Range Low (ERL) levels.

(3) Adverse effects from dredging and dredged material disposal or placement can be minimized through control of the materials discharged. Some ways of accomplishing this include:

(A) use of containment levees and sediment basins designed, constructed, and maintained to resist breaches, erosion, slumping, or leaching;

(B) use of lined containment areas to reduce leaching where leaching of chemical constituents from the material is expected to be a problem;

(C) capping in-place contaminated material or, selectively discharging the most contaminated material first and then capping it with the remaining material;

(D) properly containing discharged material and maintaining discharge sites to prevent

point and nonpoint pollution; and

(E) timing the discharge to minimize adverse effects from unusually high water flows, wind, wave, and tidal actions.

Compliance: Dredged material will be placed in a confined placement area with properly maintained levees.

(4) Adverse effects from dredging and dredged material disposal or placement can be minimized by controlling the manner in which material is dispersed. Some ways of accomplishing this include:

(A) where environmentally desirable, distributing the material in a thin layer;

(B) orienting material to minimize undesirable obstruction of the water current or circulation patterns;

(C) using silt screens or other appropriate methods to confine suspended particulates or turbidity to a small area where settling or removal can occur;

(D) using currents and circulation patterns to mix, disperse, dilute, or otherwise control the discharge;

(E) minimizing turbidity by using a diffuser system or releasing material near the bottom;

(F) selecting sites or managing discharges to confine and minimize the release of suspended particulates and turbidity and maintain light penetration for organisms; and

(G) setting limits on the amount of material to be discharged per unit of time or volume of receiving waters.

Compliance: Once perimeter levees are constructed and stabilized, dredged material dispersal would be confined within the levees. Effluent from the proposed PA would be controlled via drop outlet structures to minimize the introduction of Total Suspended Solids (TSS) into the receiving water.

(5) Adverse effects from dredging and dredged material disposal or placement operations can be minimized by adopting technology to the needs of each site. Some ways of accomplishing this include:

(A) using appropriate equipment, machinery, and operating techniques for access to sites and transport of material, including those designed to reduce damage to critical areas;

(B) having personnel on site adequately trained in avoidance and minimization techniques and requirements; and

(C) designing temporary and permanent access roads and channel spanning structures using culverts, open channels, and diversions that will pass both low and high water flows, accommodate fluctuating water levels, and maintain circulation and faunal movement.

Compliance: The most current technology for construction of the proposed PA expansion area would be utilized in order to minimize adverse impacts. Materials would be pumped by pipeline and hydraulic pipeline dredge to the PA 14/15 Expansion area. Equipment to be utilized in the construction has not yet been determined. Personnel familiar with the equipment that would be utilized in addition to PA specific construction techniques would be utilized to ensure avoidance and minimization is adhered to.

(6) Adverse effects on plant and animal populations from dredging and dredged material disposal or placement can be minimized by:

(A) avoiding changes in water current and circulation patterns that would interfere with the movement of animals;

Compliance: Changes to water current and circulation patterns would be localized, minimal, and would not adversely interfere with the movement of animals.

(B) selecting sites or managing discharges to prevent or avoid creating habitat conducive to the development of undesirable predators or species that have a competitive edge ecologically over indigenous plants or animals;

Compliance: The project would create areas of disturbance that may be conducive to the establishment of undesirable species. *Tamarix* species are currently found within the existing project footprint and surrounding areas. *Tamarix* would likely reestablish in areas of disturbance after construction activities have occurred. Disturbed areas are also conducive for the establishment of other invasive species such as Chinese tallow and Brazilian pepper.

(C) avoiding sites having unique habitat or other values including habitat of endangered species;

Compliance: Five Federal endangered or threatened species are likely to be found within the project area including brown pelican, piping plover, green sea turtle, loggerhead sea turtle, and Kemp's ridley sea turtle. The proposed project may affect, but is not likely to adversely affect these five species.

(D) using planning and construction practices to institute habitat development and restoration to produce a new or modified environmental state of higher ecological value by displacement of some or all of the existing environmental characteristics;

Compliance: Up to 1,121 acres of beneficial use area would be created east of PA 14 and at least 88 acres of saline marsh would be created behind Bolivar Peninsula. Both these areas would help to restore important estuarine habitat to the Galveston Bay system. Impacts resulting from construction of the proposed project would be fully mitigated by creation of saline marsh behind Bolivar Peninsula. Habitat Evaluation Procedure (HEP) Analysis has been conducted to assess environmental impacts associated with construction of the proposed project and to plan for appropriate mitigation.

(E) using techniques that have been demonstrated to be effective in circumstances similar to those under consideration whenever possible and, when proposed development and restoration techniques have not yet advanced to the pilot demonstration stage, initiating their use on a small scale to allow corrective action if unanticipated adverse effects occur;

Compliance: Large scale saline marsh restoration has been demonstrated to be successful in previous attempts within Galveston Bay. Techniques for marsh construction that have proved successful in previous projects would be utilized for beneficial use areas and mitigation areas.

(F) timing dredging and dredged material disposal or placement activities to avoid spawning or migration seasons and other biologically critical time periods; and

Compliance: Use of a hydraulic pipeline dredge should avoid impacts to foraging sea turtles. If construction occurs during a biologically critical time period, additional resource agency coordination of construction would be undertaken, especially to ensure compliance with the Endangered Species Act.

(G) avoiding the destruction of remnant natural sites within areas already affected by development.

Compliance: The project is in an area already disturbed by existing development of PAs.

(7) Adverse effects on human use potential from dredging and dredged material disposal or placement can be minimized by:

(A) selecting sites and following procedures to prevent or minimize any potential damage to the aesthetically pleasing features of the site, particularly with respect to water quality;

Compliance: The visual result of the project would be to mimic the construction of the existing PAs located adjacent to the project area. Therefore, aesthetic impacts would be minimal. Impacts to water quality would be temporary and minimal in nature.

(B) selecting sites which are not valuable as natural aquatic areas;

Compliance: The construction of a beneficial uses area to the east of PA 14 and saline marsh mitigation area behind Bolivar Peninsula would more than compensate for the loss of aquatic natural areas resulting from project impacts.

(C) timing dredging and dredged material disposal or placement activities to avoid the seasons or periods when human recreational activity associated with the site is most important; and

Compliance: Recreational activities associated with the site are not unique to the surrounding area. Ample opportunity would exist to recreate in similar areas within Galveston Bay during dredging and dredged material placement activities.

(D) selecting sites that will not increase incompatible human activity or require frequent dredge or fill maintenance activity in remote fish and wildlife areas.

Compliance: The project would not increase incompatible human activity or require frequent dredge or fill maintenance activities in remote fish and wildlife areas.

(8) Adverse effects from new channels and basins can be minimized by locating them at sites:

(A) that ensure adequate flushing and avoid stagnant pockets; or

(B) that will create the fewest practicable adverse effects on CNRAs from additional infrastructure such as roads, bridges, causeways, piers, docks, wharves, transmission line crossings, and ancillary channels reasonably likely to be constructed as a result of the project; or

(C) with the least practicable risk that increased vessel traffic could result in navigation hazards, spills, or other forms of contamination which could adversely affect CNRAs;

(D) provided that, for any dredging of new channels or basins subject to the requirements of §501.15 of this title (relating to Policy for Major Actions), data and information on minimization of secondary adverse effects need not be produced or evaluated to comply with this subparagraph if such data and information is produced and evaluated in compliance with §501.15(b)(1) of this title (relating to Policy for Major Actions).

Compliance: No new channels or basins would be constructed as part of the proposed project.

(c) Disposal or placement of dredged material in existing contained dredge disposal sites identified and actively used as described in an environmental assessment or environmental impact statement issued prior to the effective date of this chapter shall be presumed to comply with the requirements of paragraph (1) of this subsection unless modified in design, size, use, or function.

Compliance: PAs 14 and 15 are proposed to be expanded and would comply with requirements of paragraph (a) of this section.

(d) Dredged material from dredging projects in commercially navigable waterways is a potentially reusable resource and must be used beneficially in accordance with this policy.

Compliance: The proposed project would utilize dredged materials from dredging projects in commercially navigable waterways as a reusable resource for construction of beneficial use areas.

(1) If the costs of the beneficial use of dredged material are reasonably comparable to the costs of disposal in a non-beneficial manner, the material shall be used beneficially.

(2) If the costs of the beneficial use of dredged material are significantly greater than the costs of disposal in a non-beneficial manner, the material shall be used beneficially unless it is demonstrated that the costs of using the material beneficially are not reasonably proportionate to the costs of the project and benefits that will result. Factors that shall be considered in determining whether the costs of the beneficial use are not reasonably proportionate to the benefits include, but are not limited to:

(A) environmental benefits, recreational benefits, flood or storm protection benefits, erosion prevention benefits, and economic development benefits;

(B) the proximity of the beneficial use site to the dredge site; and

(C) the quantity and quality of the dredged material and its suitability for beneficial use.

Compliance: Beneficial use of dredged materials is proposed for the project.

(3) Examples of the beneficial use of dredged material include, but are not limited to:

(A) projects designed to reduce or minimize erosion or provide shoreline protection;

(B) projects designed to create or enhance public beaches or recreational areas;

(C) projects designed to benefit the sediment budget or littoral system;

(D) projects designed to improve or maintain terrestrial or aquatic wildlife habitat;

(E) projects designed to create new terrestrial or aquatic wildlife habitat, including the construction of marshlands, coastal wetlands, or other critical areas;

(F) projects designed and demonstrated to benefit benthic communities or aquatic vegetation;

(G) projects designed to create wildlife management areas, parks, airports, or other public facilities;

(H) projects designed to cap landfills or other waste disposal areas;

(I) projects designed to fill private property or upgrade agricultural land, if cost-effective public beneficial uses are not available; and

(J) projects designed to remediate past adverse impacts on the coastal zone.

Compliance: The beneficial use of dredged material would be used for the construction of saline marshland.

(e) If dredged material cannot be used beneficially as provided in subsection (d) (2) of this section, to avoid and otherwise minimize adverse effects as required in paragraph (a) of this subsection, preference will be given to the greatest extent practicable to disposal in:

(1) contained upland sites;

(2) other contained sites; and

(3) open water areas of relatively low productivity or low biological value.

Compliance: The expansion of PAs 14 and 15 would be fully confined.

(f) For new sites, dredged materials shall not be disposed of or placed directly on the boundaries of submerged lands or at such location so as to slump or migrate across the boundaries of submerged lands in the absence of an agreement between the affected public owner and the adjoining private owner or owners that defines the location of the boundary or boundaries affected by the deposition of the dredged material.

Compliance: This project would be constructed under Federal navigation servitude.

Coastal Coordination Council

P.O. Box 12873 ♦ Austin, Texas 78711-2873 ♦ (800) 998-4GLO ♦ FAX (512) 475-0680

January 12, 2010

Mr. Richard Medina
Chief, Planning & Environmental Branch
US Army Corps of Engineers
PO Box 1229
Galveston Texas 77553-1229

Re: Expansion of Placement Areas 14 and 15, Houston Ship Channel Project, Chambers County, Texas.
CMP #: 10-0031-F2

Dear Mr. Medina:

Pursuant to Section 506.20 of 31 TAC of the Coastal Coordination Act, the project referenced above has been reviewed for consistency with the Texas Coastal Management Program (CMP).

It has been determined that there are no significant unresolved consistency issues with respect to the project. Therefore, this project is consistent with the CMP goals and policies.

Sincerely,

Tammy S. Brooks
Consistency Review Coordinator
Texas General Land Office

cc: Steve Ireland, COE

Chairman

Jerry Patterson
Texas Land Commissioner

♦

Members

Karen Hixon
Parks & Wildlife Commission of Texas

Jose Dodier
Texas State Soil & Water Conservation Board

Edward G. Vaughan
Texas Water Development Board

Ned Holmes
Texas Transportation Commission

Elizabeth Jones
Railroad Commission of Texas

H. S. Buddy Garcia
Texas Commission on Environmental Quality

Robert R. Stickney
Sea Grant College Program

Robert "Bob" Jones
Coastal Resident Representative

Jerry Mohn
Coastal Business Representative

George Deshotels
Coastal Government Representative

Bob McCan
Agriculture Representative

♦

Tammy Brooks
Council Secretary

Jesse Solis, Jr.
Permit Service Center
Corpus Christi
1-866-894-3578

Permit Service Center
Galveston
1-866-894-7664

Appendix C

Clean Water Act 404(b)(1) Analysis and Section 401 Consultation

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

REPLY TO
ATTENTION OF

November 30, 2009

Environmental Section

Mr. Mark Fisher
Water Quality Assessment Section
Texas Commission on Environmental Quality
TCEQ-MC150
P.O. Box 13087
Austin, TX 78711-3087

Dear Mr. Fisher:

The Galveston District is developing plans to expand Houston Ship Channel Placement Areas 14 and 15 in Chambers County, Texas. A major portion of the work would be performed under the American Recovery and Reinvestment Act of 2009. The proposed work is described in detail in Section 1.3 of the enclosed Draft Environmental Assessment (EA).

Under the Clean Water Act (CWA) of 1977, a State Water Quality Certificate for the discharge activity is required prior to construction. A Joint Public Notice for the proposed project is enclosed. A CWA Section 404(b)(1) evaluation is included in Appendix E of the Draft EA. Our analysis of relevant data determined that Texas Surface Water Quality Standards will not be exceeded by the proposed action.

The District is requesting that the Texas Commission on Environmental Quality review the enclosed information and take appropriate action regarding the issuance of a State Water Quality Certificate for the proposed action. If you or your staff have any questions regarding this project, please contact Steve Ireland at (409) 766-3131.

Sincerely,

Richard Medina
Chief, Planning & Environmental Branch

Enclosures

SECTION 404(b)(1)
ENVIRONMENTAL EVALUATION

I. Project Description

A. Location. The proposed project is located in Upper Galveston Bay between existing Placement Areas (PA) 14 and 15, northeast of Red Bluff Point, in Chambers County, Texas.

B. General Description. The applicant, United States Army Corps of Engineers (USACE), proposes a 169 acre expansion of previously authorized PAs, construction of up to 1,121 acres of beneficial use area, and construction of at least 88 acres of saline marsh mitigation area in conjunction with the Houston Galveston Navigation Channel Project.

C. Authority and Purpose. The Houston Galveston Navigation Channels, Texas (HGNC) Project, which includes PAs 14 and 15, was authorized by Congress in the Water Resources Development Act of 1996 (Public Law 104-303). The purpose of the project includes allowing maintenance dredging activities to continue so that the HSC is maintained at its authorized depth, to increase available capacity to receive dredged material from the HSC, to allow the HSC to accommodate the anticipated mix and volume of future commercial vessel traffic, and to maintain navigation safety by providing a safe draft depth in the channel.

D. General Description of Dredged or Fill Material.

1. General Characteristics. According to the *Soil Survey of Chambers County, Texas* (1976), the proposed project is located within the Ijam soil mapping unit. Ijam soils are formed in alkaline, saline, clayey, marine, and alluvial sediment that was dredged or pumped from the floor of rivers, bays, and canals or was removed from the land surface during construction of canals or waterways. These soils are in areas where elevation ranges from sea level to 8 feet above sea level and slopes are plane to concave. Ijam soils are very poorly drained, permeability is very slow, and available water capacity is moderate. Ijam soils are considered to be hydric in Chambers County.

2. Quantity and Source of Material. Materials for this construction will be mined from the Houston Ship Channel from approximate stations 00+000 to 38+000 (Morgan's Point to the northern tip of Mid-Bay), dredged from the permitted construction of the Bayport facilities, and beneficial re-use of dredged materials from PAs 14 and 15. Areas between the HSC stations may be strategically mined up to -80 feet MLT to provide the most efficient use of construction grade materials.

E. Description of the Proposed Discharge Site(s).

1. Location and Size. The proposed project includes the construction of 169 acres of PA, up to 1,121 acres of beneficial use area, and at least 88 acres of saline marsh mitigation area. The proposed project (PA expansion and beneficial use site) is located approximately 2.75 miles northeast of Red Bluff Point in Upper Galveston Bay. The proposed mitigation is located immediately north of the western end of Bolivar Peninsula.

2. Type of Discharge and Fill Site. The proposed project will affect approximately 169 acres of waters of the U.S. (Galveston Bay) including approximately 29 acres of saline marsh wetlands, 113 acres of sub-tidal shallow bay bottom, and 27 acres of intertidal sand flats. These discharges represent the minimum necessary to construct the proposed project. To the maximum extent possible, impacts to potential jurisdictional waters of the U.S. including wetlands have been minimized.

3. Timing and Duration of Discharge. Construction of the containment levees for the 169-acres of upland and up to 1,121 acres of beneficial use capacity is expected to begin in March 2010. Levee construction is expected to last approximately one year. The beneficial use marsh creation will be constructed in conjunction with the program for maintenance of the ship channel as necessary over the next 5-20 years.

F. Method of Discharge. Discharge will be accomplished by use of hydraulic dredging equipment, pipelines, and heavy tracked equipment.

II. Factual Determinations

A. Physical Substrate Determinations.

1. Substrate Elevation and Slope. Containment perimeter levees will be constructed to 10 feet. Work material will be deposited between the levees to an elevation no higher than 3 feet below the top of the levee.

2. Sediment Type. Expected sediments would be composed of dredged material and elements typical of the surrounding bay bottom. No deleterious or hazardous materials would be used for the construction of the project.

3. Dredged/Fill Material Movement and Footprint. Dredged materials used for constructing the perimeter levees of the PA will be protected by rip-rap on the channel side to protect the levee from impact due to wave energy generated by commercial vessels in the adjacent HSC. Dredged material deposited into levees of both the PA and the beneficial uses site will be securely maintained by the levees.

4. Physical Effects on Benthos. Benthic communities within the footprint of the PA will be permanently impacted due to inundation of sediments. Benthic communities surrounding the project footprint may be temporarily impacted due to siltation from levee construction. These impacts will be temporary and localized until construction of the perimeter levees is complete. Benthic communities in these areas are expected to fully recover.

5. Actions Taken to Minimize Impact. Dredge and fill activities of undisturbed areas will be limited to the minimum necessary to meet project objectives.

B. Water Circulation, Fluctuation, and Salinity Determinations.

1. Water Quality. The proposed project is anticipated to generate short-term and site-specific increases in suspended sediments and turbidity. Best Management Practices (BMPs) and erosion control features would be installed, monitored and maintained as needed. Disturbed areas would be vegetated as soon as practicable to stabilize exposed earthen material particularly on the perimeter levees. On-site measures will be incorporated, at the discretion of the project engineer, to monitor and maintain water quality standards during construction. No significant degradation of water quality would be expected following implementation of these measures.

   a. Salinity. The proposed construction activities should have no measurable effect on existing salinity.

   b. Water Chemistry. The proposed construction activities should have no measurable effect on existing water chemistry. Water quality standards should not be exceeded during construction.

   c. Clarity. Some short-term increases in water turbidity and associated decreases in water clarity would be expected during construction activities. However, suspended sediments should settle from the water column as construction activities are completed.

d. Color. A slight change in color may occur as waters are agitated during construction activities. However, no long-term change in water color is anticipated as a result of the proposed project.

e. Odor. Some odors may be released during construction activities as organic matter within disturbed soils is exposed. This condition would be temporary and would not be expected to be severe. No long-term odor issues are anticipated.

f. Taste. There is no known use of the surface waters in the immediate project area as a supply of potable water. Therefore, the proposed project would not have the potential to affect the taste of potable water supplies.

g. Dissolved Gas Levels. Dissolved gas levels of the waters in the project area are not expected to be affected during or following project construction activities. There may be a temporary and minimal decrease of dissolved oxygen levels within the water column as a result of localized increase in suspended sediments and turbidity.

h. Nutrients. Nutrients that may be locked into dredged materials sediments may be released into the water column and temporary elevations in nutrients levels may be seen. These elevations are not anticipated to have an adverse effect to the biota of Galveston Bay.

i. Eutrophication. Construction of the proposed project may result in the minor input of additional primary nutrients into the waters of the project area. However, symptoms of eutrophication would not be expected in the receiving waters.

j. Others as Appropriate. Upper Galveston Bay (Segment 2421_01) has been listed as impaired by the Texas Commission on Environmental Quality (TCEQ) due to bacteria for oyster waters, dioxin in edible tissue, and polychlorinated biphenyls (PCB's) in edible tissue. The construction of the proposed project is not anticipated to exacerbate bacterial, dioxin, or PCB levels within Upper Galveston Bay. Any portable sewage facilities (Port-o-Let) used during construction will be contained and in a location where any spill from this facility would not be directed toward the bay.

2. Current Patterns and Circulation.

a. Current Patterns and Flow. Galveston Bay is an estuarine system that exhibits diurnal tides. Current flow patterns within the project footprint will be permanently altered but overall effects to the Galveston Bay system are expected to be insignificant.

b. Velocity. Flow velocities are dependent upon the intensity of the tide which varies daily. Flow velocities will be permanently impacted within the project footprint but impacts to the Galveston Bay system will be insignificant.

c. Stratification. Stratification naturally occurs in estuarine systems due to differences in temperature and salinity. Impacts to stratification are not expected to occur as a result of the proposed project.

d. Hydrologic Regime. Galveston Bay is an approximately 600 square mile estuary in Chambers, Harris, and Galveston Counties, Texas. Galveston Bay is located within three United States Geological Survey (USGC) Hydrographic Unit Codes (HUC) including West Galveston Bay (HUC #12040204), North Galveston Bay (HUC #12040203), and East Galveston Bay (HUC #12040202).

3. Normal Water Level Fluctuations. Water level fluctuations on-site are largely controlled by tidal

forces. Galveston Bay exhibits diurnal tides with two high and two low tides each day. Normal water levels in water bodies outside the project boundary would not be affected by fill activities expected to occur on-site. Bathymetry within the project area is relatively shallow, extending no lower than 7 feet below Mean Sea Level (MSL). Elevations within the proposed project range from -7 MSL to +9 MLT.

4. Salinity Gradients. Salinity gradients naturally occur in estuarine systems due to differences in salinity from the mixture of saline water from the Gulf of Mexico and fresh water from land based rivers. Impacts to stratification are not expected to occur as a result of the proposed project.

5. Actions Taken to Minimize Impacts. The applicant has designed the project to avoid and minimize impacts to waters of the U.S. to the greatest extent practicable, while still achieving a feasible project that meets the purpose and need.

C. Suspended Particulate/Turbidity Determinations.

1. Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Placement Site. Erosion control devices and other BMPs would be installed and maintained as required by the SWP3. Additionally, disturbed areas would be vegetated as soon as practicable to stabilize exposed earthen material particularly on perimeter levees. A temporary increase in suspended particulates and turbidity levels would be expected as construction activities occur. Suspended particulates and turbidity are expected to normalize after construction is complete.

2. Effects on Chemical and Physical Properties of the Water Column.

   a. Light Penetration. Aside from temporary short-term periods of increased turbidity during construction, light penetration in waters within the project area should be equivalent to waters outside the project site.

   b. Dissolved Oxygen. No adverse impact to dissolved oxygen levels of area waters is expected following construction of the proposed project. There may be a temporary and minimal decrease of dissolved oxygen levels within the water column as a result of localized increase in suspended sediments and turbidity.

   c. Toxic Metals and Organics. Although some temporary suspended particulate matter is anticipated in the water column in the immediate areas of construction, toxic metals and organics are not expected to affect waters of the project area.

   d. Pathogens. Any pathogenic organisms associated with the suspended particulate matter would be expected to settle out with the particulate material. Construction of the proposed project would not introduce additional pathogens into area waters.

   e. Aesthetics. PA construction associated with previous activities near the site may have slightly reduced the aesthetic attributes of the area. The construction of the proposed project is not anticipated to result in a negative loss of aesthetic values within the project vicinity, due to prior aesthetics impacts in the same location.

   f. Others as Appropriate. Not applicable.

3. Effects on Biota.

   a. Primary Production and Photosynthesis. Primary productivity and photosynthesis within the project limits would be temporarily affected through construction of the proposed project due to suspended particulate matter and turbidity. Impacts to primary production and photosynthesis would return to normal levels following construction of the perimeter levees.

b. Suspension/Filter Feeders. Sessile suspension and/or filter feeders that potentially occur within the project footprint would be expected to be eliminated during construction of the proposed project. Motile suspension and/or filter feeders that potentially occur within the project footprint are able to move to more suitable areas and would be expected to be displaced and/or eliminated during construction of the proposed project. Temporary impacts to both sessile and motile suspension and/or filter feeders outside the project footprint are anticipated to occur due to suspended particulates and turbidity in the water column.

c. Sight Feeders. Sight feeders are likely present in the project footprint. Sight feeders occurring within the project footprint would be expected to be displaced and/or eliminated during construction of the proposed project. Impacts to sight feeders outside the project footprint would be localized and minimal due to increased turbidity associated with construction.

4. Actions taken to minimize impacts. Best management practices will be implemented as part of project construction activities to minimize potential impacts from suspended particulates and turbidity. These practices would be maintained as construction continues on the project site.

D. Contaminant Determinations. Dredged materials obtained from off-site sources for construction purposes is expected to be clean (i.e., uncontaminated) and be representative of the soils indigenous to the project site.

E. Aquatic Ecosystem and Organism Determinations.

1. Plankton Effects. Construction of the proposed project would be expected to permanently affect plankton populations within the project footprint. Construction activities are also expected to temporarily affect plankton populations in the general project area due to suspended particulates and turbidity, although these impacts will be localized and temporary in nature; plankton surrounding the project area is anticipated to fully recover after completion of the perimeter levee construction.

2. Benthos Effects. Construction of the proposed project would be expected to permanently affect benthos populations within the project footprint. Construction activities are also expected to temporarily affect benthos populations in the general project area due to suspended particulates and turbidity, although these impacts will be localized and temporary in nature; benthos surrounding the project area is anticipated to fully recover after completion of the perimeter levee construction.

3. Nekton Effects. Construction of the proposed project would be expected temporarily affect fish populations surrounding the project footprint; however, it is not expected that fish populations in the general project area would be negatively impacted.

4. Aquatic Food Web Effects. Impacts to the aquatic food web from project construction activities are expected to be negligible. The project will result in a net gain of saline marsh habitat, thereby providing benefiting the aquatic food web. The aquatic food web present within Galveston Bay would not be permanently affected by construction of the proposed project.

5. Special Aquatic Sites Effects.

a. Sanctuaries and Refuges. The project site is located within Galveston Bay National Estuary Program (GBNEP) which is one of 28 National Estuary Programs (NEP) in the country. As a non-regulatory program administered by the TCEQ, GBEP is charged with implementing *The Galveston Bay Plan* — a Comprehensive Conservation Management Plan for Galveston Bay.

b. Wetlands. Waters of the United States, including wetlands, have been determined to be present within the project footprint. Unavoidable impacts to some waters of the United States, including wetlands, are anticipated from construction of the proposed project. Any wetlands located in the interior of active PAs are not generally considered jurisdictional as these wetlands may be destroyed upon future depositional activities within the PAs.

c. Mud Flats. No existing mud flats are present within the project limits, although there are sand flats located within the project footprint. Unavoidable impacts to sand flats are anticipated from construction of the proposed project.

d. Vegetated Shallows. No existing vegetated shallows are present on the project tract.

e. Riffle and Pool Complexes. Not Applicable.

6. Threatened and Endangered Species. Based on a Biological Assessment (BA) conducted in October of 2009, five endangered species are likely to occur within the project site including the brown pelican, piping plover, green sea turtle, Kemp's ridley sea turtle, and loggerhead sea turtle. Although it is likely that these species may be found on the site, the proposed project may affect, but is not likely to adversely affect, these species. Coordination with the USFWS was conducted in conjunction with this assessment.

7. Other Wildlife. Wildlife present within the proposed project includes small mammals and various birds such as seabirds, wading birds water fowl, migrating raptors, and neo-tropical passerines. In Galveston Bay, various estuarine fish such as Gulf menhaden, spotted sea trout, red drum, flounder, and catfish could be expected to be found. Similar habitats to those being affected by the proposed project area are readily available for these species nearby. The proposed project is not anticipated to have a regional adverse effect to these species and the beneficial use and mitigation efforts are anticipated to, over time, allow for expanded habitat to form within Galveston Bay, enabling wildlife communities to reestablish in the project vicinity.

8. Actions Taken to Minimize Impacts. The proposed project has been planned to minimize impacts to potential jurisdictional waters of the United States, including wetlands to the greatest extent practicable. In order to accomplish the project, impacts to waters of the United States, including wetlands are unavoidable.

F. Proposed Placement Site Determinations

1. Mixing Zone Determination. Not applicable.

2. Determination of Compliance with Applicable Water Quality Standards. Not applicable.

3. Potential Effects on Human Use Characteristics.

a. Municipal and Private Water Supply. No existing municipal or private water supply systems are expected to be adversely affected by construction of the proposed project.

b. Recreational and Commercial Fisheries. Impacts to recreational and commercial fisheries are anticipated to be negligible due to the small size of the direct impacts in relation to the entire Galveston Bay system in addition to the minor and temporary nature of the secondary impacts. The creation of the beneficial use component of the project is anticipated to create saltmarsh habitats, which would provide beneficial effects to recreational and commercial fisheries within the Bay. These habitats provide nursing and refugia habitat for these species, as well as, other functions and values.

c. Water-Related Recreation. Water-related recreation is expected to be minimally affected by construction of the proposed project. Galveston Bay is used for recreational fishing, boating, and swimming. Upper Galveston Bay has multiple recreation boat landings and residential docks. Watercraft will no longer be able to access the area between PA 14 and 15 after construction of the project.

d. Aesthetics. PA construction associated with previous activities near the site may have slightly reduced the aesthetic attributes of the area. The construction of the proposed project is not anticipated to result in a negative loss of aesthetic values within the project vicinity, due to prior aesthetics impacts in the same location.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. The project site is located within Galveston Bay Estuary Program (GBEP) which is one of 28 National Estuary Programs (NEP) in the country. As a non-regulatory program administered by the TCEQ, GBEP is charged with implementing *The Galveston Bay Plan* — a Comprehensive Conservation Management Plan for Galveston Bay.

G. Determination of Cumulative Effects on the Aquatic Ecosystem.

Cumulative impacts are the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. The combined addition and interaction of other projects and actions relative to the proposed project could potentially result in local and regional impacts to the environment outside of the project limits. The cumulative impacts of an action would be the effects of that action on a resource, ecosystem, or human community combined with other activities affecting that resource, regardless of what entity is responsible for implementing the action.

The identification of the study area within which the effects of the proposed project will be felt allows an assessment of cumulative impacts to be focused where potential impacts have occurred or are likely to occur. The project study area identified is all of Galveston Bay in addition to all areas all areas within a 10-mile radius circle having a center-point at the existing inlet between Dredged Material Placement Area (PA) 14 and PA 15. Potential affected resources include water quality, vegetation, wildlife/aquatic habitats, aquatic biota, and endangered species.

Galveston Bay, as previously stated, is located in Chambers, Harris, and Galveston Counties. The watershed covers about 600 square miles. Drainage areas contributing freshwater to the Galveston Bay system include the Trinity and San Jacinto River basins, the Trinity-San Jacinto coastal basin, and parts of the Neches-Trinity and San Jacinto-Brazos coastal basins. The Bay has three openings to the Gulf of Mexico; Bolivar Roads, San Luis Pass, and Rollover Pass which allow for circulation of Gulf water into the Bay. Approximately 4.5 million people live in the five counties that surround Galveston Bay.

The eastern portion of the bay remains largely rural while the western portion is occupied by the urban metropolis of Houston and surrounding cities. Development pressures continue to expand outward from the center of the Houston metropolitan area. Future land uses around the perimeter of Galveston Bay are anticipated to continue to be developed in a similar fashion.

The proposed project would be located in the Upper Galveston Bay where land development activities are not occurring, due to the absence of buildable land. Other Dredged Material Placement Areas are located along the Houston Ship Channel in close vicinity to the site of the proposed project. Due to the relative remoteness of the project site, Galveston Bay provides some "buffering" of the project to the more concentrated human environment on the mainland.

Upper Galveston Bay (Segment 2421_01) has been listed as impaired by the TCEQ due to bacteria for oyster waters, dioxin in edible tissue, and polychlorinated biphenyls (PCB's) in edible tissue. The construction of the proposed project is not anticipated to exacerbate bacterial, dioxin, or PCB levels within Upper Galveston Bay. The project improvements, including construction of beneficial use areas and mitigation areas will help to "polish" water quality and trap pollutants, potentially improving water quality.

Stormwater runoff and overland sheet flow discharged into Galveston Bay can carry a litany of various types of pollutants and sediment loads. This runoff may contain nutrients, oils, greases, pesticides and herbicides, bacterial inputs, as well as, other non-point source (grass clippings and garbage from storm drains) and point source pollutants (wastewater treatment plants, industrial activities, etc.). Sediment loads into the watershed are as a result ground disturbances that are not adequately controlled through BMPs performed during construction and general unauthorized dumping into the storm sewer system. Future land use changes would have the potential to result in additional stormwater-related pollutant inputs into Galveston Bay if inadequately treated prior to discharge. Harris County has implemented a guidance document for new residential and commercial developments, which identify various BMPs to control pollutants from entering into the watershed. It is anticipated that this guidance would be implemented in the long-term.

The project area is comprised of shallow bay, saline marsh, and sand flat areas. The majority of water quality inputs to the project area are from outside sources. It is expected that the overall effect of the proposed project to water quality of Galveston Bay is negligible.

Previous developments in the vicinity of the project tract have resulted in direct modifications of the surrounding environment. PAs 14 and 15 were previously constructed, raising the topography of the site and impacting previously existing habitats and associated biota. The proposed project is anticipated to have temporary effects to wildlife populations in the area during construction. These temporary effects would result in a displacement of these creatures into surrounding areas. Some species of aquatic wildlife may be permanently affected as outlined previously. The construction of the proposed project is anticipated to have a net environmental benefit to wildlife species, with the construction of beneficial use areas and mitigation areas leading to a diverse community of wildlife.

Based on the rate of population growth in the region and the increasing demand for residential housing, it is reasonable to conclude that residential and commercial development and transportation improvements would continue in the project study area, and would be accompanied by continued removal of natural vegetative communities, alteration of surface topography, and concentration of storm water flows through drainage improvements. The proposed project will not influence growth patterns or populations within the project study area.

The remainder of the watershed will likely continue to be subjected to small-scale and possibly large-scale development. Collectively, individual development, roadway, and drainage projects will further reduce the extent of forest community and natural drainage features, along with their associated upland and wetland habitats. Surface topography will be altered to accommodate the development, and storm water flows will be directed into improved or constructed drainage channels. Over time, it is also likely that existing areas of low-density residential development will be replaced with higher-density developments. Properties along major thoroughfares and at the intersections of major thoroughfares/highways would be expected to support commercial enterprises. The cumulative effect would be a conversion of the majority of the watershed from natural vegetation and habitat to a generally developed condition supporting maintained lawns, landscaped green space, and impervious cover.

Although development in the region would result in the net conversion of natural areas to structures, impervious cover, and maintained open space, the cumulative impact may not be completely adverse. Mitigation efforts to compensate for the loss of natural resources could be accomplished within the watershed to protect natural features. There may also be opportunities to restore or enhance degraded natural areas, or possibly to create certain habitat types that previously were not present in a particular area, thereby making available a diversity of habitat types for terrestrial and aquatic wildlife.

H. Determination of Secondary Effects on the Aquatic Ecosystem.

Secondary effects of the proposed development are those effects that are expected to be caused by the proposed project but are later in time or are removed in distance. The proposed project would not result in a change in land use. The proposed project improvements are anticipated to have a beneficial secondary effect to Galveston Bay by potentially improving water quality, due to the net increase in wetlands to be constructed as beneficial uses and mitigation areas. No adverse secondary effects are anticipated from the proposed project.

Implementation of BMPs during construction would minimize the potential for sediments and eroded material to enter into area waters or permanently degrade water quality. Positive erosion control measures subject to design criteria and requirements of local governing agencies, would be installed and maintained, and disturbed areas would be revegetated as soon as practicable to stabilize exposed soils. Development of the proposed project would negatively impact aquatic resources and vegetation. However, these effects would be mitigated by the proposed project improvements.

Carolyn Murphy — Date 1/25/2010

Ms. Carolyn Murphy
Chief–Environmental Section
U.S. Army Corps of Engineers, Galveston District

Bryan W. Shaw, Ph.D., *Chairman*
Buddy Garcia, *Commissioner*
Carlos Rubinstein, *Commissioner*
Mark R. Vickery, P.G., *Executive Director*

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

December 17, 2009

Mr. Steve Ireland
U.S. Army Corps of Engineers
Galveston District CESWG-PE-RE
P.O. Box 1229
Galveston, Texas 77553-1229

Re: USACE Public Notice Number HGNC-09-01

Dear Mr. Ireland:

As described in the Joint Public Notice, dated November 30, 2009, the Galveston District of the U.S. Army Corps of Engineers (Corps), proposes to expand Placement Areas (PA) 14 and 15 along the Houston Ship Channel (HSC) to increase dredged material placement capacity and to reduce future maintenance costs associated with the HSC. The project is located in Chambers County, Texas, about 4.5 miles southeast of the City of La Porte, Texas. The site is located within upper Galveston Bay, east of the HSC, and at the southern end of Atkinson Island.

The proposed work would involve the construction of an approximate 169-acre upland placement area between PAs 14 and 15 and the construction of up to three marsh placement area, or Beneficial Use (BU) sites. The BU sites would be constructed east of PAs 14 and 15 and would include a 305-acre site, a 392-acre site, and a 424-acre site. A mitigation marsh site of at least 75 acres would be constructed adjacent to the Bolivar Marsh Site in lower Galveston Bay near Bolivar Peninsula to provide compensation for the conversion of estuarine habit to uplands as a result of the construction of the proposed upland PA expansion (169-acre).

A Draft Environmental Assessment (Draft EA dated November 2009) was prepared for this project and provided to the Texas Commission on Environmental Quality (TCEQ) for review. The draft EA states that the material for constructing the containment levees for the PA expansion and the BU sites would be obtained by mining (dredging) clay material from the HSC between Morgan's Point and the Bayport Ship Channel (BSC). In addition, material may be obtained from the advanced maintenance of the BSC flare and the planned dredging of berths at the Bayport Terminal. The initial construction of the levees would begin in 2010 with expected completion a year later. It is expected that the first placement of dredged material into the new PA and BU sites would occur during the next dredging cycle after construction.

In addition to the information contained in the public notice, the following information is needed for review of the proposed project. Responses to this letter may raise other questions that will need to be addressed before a water quality certification determination can be made.

1. The draft EA stated that effluent from the proposed PA would be controlled via drop outlet structures to minimize the introduction of Total Suspended Solids (TSS) into the receiving water. The TCEQ requires that effluent from an upland contained disposal area to not exceed a TSS concentration of 300 milligrams per liter (mg/l). Please verify that this requirement will be part of the project.

2. The draft EA stated that the material for constructing the containment levees for the PA expansion and the BU sites would be obtained by mining (dredging) clay material from the HSC between Morgan's Point and the BSC. Sediment samples were taken in October 2009 from this area and will be available in December 2009 and incorporated into the final EA. Please submit a summary of results and discussion of the data to the TCEQ prior to the final EA.

3. Upper Galveston Bay, Segment 2421, is listed as impaired by the TCEQ for bacteria in oyster waters, dioxin in edible tissue, and polychlorinated biphenyls (PCBs) in edible tissue. The draft EA indicated that the construction of the proposed project is not anticipated to exacerbate bacterial, dioxin, and PCB levels within Galveston Bay. Although no contaminated sediment is expected in the construction of the levees, it is conceivable that contaminated dredged material from the HSC could be placed within the proposed BU sites in the future. The TCEQ recommends that dredged material destined for the proposed BU sites be screened for dioxin and PCB. Screening levels for dioxin being developed for the San Jacinto Waste Pit Superfund site should be considered to determine if dredged material is suitable for the proposed BU sites.

The TCEQ looks forward to receiving and evaluating other agency or public comments. Please provide any agency comments, public comments, as well as the applicant's comments, to Mr. John Trevino of the Water Quality Division MC-150, P.O. Box 13087, Austin, Texas 78711-3087. Mr. Trevino may also be contacted by e-mail at *jtrevino@tceq.state.tx.us*, or by telephone at (512) 239-4600.

Sincerely,

Charles W. Maguire, Director
Water Quality Division
Texas Commission on Environmental Quality

CWM/JT/sp

cc: Mr. Ben Rhame, Secretary, Coastal Coordination Council, P.O. Box 12873, Austin, Texas 78711-2873

From:	Ireland, Steven K SWG
To:	"jtrevino@tceq.state.tx.us"
Cc:	"Bulger, Angela G"; "Ryan Robol"; Worthington, James F SWG; Collins, Christopher A CPT SWG; Murphy, Carolyn E SWG
Subject:	HGNC PA 14/15 Expansion
Date:	Thursday, January 07, 2010 3:37:50 PM
Attachments:	October 09 Sediment Sampling Summary.doc Fwd Galveston Bay Foundation comments on HGNC-09-01.pdf

John,

In response to your December 17, 2009 letter regarding the draft Environmental Assessment for the expansion of Houston Ship Channel Placement Areas 14 and 15, we are providing the following information that TCEQ requested in its letter:

1. The following statement will be added to Section 4.2.5 of the final EA: "The new upland confined placement area will be designed and operated with the goal of achieving an effluent total suspended solids (TSS) concentration of not more than 300 milligrams per liter."

2. As you requested, I've attached the sediment sampling summary from the October 2009 sampling effort for your review. This will be incorporated into Section 3.2.5 of the final EA .

3. Dredged maintenance material will be screened in the HSC for dioxin and PCBs before placement into the BU sites to ensure that the material is suitable for marsh creation in the bay. The District will consider screening levels for dioxin being developed for the San Jacinto Waste Pit Superfund Site and/or other state or Federal standards that may be developed.

I've also attached emailed comments from the Galveston Bay Foundation, which were the only comments (other than the TCEQ's) submitted in response to the joint public notice.

Steve Ireland
Environmental Section
USACE, Galveston District

Bryan W. Shaw, Ph.D., *Chairman*
Buddy Garcia, *Commissioner*
Carlos Rubinstein, *Commissioner*
Mark R. Vickery, P.G., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

January 12, 2010

Mr. Steve Ireland
U.S. Army Corps of Engineers
Galveston District CESWG-PE-RE
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Expansion of PA 14 and 15 (HGNC-09-01)

Dear Mr. Ireland:

This letter is in response to the draft Environmental Assessment (EA) dated November 2009, on the proposed expansion of Placement Areas (PA) 14 and 15 along the Houston Ship Channel (HSC) to increase dredged material placement capacity and to reduce future maintenance costs associated with the HSC. The project is located in Chambers County, Texas, about 4.5 miles southeast of the City of La Porte, Texas. The site is located within upper Galveston Bay, east of the HSC, and at the southern end of Atkinson Island.

The Texas Commission on Environmental Quality (TCEQ) has reviewed the EA. Based on our evaluation of the information contained in these documents, the TCEQ certifies that there is reasonable assurance that the project will be conducted in a way that will not violate water quality standards.

The proposed work would involve the construction of an approximate 169-acre upland placement area between PAs 14 and 15 and the construction of up to three marsh placement area, or Beneficial Use (BU) sites. The BU sites would be constructed east of PAs 14 and 15 and would include a 305-acre site, a 392-acre site, and a 424-acre site.

A mitigation marsh site of at least 75 acres would be constructed adjacent to the Bolivar Marsh Site in lower Galveston Bay near Bolivar Peninsula to provide compensation for the conversion of estuarine habit to uplands as a result of the construction of the proposed upland PA expansion (169-acre).

The TCEQ has reviewed this proposed action for consistency with the Texas Coastal Management Program (CMP) goals and policies in accordance with the regulations of the

Coastal Coordination Council and has determined that the proposed action is consistent with the applicable CMP goals and policies.

The formal consistency determination will be provided by a letter from the Coastal Coordination Council under the federal consistency process.

No review of property rights, location of property lines, nor the distinction between public and private ownership has been made, and this certification may not be used in any way with regard to questions of ownership.

If you require additional information or further assistance, please contact John Trevino, Water Quality Assessment Section, Water Quality Division (MC-150), at (512) 239-4600.

Sincerely,

Charles W. Maguire, Director
Water Quality Division
Texas Commission on Environmental Quality

CWM/JT/sp

cc: Mr. Ben Rhame, Secretary, Coastal Coordination Council, P.O. Box 12873, Austin, Texas 78711-2873

Appendix D

Section 106 Consultation

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

August 24, 2009

Environmental Section

James E. Bruseth, Ph.D.
Deputy State Historic Preservation Officer
Division of Archaeology
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dear Dr. Bruseth:

The U.S. Army Corps of Engineers, (USACE) Galveston District, in cooperation with the Port of Houston Authority is developing plans to connect two existing dredged material placement areas (14 and 15) along the Houston Ship Channel (Figures 1 and 2). The project area can be located in Galveston Bay on the U.S.G.S. quadrangle map entitled Morgans Point, Texas, in state tract 126; the approximate coordinates in NAD 84, Zone 15N, are: easting: 311085, northing: 3279470.

State Tract 126 is not considered high probability for containing historic properties as of the most recent update to state tracts dated September 11, 2008. Additionally, the project area has been previously surveyed and subjected to numerous disturbances. The previous survey consisted of a 300-foot wide survey area as documented in the report entitled *Historical Research and Marine Remote-Sensing Survey of Proposed Oyster Reef Pads and Boaters' Cuts, Galveston Bay, Chambers and Galveston Counties, Texas*, prepared by PBS&J, and dated May 2000. No significant anomalies were identified as a result of this effort. The project area has been heavily disturbed by several activities, including: dredging a boater's cut, construction of the existing placement areas, and construction of an oil well and numerous pipelines.

For these reasons, the USACE is requesting your concurrence that no additional surveys are needed for the proposed project. Thank you for your cooperation. If you have any questions or require additional information, please call staff archeologist Jerry Androy at (409) 766-3821.

Sincerely,

Carolyn Murphy

Carolyn Murphy
Chief, Environmental Section

Figure 1. Overview of Project Area.

Figure 2. Location of the Proposed Placement Area.

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

REPLY TO
ATTENTION OF
Environmental Section

December 10, 2009

RECEIVED
DEC 11 2009
TEXAS HISTORICAL COMMISSION

Dr. James E. Bruseth
Director, Antiquities Protection
Deputy State Historic Preservation Officer
Division of Archaeology
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dear Dr. Bruseth:

The U.S. Army Corps of Engineers, Galveston District (USACE) Staff Archeologist has reviewed the enclosed draft report entitled, *Atkinson Island Remote-Sensing Survey and Assessment of Four Anomalies, Houston Ship Channel Project, Chambers County, Texas;* prepared for the USACE by PBS&J, and dated December 2009 (Enclosed). The USACE is seeking your concurrence on the results of the report.

As described in the report, the survey resulted in the identification of one significant anomaly (AI-12) that requires further investigation. The USACE proposes to conduct the additional investigations pursuant to the Programmatic Agreement (PA) among the Corps of Engineers, Galveston District, the Texas State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding Maintenance Dredging and New Construction on the Galveston Bay Navigation System, dated 22 April, 1988.

Thank you for your cooperation in this review process. If you have any questions concerning our review or if we can be of further assistance, please contact Jerry Androy at 409-766-3821.

Sincerely,

Carolyn Murphy

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Appendix E

Habitat Evaluation Procedure Analysis

HABITAT EVALUATION PROCEDURE ANALYSIS

1.0 BACKGROUND INFORMATION

1.1 Project Description

The proposed expansion of Placement Area (PA) 14 and 15 includes the construction of an expanded PA. The project is located in Chambers County, Texas within upper Galveston Bay at the southern tip of Atkinson Island. Refer to Exhibits 1 and 2 for the location of the proposed project. The proposed action includes construction of perimeter levees to enclose approximately 169-acres of land between existing PAs 14 and 15. Subsequent to construction of the perimeter levees, dredged material from maintenance dredging activities would be placed within the levees.

The purpose of the project is to allow maintenance dredging activities to continue so that the Houston Ship Channel (HSC) is maintained at its authorized depth. Existing PAs are reaching capacities. Additional capacity is required so that maintenance dredging activities within the HSC would not be delayed or interrupted. The proposed project would increase available capacity to receive dredged material from the HSC, allow the HSC to accommodate the anticipated mix and volume of future commercial vessel traffic, and maintain navigation safety by providing a safe draft depth in the channel.

Construction of the perimeter levees (18% of total project) would occur in 2010 to 2011. The perimeter levees would impact 31 acres of existing habitat. Approximately 49 acres of existing habitat (29%) would be impacted from placement of levee material from 2010 to 2011. The remaining 89 acres (53%) of impact will occur when dredged maintenance material is placed within the perimeter levees of the PA expansion area in 2020.

Habitat cover types within the proposed project footprint consist of sub-tidal unconsolidated bottom, intertidal emergent marsh, and intertidal unconsolidated shore. Cover types were determined during an on-site field assessment of the project area on October 6, 2009. Cover types within the project footprint were delineated based upon site conditions observed during the on-site field assessment in addition to aerial photographic interpretation. Exhibit 3 depicts the anticipated direct impacts to on-site habitats due to construction of the expanded PA. Impacts from the proposed project will be mitigated through the off-site creation of intertidal emergent marsh.

1.2 HEP Overview

Habitat Evaluation Procedure (HEP), developed by the U.S. Fish and Wildlife Service (USFWS), is a method used to quantify the impacts of a proposed project by evaluating the ability of the wildlife habitat within a study area to provide key components necessary for specific wildlife species (USFWS, 1980). HEP is a species-habitat approach to impact assessment that quantifies habitat quality for selected evaluation species through the use of a habitat suitability index (HSI). The HSI value is derived from an evaluation of the ability of key habitat components to provide the life requisites of selected species of wildlife (USFWS, 1980). HEP is based on the assumption that habitat for selected species can be described by an HSI. The species HSI or the average HSI for multiple species is multiplied by the area of available habitat to determine the total habitat units (HU) for the species for particular cover types in the study area.

The first step of the HEP analysis, the baseline assessment, describes the existing habitat conditions in terms of HUs for the study area. The next step involves projecting future habitat conditions in terms of HUs and comparing the future project habitat conditions with the proposed project to the future project habitat conditions without the proposed project. The impact of the proposed project is equal to the difference between the future "without project" HUs and the future "with project" HUs. The quantitative project impact value is then used to determine the mitigation acreage required to compensate for the habitat lost as a result of the proposed project.

2.0 HEP BASELINE ASSESSMENT

The HEP baseline assessment was conducted on October 6, 2009. The baseline assessment evaluated the habitat quality of the cover types within the project impact area as they existed on October 6, 2009, before construction was initiated. This assessment described the habitat quality of pre-construction conditions in terms of HUs in 2009.

The cover types identified within the project footprint, as described by Cowardin (Cowardin et al., 1979), consisted of estuarine sub-tidal unconsolidated bottom (E1UBL), estuarine intertidal emergent marsh (E2EM), and estuarine intertidal unconsolidated shore (E2US). Each cover type is described in more detail in Section 2.1. Based on the cover types present within the project footprint, four HSI models were selected to evaluate the habitat quality within the project footprint: great egret (Chapman and Howard, 1984), gulf menhaden (Christmas et al., 1982), red drum (Buckley, 1984), and white shrimp (Turner and Brody, 1983). Species selection for HSI models are described in more detail in Section 2.2. Acreages and descriptions of cover types within the project area are included in Table 1.

Table 1: Cover Types Present within Proposed Impact Area

Cover Type		Acreage		
Cowardin Classification	**Description**	**Total Observed (10/6/09)**	**Impacted***	**Remaining****
E1UBL	Sub-tidal Unconsolidated Bottom	112.67	112.67	0.00
E2EM	Intertidal Emergent Marsh	29.38	29.38	0.00
E2US	Intertidal Unconsolidated Shore	27.09	27.09	0.00
Total		**169.14**	**169.14**	**0.00**

* Impacted acreage after construction is complete
** Remaining acreage after construction is complete

All of the habitat within the project area would be impacted after the project is complete. At the time of sampling for the baseline assessment, none of the habitat within the project footprint had been impacted. The data collected within these sample locations is assumed to be representative of the conditions present within the project footprint prior to construction.

2.1 Cover Type Descriptions

The cover types identified within the project footprint, as described by Cowardin (Cowardin et al., 1979), consisted of E1UBL, E2EM, and E2US.

No submerged aquatic vegetation was observed within the E1UBL areas. These areas are permanently inundated with tidal waters. Approximately 112.67 acres of E1UBL cover type was determined to be within the project footprint.

Vegetation observed within E2EM areas included smooth cordgrass *(Spartina alterniflora)*, saltmeadow cordgrass (*Spartina patens*), Gulf cordgrass (*Spartina spartinae*), Virginia glasswort (*Salicornia depressa*), shoreline seapurslane (*Sesuvium portulacastrum*), saltgrass (*Distichlis spicata*), seashore dropseed (*Sporobolus virginicus*), common sunflower (*Helianthus annuus*), bushy seaside tansy

(*Borrichia frutescens*), seaside goldenrod (*Solidago sempervirens*), and salt cedar (*Tamarix spp.*). Approximately 29.38 acres of E2EM cover type was determined to be within the project footprint.

Very sparse vegetation was observed within E2US areas. This area was dominated by sand flats and sand/mud flats. Vegetation observed within these areas included smooth cordgrass and saltmeadow cordgrass. Approximately 27.09 acres of E2EM cover type was determined to be within the project footprint.

2.2 HSI Model Selection

HSI model selection was based on species utilization of cover types present within the project footprint. Four HSI models were selected to evaluate the habitat quality within the project footprint: great egret, gulf menhaden, red drum, and white shrimp. These species were selected based upon their ecological dependence upon the habitat that is proposed to be impacted. Each of the four species was evaluated using for each of the three cover types, yielding one average HSI value for cover type that was evaluated. More details regarding the selection of each species is described in further detail below.

The great egret (*Casmerodius albus*) is commonly observed within and in the vicinity of the project area. Great egrets nest on upland islands and forage in open, calm, shallow water areas near the margins of wetlands (Chapman and Howard, 1984). The great egret HSI model was selected to be incorporated into the HEP analysis for this project in order to yield a broader ecological analysis as compared to the other three aquatic dependent species examined. Separate HSI equations using different HSI variables are used to evaluate great egret feeding and nesting habitats. Although suitable nesting habitat is available in the project area, the HSI model for great egret feeding habitats was utilized for this project to evaluate the habitat value of the intertidal emergent marsh and intertidal unconsolidated shore cover types.

Gulf menhaden (*Brevoortia patronus*) is an estuarine dependent species that inhabits northern Gulf of Mexico waters (Christmas et al., 1982). The gulf menhaden HSI model was selected to be incorporated into the HEP analysis for this project due to this species importance as a prey species for other important commercial and recreational fisheries species associated with estuarine ecosystems. The great abundance of gulf menhaden and their wide distribution and use of estuarine and marine waters indicate that they can tolerate extremes of many environmental factors. Due to the changing habitat requirements and seasonal movement during their life history, HSI models that utilize different variables were developed for both estuarine and nearshore marine waters. The estuarine gulf menhaden HSI model was utilized for this project.

Red drum (*Sciaenops ocellatus*) is an estuarine dependent species found along the Atlantic coast and in the Gulf of Mexico. The red drum HSI model was selected to be incorporated into the HEP analysis for this project due to this species importance to commercial and recreational fisheries. The red drum HSI is designed for use throughout their range and can be used to assess habitat suitability for both their larval or juvenile life stages. No model was developed for the adult stage because they are highly mobile and tolerate a wide range of environmental conditions. Of the two models developed for the larval and juvenile red drum, one is designed for use in estuaries with naturally vegetated substrates and the other for use in estuaries that cannot support bottom vegetation because of natural factors such as high turbidity. Each model utilizes different variables. These HSI models are applicable in the estuarine sub-tidal habitat classes of Cowardin et al. (1979). The naturally non-vegetated substrate HSI model for the red drum was utilized for this project.

White shrimp (*Penaeus setiferus*) occur in both marine and estuarine habitats, depending on life stage. Adult shrimp spawn offshore in marine waters. Post-larval shrimp enter estuaries where they are highly dependent on coastal wetlands for food and habitat cover. Juvenile shrimp leave the estuary and move offshore to grow into adults. White shrimp HSI models should be used to evaluate areas with salt and brackish marshes and submerged seagrass beds with alternately flooding and receding waters. The white shrimp HSI model was selected to be incorporated into the HEP analysis for this project due to this species importance to commercial and recreational fisheries.

2.3 Sampling Methodology

Three evenly-spaced linear transect lines, as depicted in Exhibit 5, were established within the project footprint for habitat parameter sampling. Transects were aligned perpendicular to the existing PAs 14 and 15. Four evenly spaced sampling points were established along each transect. Appropriate habitat data for each species was observed and recorded at each sampling location. Field data is shown in Attachment A. Data for water quality variables was obtained from long-term water quality monitoring datasets recorded by the Texas Water Development Board (TPWD) with the aid of from Texas Parks and Wildlife Department (TPWD) personnel (TWDB, 2009). Water quality data from the TWDB "Baytown" datasonde was utilized for the data source for the project area as this was the closest available monitoring station to the project site. Aerial photographic interpretation and bathymetric data was also utilized to aid in data compilation. Species-specific HSI model variables sampled for are described in Table 2.

Table 2: HSI Model Variables

Habitat Variable	Species			
	Great egret	Gulf menhaden	Red drum	White shrimp
% area with water 10-23 cm deep[1]	X			
% of submerged or emergent vegetation cover in zone 10-23 cm deep[1]	X			
Lowest monthly average winter water temperature[4]		X		
Highest monthly average summer water temperature[4]		X		
Lowest monthly average winter salinity[4]		X		
Average annual salinity (water quality)[4]		X		
Lowest weekly average dissolved oxygen[4]		X		
Average annual salinity (food)[4]		X		
Water color[2]		X		
Substrate composition[2]		X	X	X
Marsh acreage[1]		X		
Mean temperature[4]			X	X[3]
Mean salinity[4]			X	X[3]
% of open water fringed with persistent emergent vegetation[1]			X	
Mean depth at low tide[1]			X	
% estuary covered by vegetation[1]				X

[1]Estimated from observations made during transect assessments (October 6, 2009), along with aerial photographic interpretation, and bathymetric data obtained from USACE.
[2]Data obtained from visual observation (October 6, 2009).
[3]Mean temperature and salinity for white shrimp during summer (Turner and Brody, 1983).
[4]Data obtained from TPWD-TWDB Hydrolab Datasonde website (TWDB, 2009).

2.4 Baseline Assessment Results

A HEP baseline assessment was conducted for each evaluation species. Data were applied to species-specific HSI models over all three cover types to obtain HSI scores for gulf menhaden, red drum, white shrimp, and great egret within each cover type. Observed data was referenced to suitability index (SI) graphs, found in the species-specific HSI model reports, to obtain suitability indices. Suitability indices were utilized in HSI equations to complete HSI analysis. HSI scores for each species were averaged to obtain a mean HSI per cover type. The mean HSI was multiplied by the acreage of the cover type to obtain HUs. Analysis of the four cover types resulted in a total of 58.99 HUs. HSIs and HUs are summarized by cover type in Table 3. Subsequent sections describe the derivation of HSIs for each species.

Table 3: Habitat Units within the Study Area at Baseline (2009)

Cover Type	Evaluation Species	Evaluation Species' HSI	Cover Type Mean HSI	Total Area of Habitat in project area (acres)	Habitat Units (HUs) in Study Area
Sub-tidal Unconsolidated Bottom	Great egret	0.06	0.35	112.67	39.43
	Gulf menhaden	0.80			
	Red drum	0.27			
	White shrimp	0.29			
Intertidal Emergent Marsh	Great egret	0.28	0.38	29.38	11.16
	Gulf menhaden	0.90			
	Red drum	0.00			
	White shrimp	0.34			
Intertidal Unconsolidated Shore	Great egret	0.31	0.31	27.09	8.40
	Gulf menhaden	0.72			
	Red drum	0.00			
	White shrimp	0.20			
Total Habitat Units (Baseline-2009)					**58.99**

2.4.1 Great Egret HSI Model

The HSI model for the great egret feeding habitat is based on two habitat variables, described in Table 4, within one life requisite (food). Optimal feeding habitat for the great egret consists of:

- Areas with 100 percent water cover at a depth of 10 to 23 centimeters (cm); and
- Areas with 40 to 60 percent coverage of emergent or aquatic vegetation.

All habitat variables included in this model were estimated based upon qualitative observations made in the field and supplemented with aerial photographic interpretation (V_1) and bathymetric data (V_2) obtained from United States Army Corps of Engineers (USACE) surveys.

Table 4: Baseline Habitat Variables, Observed Data, and Suitability Index for Great Egret

Habitat Variable Category	Habitat Variable	Habitat Variable Description	Cover Type					
			Sub-tidal Unconsolidated Bottom		Intertidal Emergent Marsh		Intertidal Unconsolidated Shore	
			Observed	SI	Observed	SI	Observed	SI
Water Depth	V_1	Project area with 10 to 23 cm water depth (%)	10%	0.10	3%	0.03	50%	0.50
Vegetation	V_2	Project area in 10 to 23 cm zone covered with submerged or emergent vegetation (%)	3%	0.02	90%	0.35	1%	0.11

The mathematical equation used to determine HSI for great egret feeding habitat is:

HSI = Food

Food = $(V_1 + V_2) / 2$

The HSI scores for the great egret ranged from 0.06-0.31.

2.4.2 Gulf Menhaden HSI Model

The HSI model for the gulf menhaden in estuarine habitats is based on nine habitat variables, described in Table 5, aggregated into three life requisites (water quality, food, and cover) for the four life stages (adult, egg, larval, and juvenile) of this species. Optimal water quality conditions (SI = 1.0) for the gulf menhaden occur when:

- The lowest monthly average winter temperature is between 5°C and 20°C;
- The lowest monthly average winter salinity is between 5 parts per thousand (ppt) and 12 ppt;
- The highest monthly average summer water temperature is between 20°C and 33°C;
- The average annual salinity is between 10 ppt and 35 ppt; and
- The lowest weekly average dissolved oxygen (DO) concentration is above 5.5 parts per million (ppm);

Optimal feeding conditions (SI = 1.0) for the gulf menhaden occur when:

- The average annual salinity is between 5 ppt and 20 ppt;
- The estuarine water color is brown; and
- The substrate composition is mud.

Optimal cover conditions (SI = 1.0) for the gulf menhaden occur when:

- The area of tidal marsh in the drainage basin is greater than 1,000 acres.

Water quality habitat variables (V_3, V_8, V_9, V_{10}, V_{13}, and V_{14}) included in this model were obtained from long term monitoring data from TPWD. Water color data (V_{12}) was obtained via visual assessment during transect sampling. Water color was consistent at all sampling points that were submerged with water. Marsh area data (V_{11}) was estimated based on aerial photographs for the entire Galveston Bay ecosystem. Substrate composition data (V_5) was obtained via visual assessment during transect sampling. Substrate composition varied among the three cover types that were located within the impact areas.

- Substrate was observed to be mud (SI = 1.0) in the intertidal emergent marsh areas;
- Muddy sand in the sub-tidal unconsolidated bottom areas (the SI was interpolated within the HSI suitability graph for gulf menhaden to be 0.3 because the substrate composition for this cover type was between a sandy mud and sand/shell); and
- Sand/shell (SI = 0.1) in the intertidal unconsolidated shore.

Table 5: Baseline Habitat Variables, Observed Data, and Suitability Index for Gulf Menhaden

Habitat Variable Category	Habitat Variable	Habitat Variable Description	Cover Type					
			Sub-tidal Unconsolidated Bottom		Intertidal Emergent Marsh		Intertidal Unconsolidated Shore	
			Observed	SI	Observed	SI	Observed	SI
Water Temperature	V_8	Lowest monthly average winter (°C)	12.04	1.0	12.04	1.0	12.04	1.0
	V_{13}	Highest monthly average (°C)	30.7	1.0	30.7	1.0	30.7	1.0
Salinity	V_3	Average annual-food (ppt)	11.83	1.0	11.83	1.0	11.83	1.0
	V_9	Lowest monthly average winter (ppt)	6.19	1.0	6.19	1.0	6.19	1.0
	V_{14}	Average annual-water quality (ppt)	11.83	1.0	11.83	1.0	11.83	1.0
Water Color	V_{12}	Water color	Brown	1.0	Brown	1.0	Brown	1.0
Substrate Composition	V_5	Substrate composition	Muddy Sand	0.3	Mud	1.0	Sand/shell	0.1
Marsh Area	V_{11}	Total marsh in drainage basin (acres)	>1,000	1.0	>1,000	1.0	>1,000	1.0
Dissolved Oxygen	V_{10}	Lowest weekly average (ppm)*	2.25	0.0	2.25	0.0	2.25	0.0

*Lowest weekly average was not available in the TPWD dataset. Lowest monthly average was used.

The mathematical equation used to determine HSI for gulf menhaden in estuarine habitats is:

$$HSI = [\text{Water quality} \times (\text{Food})^2 \times \text{Cover}]^{1/4}$$

$$\text{Water quality} = \frac{(V_8 \times V_{13})^{1/2} + (V_9 \times V_{14})^{1/2} + V_{10}}{3}$$

Food = $[(V_3)^2 \times (V_{12})^2 \times V_5]^{1/5}$

Cover = V_{11}

The calculation of the HSI for the sub-tidal unconsolidated cover type is as follows:

$HSI_1 = [\text{Water quality} \times (\text{Food})^2 \times \text{Cover}]^{1/4} = [0.67 \times (0.79)^2 \times 1.0]^{1/4} = 0.80$

$$\text{Water quality} = \frac{(V_8 \times V_{13})^{1/2} + (V_9 \times V_{14})^{1/2} + V_{10}}{3} = \frac{(1.0 \times 1.0)^{1/2} + (1.0 \times 1.0)^{1/2} + 0.0}{3} = 0.67$$

Food = $[(V_3)^2 \times (V_{12})^2 \times V_5]^{1/5} = [(1.0)^2 \times (1.0)^2 \times 0.3]^{1/5} = 0.79$

Cover = $V_{11} = 1.0$

The calculation of the HSI for the intertidal emergent marsh cover type is as follows:

$HSI_2 = [\text{Water quality} \times (\text{Food})^2 \times \text{Cover}]^{1/4} = [0.67 \times (1.0)^2 \times 1.0]^{1/4} = 0.90$

$$\text{Water quality} = \frac{(V_8 \times V_{13})^{1/2} + (V_9 \times V_{14})^{1/2} + V_{10}}{3} = \frac{(1.0 \times 1.0)^{1/2} + (1.0 \times 1.0)^{1/2} + 0.0}{3} = 0.67$$

Food = $[(V_3)^2 \times (V_{12})^2 \times V_5]^{1/5} = [(1.0)^2 \times (1.0)^2 \times 1.0]^{1/5} = 1.0$

Cover = $V_{11} = 1.0$

The calculation of the HSI for the intertidal unconsolidated shore cover type is as follows:

$HSI_3 = [\text{Water quality} \times (\text{Food})^2 \times \text{Cover}]^{1/4} = [0.67 \times (0.63)^2 \times 1.0]^{1/4} = 0.72$

$$\text{Water quality} = \frac{(V_8 \times V_{13})^{1/2} + (V_9 \times V_{14})^{1/2} + V_{10}}{3} = \frac{(1.0 \times 1.0)^{1/2} + (1.0 \times 1.0)^{1/2} + 0.0}{3} = 0.67$$

Food = $[(V_3)^2 \times (V_{12})^2 \times V_5]^{1/5} = [(1.0)^2 \times (1.0)^2 \times 0.1]^{1/5} = 0.63$

Cover = $V_{11} = 1.0$

The HSI scores for the gulf menhaden ranged from 0.72-0.90.

2.4.3 Red Drum HSI Model

The HSI model for the red drum in estuaries with little or no submerged vegetation is based on five habitat variables, described in Table 6, aggregated into three life requisites (water quality, food, and cover) for larval and juvenile red drum. Optimal water quality conditions are assumed to occur when:

- The mean water temperature is between 25°C and 30°C; and
- The mean salinity is between 25 ppt and 30 ppt.

Optimal feeding conditions are assumed to occur when:

- 100 percent of open water is fringed by persistent emergent vegetation.

Optimal cover conditions are assumed to occur when:

- The substrate composition is comprised of mud; and
- The mean depth of estuarine open water at low tide is between 1.5 to 2.5 meters.

Water quality habitat variables (V_1 and V_2) included in this model were obtained from long term monitoring data from TPWD. Vegetation data (V_3) was obtained via qualitative observations made in the field and supplemented with aerial photographic interpretation. Water depth data (V_6) was obtained via on-site visual observations and supplemented with bathymetric surveys from the USACE. Water depth data varied among the three cover types. Substrate composition data (V_5) was obtained via visual assessment during transect sampling. Substrate composition varied among the three cover types that were located within the impact areas.

- Substrate was observed to be mud (SI = 1.0) in the intertidal emergent marsh areas;
- Muddy sand in the sub-tidal unconsolidated bottom areas (the SI was interpolated within the HSI suitability graph for red drum to be 0.9 because the substrate composition for this cover type was between a mud and fine sand); and
- Coarse sand (SI = 0.5) in the intertidal unconsolidated shore.

Table 6: Baseline Habitat Variables, Observed Data, and Suitability Index for Red Drum

Habitat Variable Category	Habitat Variable	Habitat Variable Description	Cover Type					
			Sub-tidal Unconsolidated Bottom		Intertidal Emergent Marsh		Intertidal Unconsolidated Shore	
			Observed	SI	Observed	SI	Observed	SI
Temperature	V_1	Mean Temperature (°C)	29.31	1.0	29.31	1.0	29.31	1.0
Salinity	V_2	Mean salinity (ppt)	11.83	0.1	11.83	0.1	11.83	0.1
Vegetation	V_3	Open water fringed with persistent emergent vegetation (%)	10	0.27	10	0.27	10	0.27
Substrate Composition	V_5	Substrate composition	Muddy sand	0.9	Mud	1.0	Coarse sand	0.5
Water Depth	V_6	Mean depth at low tide (meters)	1.5	1.0	0.0	0.0	0.0	0.0

The mathematical equation used to determine HSI for red drum in estuaries with little or no submerged vegetation is:

HSI = Water quality, Food, or Cover, whichever is lower
Water quality = $(V_1^2 \times V_2)^{1/3}$
Food = V_3
Cover = $(V_5 \times V_6)^{1/2}$

The calculation of the HSI for the sub-tidal unconsolidated cover type is as follows:

HSI_4 = Water quality, Food, or Cover, whichever is lower = 0.27
Water quality = $(V_1^2 \times V_2)^{1/3} = (1.0^2 \times 0.1)^{1/3} = 0.46$
Food = $V_3 = 0.27$
Cover = $(V_5 \times V_6)^{1/2} = (0.9 \times 1.0)^{1/2} = 0.95$

The calculation of the HSI for the intertidal emergent marsh cover type is as follows:

HSI_5 = Water quality, Food, or Cover, whichever is lower = 0.00

Water quality = $(V_1^2 \times V_2)^{1/3} = (1.0^2 \times 0.1)^{1/3} = 0.46$
Food = $V_3 = 0.27$
Cover = $(V_5 \times V_6)^{1/2} = (1.0 \times 0.0)^{1/2} = 0.0$

The calculation of the HSI for the intertidal unconsolidated shore cover type is as follows:
HSI_6 = Water quality, Food, or Cover, whichever is lower = 0.00
Water quality = $(V_1^2 \times V_2)^{1/3} = (1.0^2 \times 0.1)^{1/3} = 0.46$
Food = $V_3 = 0.27$
Cover = $(V_5 \times V_6)^{1/2} = (0.5 \times 0.0)^{1/2} = 0.0$

The HSI scores for the red drum ranged from 0.00-0.27.

2.4.4 White Shrimp HSI Model

The HSI model for the white shrimp in estuarine habitats is based on four habitat variables, described in Table 7, aggregated into two life requisites (food/cover and water quality). Optimal food/cover conditions are assumed to occur in estuaries that:

- Are covered by 100 percent cover of vegetation (marsh and seagrass); and
- Have substrate composition is comprised of a soft bottom with peaty silts and/or organic mud with decaying vegetation and organic material.

Optimal water quality conditions are assumed to occur when:

- The mean summer salinity is between 1 ppt and 15 ppt; and
- The mean summer water temperature is between 20°C and 30°C.

Water quality habitat variables (V_{3w} and V_4) included in this model were obtained from long term monitoring data from TPWD. Vegetation data (V_1) was obtained via qualitative observations made in the field and supplemented with aerial photographic interpretation. Substrate composition data (V_{2w}) was obtained via visual assessment during transect sampling. Substrate composition varied among the three cover types that were located within the impact areas.

- Substrate was observed to be soft bottom (SI = 1.0) in the intertidal emergent marsh areas;
- Muddy sand in the sub-tidal unconsolidated bottom areas (SI = 0.6); and
- Sand (SI = 0.2) in the intertidal unconsolidated shore.

Table 7: Baseline Habitat Variables, Observed Data, and Suitability Index for White Shrimp

Habitat Variable Category	Habitat Variable	Habitat Variable Description	Cover Type					
			Sub-tidal Unconsolidated Bottom		Intertidal Emergent Marsh		Intertidal Unconsolidated Shore	
			Observed	SI	Observed	SI	Observed	SI
Vegetation	V_1	Estuary covered by vegetation (%)	20	0.2	20	0.2	20	0.2
Substrate	V_{2w}	Substrate composition	Muddy Sand	0.6	Soft bottom	1.0	Sand	0.2

Habitat Variable Category	Habitat Variable	Habitat Variable Description	Cover Type					
			Sub-tidal Unconsolidated Bottom		Intertidal Emergent Marsh		Intertidal Unconsolidated Shore	
			Observed	SI	Observed	SI	Observed	SI
Water Quality	V_{3w}	Mean summer salinity (ppt)	11.83	1.0	11.83	1.0	11.83	1.0
	V_4	Mean summer water temperature (°C)	29.31	1.0	29.31	1.0	29.31	1.0

The mathematical equation used to determine HSI for white shrimp in estuarine habitats is:

HSI = Water quality or Food/Cover, whichever is lower
Food/Cover = $(V_1^2 \times V_{2w})^{1/3}$
Water Quality = $(V_{3w} \times V_4)^{1/2}$

The calculation of the HSI for the sub-tidal unconsolidated cover type is as follows:

HSI_7 = Water quality or Food/Cover, whichever is lower = 0.29
Food/Cover = $(V_1^2 \times V_{2w})^{1/3} = (0.2^2 \times 0.6)^{1/3} = 0.29$
Water Quality = $(V_{3w} \times V_4)^{1/2} = (1.0 \times 1.0)^{1/2} = 1.0$

The calculation of the HSI for the intertidal emergent marsh cover type is as follows:

HSI_8 = Water quality or Food/Cover, whichever is lower = 0.34
Food/Cover = $(V_1^2 \times V_{2w})^{1/3} = (0.2^2 \times 1.0)^{1/3} = 0.34$
Water Quality = $(V_{3w} \times V_4)^{1/2} = (1.0 \times 1.0)^{1/2} = 1.0$

The calculation of the HSI for the intertidal unconsolidated shore cover type is as follows:

HSI_9 = Water quality or Food/Cover, whichever is lower = 0.20
Food/Cover = $(V_1^2 \times V_{2w})^{1/3} = (0.2^2 \times 0.2)^{1/3} = 0.20$
Water Quality = $(V_{3w} \times V_4)^{1/2} = (1.0 \times 1.0)^{1/2} = 1.0$

The HSI scores for the white shrimp ranged from 0.20-0.34.

3.0 HEP ANALYSIS BACKGROUND INFORMATION

Federal projects are evaluated over a period of time that is referred to as the "period of analysis" and includes a "pre-start period" and the "life of the project" as defined by the HEP Manual (USFWS, 1980). Although called "life of the project," the project is expected to last over 50 years, and benefits will still be derived from the project after the 50-year period. The pre-start period is the construction period. The "life of the project" is defined as that period between the times the project becomes operational (end of construction period) and the end of a 50-year period of analysis as determined by the lead agency. For the purposes of this project, the pre-start period is defined as 2010 to 2020. Perimeter levees would be constructed and placement of levee material within the project area would occur from 2010-2011. Total impact, placement of dredged material within PA 14/15 expansion area, would not occur until 2020. The life of the project is defined as 2020 to 2070.

The project impact analysis projects future habitat conditions over the period of analysis (60 years) in terms of average annual habitat units ("AAHU") and determines the net impact of the proposed project. AAHUs were calculated for the habitat conditions within the expansion area with the proposed project constructed ("with project") and the habitat conditions within the expansion area without the proposed project constructed ("without project"). HUs are annualized by summing the HUs for all years in the period of analysis and dividing the total by the number of years in the period of analysis, resulting in AAHUs. The following equation was used to determine AAHUs (USFWS, 1980).

$$(T2 - T1)\left(\frac{A2H2 - A1H1}{3}\right) + \left(\frac{A2H1 - A1H2}{6}\right)$$

T1 = First year of time interval
T2 = Second year of time interval
A1 = Habitat area of first target year
A2 = Habitat area of second target year
H1 = HSI of first target year
H2 = HSI of second target year

The net average annual impact of the proposed project is equal to the difference between the "without project" AAHUs and the "with project" AAHUs. The required mitigation acreage for the project is determined based on the HSI scores for each cover type within the expansion area.

The mitigation alternatives analysis evaluates the habitat associated with the proposed mitigation site (described in Section 6.0) using the HSI models for all four evaluation species. The required mitigation acreage for the proposed project is determined based on the predicted mean HSI score for the mitigation area.

4.0 HEP ANALYSIS METHODS

The project impact analysis involves projecting future habitat conditions in terms of AAHUs and comparing the projected habitat conditions with the proposed project to the projected habitat conditions without the proposed project. The net average annual impact of the proposed project is equal to the difference between the "without project" AAHUs and the "with project" AAHUs. To determine future AAHUs, HSI variable values were predicted for interval years over the period of analysis (60 years). In order to predict HSI variable values, assumptions for future conditions were established. The assumptions listed in Table 8 were used to predict the future HSI variable values for the “with project” and “without project” conditions.

Table 8: HSI Variable Assumptions

HSI Model	Variable	Habitat Variable	Assumption	
			With Project	Without Project
Great Egret	V_1	% area with water 10-23 cm deep	Shoaling would cease with construction of levees. Percent of area 10-23 cm deep would be consistent with baseline conditions until total impact occurs at year 10.	Shoaling would continue. Percent of area within 10-23 cm deep would increase through the period of analysis.

HSI Model	Variable	Habitat Variable	Assumption	
			With Project	Without Project
	V_2	% of submerged or emergent vegetation cover in zone 10-23 cm deep	Shoaling would cease with construction of levees. Submerged/Emergent vegetation would be consistent with baseline conditions until total impact occurs at year 10.	Shoaling would continue. Submerged/Emergent vegetation would increase through the period of analysis.
Gulf Menhaden	V_8	Lowest monthly average winter water temperature	Enclosure of project area by levees may slightly increase temperature above baseline conditions until total impact occurs at year 10.	Temperature would remain consistent with baseline conditions.
	V_{13}	Highest monthly average summer water temperature	Enclosure of project area by levees may slightly increase temperature above baseline conditions until total impact occurs at year 10.	Temperature would remain consistent with baseline conditions.
	V_9	Lowest monthly average winter salinity	Salinity would remain consistent with baseline conditions until total impact occurs at year 10.	Salinity would remain consistent with baseline conditions.
	V_3	Average annual salinity (food)	Salinity would remain consistent with baseline conditions until total impact occurs at year 10.	Salinity would remain consistent with baseline conditions.
	V_{10}	Lowest weekly average dissolved oxygen	Enclosure of project area by levees may slightly decrease dissolved oxygen levels below baseline conditions until total impact occurs at year 10.	Dissolved oxygen would remain consistent with baseline conditions.
	V_{14}	Average annual salinity (water quality)	Salinity would remain consistent with baseline conditions until total impact occurs at year 10.	Salinity would remain consistent with baseline conditions.
	V_{12}	Water color	Water quality would remain consistent with baseline conditions until total impact occurs at year 10.	Water quality would remain consistent with baseline conditions.
	V_5	Substrate composition	Substrate composition would remain consistent with baseline conditions until total impact occurs at year 10.	Substrate composition would remain consistent with baseline conditions.
	V_{11}	Marsh acreage	Marsh acreage in Galveston Bay would remain consistent with baseline conditions.	Marsh acreage in Galveston Bay would remain consistent with baseline conditions.
Red Drum	V_1	Mean temperature	Enclosure of project area by levees may slightly increase temperature above baseline conditions until total impact occurs at year 10.	Temperature would remain consistent with baseline conditions.
	V_2	Mean salinity	Salinity would remain consistent with baseline conditions until total impact occurs at year 10.	Salinity would remain consistent with baseline conditions.
	V_3	% of open water fringed with persistent emergent vegetation	Shoaling would cease with construction of levees. Percentage of open water fringed with emergent vegetation would be consistent with baseline conditions until total impact occurs at year 10.	Shoaling would continue and emergent vegetation would continue to become established. The percentage of open water fringed with persistent emergent vegetation would increase.
	V_5	Substrate composition	Substrate composition would remain consistent with baseline conditions until total impact occurs at year 10.	Substrate composition would remain consistent with baseline conditions.
	V_6	Mean depth at low tide	Shoaling would cease with construction of levees. Mean depth at low tide would be consistent with baseline conditions until total impact occurs at year 10.	Shoaling would continue. Mean depth at low tide would decrease through the period of analysis. Mean depth of low tide would remain consistent in intertidal emergent marsh and intertidal subconsolidated shore cover types.

HSI Model	Variable	Habitat Variable	Assumption	
			With Project	Without Project
White Shrimp	V_1	% estuary covered by vegetation	Percentage of estuary covered by vegetation would remain consistent with baseline conditions.	Percentage of estuary covered by vegetation would remain consistent with baseline conditions.
	V_{2w}	Substrate composition	Substrate composition would remain consistent with baseline conditions until total impact occurs at year 10.	Substrate composition would remain consistent with baseline conditions.
	V_{3w}	Mean summer salinity	Salinity would remain consistent with baseline conditions until total impact occurs at year 10.	Salinity would remain consistent with baseline conditions.
	V_4	Mean summer water temperature	Enclosure of project area by levees may slightly increase temperature above baseline conditions until total impact occurs at year 10.	Temperature would remain consistent with baseline conditions.

5.0 HEP ANALYSIS RESULTS

5.1 Project Impact Analysis

A project impact analysis using HEP was conducted for each evaluation species. The HSI scores for each evaluation species were predicted over the period of analysis under the assumptions presented in Section 4.0. The baseline and projected HSI scores are presented in Attachment B. The proposed project would impact 169.14 acres of habitat. Table 9 presents the impacts associated with the proposed project by year. The available habitat area per interval year was decreased according to Table 9 to determine the "with project" AAHUs. The "with project" AAHUs and the "without project" AAHUs were determined by multiplying the HSI scores in Attachment B by the area of available habitat. The AAHUs calculated for the "with project" conditions and the "without project" conditions are presented in Attachment C.

Table 9: Annual Habitat Impact Acreages

Habitat Impact (Acres)				
Target Year	Sub-tidal Unconsolidated Bottom	Intertidal Emergent Marsh	Intertidal Unconsolidated Shore	Cumulative Impact
TY0 (2009) (Baseline)	0.00	0.00	0.00	0.00
TY1 (2010)	19.50	7.61	12.66	39.77
TY2 (2011)	19.50	7.60	12.66	79.53
TY3 (2012)	0.00	0.00	0.00	79.53
TY4 (2013)	0.00	0.00	0.00	79.53
TY5 (2014)	0.00	0.00	0.00	79.53
TY6 (2015)	0.00	0.00	0.00	79.53
TY7 (2016)	0.00	0.00	0.00	79.53
TY8 (2017)	0.00	0.00	0.00	79.53
TY9 (2018)	0.00	0.00	0.00	79.53
TY10 (2019)	0.00	0.00	0.00	79.53
TY11 (2020) (Total Impact)	73.67	14.17	1.77	169.14

Predicted AAHUs and the net impacts associated with the proposed project are summarized by cover type in Table 10.

Table 10: Net Impact in Terms of AAHUs

Evaluation Species	Total Area of Habitat at Baseline Year (acres)	"Without Project" AAHUs	"With Project" AAHUs	Net Impact AAHUs
Sub-tidal Unconsolidated Bottom	112.67	49.53	7.60	41.93
Intertidal Emergent Marsh	29.38	11.50	1.53	9.97
Intertidal Unconsolidated Shore	27.09	10.15	0.28	9.87
Total		**71.18**	**9.42**	**61.76**

5.1.1 Sub-tidal Unconsolidated Bottom

Over the period of analysis (60 years), the habitat within the project area would provide 49.53 AAHUs without the proposed project and 7.60 AAHUs with the proposed project. The proposed project would impact 112.67 acres (100 percent) of the habitat within the proposed expansion area. The loss of habitat over the period of analysis results in a net impact of 41.93 AAHUs.

5.1.2 Intertidal Emergent Marsh

Over the period of analysis (60 years), the habitat within the project area would provide 11.50 AAHUs without the proposed project and 1.53 AAHUs with the proposed project. The proposed project would impact 29.38 acres (100 percent) of the habitat within the proposed expansion area. The loss of habitat over the period of analysis results in a net impact of 9.97 AAHUs.

5.1.3 Intertidal Unconsolidated Shore

Over the period of analysis (60 years), the habitat within the project area would provide 10.15 AAHUs without the proposed project and 0.28 AAHUs with the proposed project. The proposed project would impact 27.09 acres (100 percent) of the habitat within the proposed expansion area. The loss of habitat over the period of analysis results in a net impact of 9.87 AAHUs.

5.2 Mitigation Analysis

Mitigation analysis was conducted for all four evaluation species. The HSI scores for each evaluation species within the proposed mitigation area were predicted over the period of analysis under assumptions presented below.

- Construction of mitigation area would begin in 2010.
- Construction and planting would be completed by the end of 2011. Vegetation would be considered to be fully established (100% cover) after three years, starting in 2014.
- Data for water quality variables of the mitigation site were obtained from the TPWD-TWDB "East Bay" datasonde. The East Bay monitoring station was the closest available to the mitigation site. The salinity patterns near the mitigation site were reviewed (USACE, 1995). Based on the location of the "East Bay" datasonde compared to the location of the mitigation

area, an increase of 5 ppt was added to the salinity levels recorded at the “East Bay” datasounde to reflect salinity levels at the mitigation site.

- Habitat variable assumptions are listed in Table 11.

Table 11: Mitigation Variable Assumptions

HSI Model	Variable	Habitat Variable	Mitigation Site Assumptions
Great egret	V_1	% area with water 10-23 cm deep	At the end of construction, 35% of the area constructed would fall within the 10-23 cm depth range
	V_2	% of submerged or emergent vegetation cover in zone 10-23 cm deep	Within the 10-23 cm zone, the constructed area would be initially planted with 50% emergent vegetation cover. The cover would be expected to incrementally increase each year to achieve full (50%) coverage after the third year of growth.
Gulf menhaden	V_8	Lowest monthly average winter water temperature	Temperature would remain consistent with baseline conditions throughout the period of analysis.
	V_{13}	Highest monthly average summer water temperature	Temperature would remain consistent with baseline conditions throughout the period of analysis.
	V_9	Lowest monthly average winter salinity	Salinity would remain consistent with baseline conditions throughout the period of analysis.
	V_3	Average annual salinity (food)	Salinity would remain consistent with baseline conditions throughout the period of analysis.
	V_{10}	Lowest weekly average dissolved oxygen	Dissolved oxygen would remain consistent with baseline conditions throughout the period of analysis.
	V_{14}	Average annual salinity (water quality)	Salinity would remain consistent with baseline conditions throughout the period of analysis.
	V_{12}	Water color	Water color would remain consistent with baseline conditions throughout the period of analysis.
	V_5	Substrate composition	Substrate composition would change to a mud after construction of the mitigation areas.
	V_{11}	Marsh Acreage	Marsh acreage in the Galveston Bay ecosystem would remain the same throughout the period of analysis.
Red drum	V_1	Mean temperature	Temperature would remain consistent with baseline conditions throughout the period of analysis.
	V_2	Mean salinity	Salinity would remain consistent with baseline conditions throughout the period of analysis.
	V_3	% of open water fringed with persistent emergent vegetation	The percent of open water fringed with persistent vegetation would be expected to incrementally increase each year to achieve full (100%) coverage after the third year of growth.
	V_5	Substrate composition	Substrate composition would change to a mud after construction of the mitigation areas.
	V_6	Mean depth at low tide	Mean depth at low tide would remain consistent with baseline conditions throughout the period of analysis.
White shrimp	V_1	% estuary covered by vegetation	Percentage of estuary covered by vegetation would remain consistent with baseline conditions throughout the period of analysis.
	V_{2w}	Substrate composition	Substrate composition would begin to change from a muddy sand to a organic mud as decaying vegetation and reduced currents ensue after construction of the mitigation areas.
	V_{3w}	Mean summer salinity	Salinity would remain consistent with baseline conditions throughout the period of analysis.
	V_4	Mean summer water temperature	Temperature would remain consistent with baseline conditions throughout the period of analysis.

The purpose of the mitigation analysis was to determine the mitigation requirements based on the net impact of the proposed project. The required mitigation acreage was calculated by dividing the AAHUs associated with the net impact of the proposed project by the mean HSI score for the mitigation area.

The proposed mitigation consists of intertidal emergent marsh as described in Section 6.0. The intertidal emergent marsh mitigation area would mitigate for impacts to all cover types within the project area including sub-tidal unconsolidated bottom and intertidal unconsolidated shore. The acres for required mitigation are calculated by dividing the net impact of the proposed project (AAHUs) by the mean HSI score over the period of analysis within the mitigation area. Approximately 88.23 acres of mitigation (intertidal emergent marsh) would be required to mitigate for the 169.14 acres of habitat impacts resulting from the proposed project. The projected HSI scores for the wetland mitigation site are presented in Attachment D and summarized in Table 12.

Table 12: Mitigation Requirement Calculations

Cover Type	Evaluation Species	Mean HSI Score of evaluation species*	Mean HSI Score of Mitigation Area	Net Impact of the Proposed Project (AAHUs)	Required Mitigation (acres)
Intertidal Emergent Marsh**	Great egret	0.62	0.70	61.76	88.23
	Gulf menhaden	0.90			
	Red drum	0.58			
	White shrimp	0.69			

* Mean HSI score over the period of analysis for the proposed mitigation site.

** Intertidal Emergent Marsh would also mitigate for impacts to Intertidal Unconsolidated Bottom and Sub-tidal Unconsolidated Bottom cover types.

Mitigation is proposed to be comprised of saline marsh habitat that would be constructed within the Galveston Bay system. Details of the proposed mitigation plan are described in the Environmental Assessment.

6.0 REFERENCES

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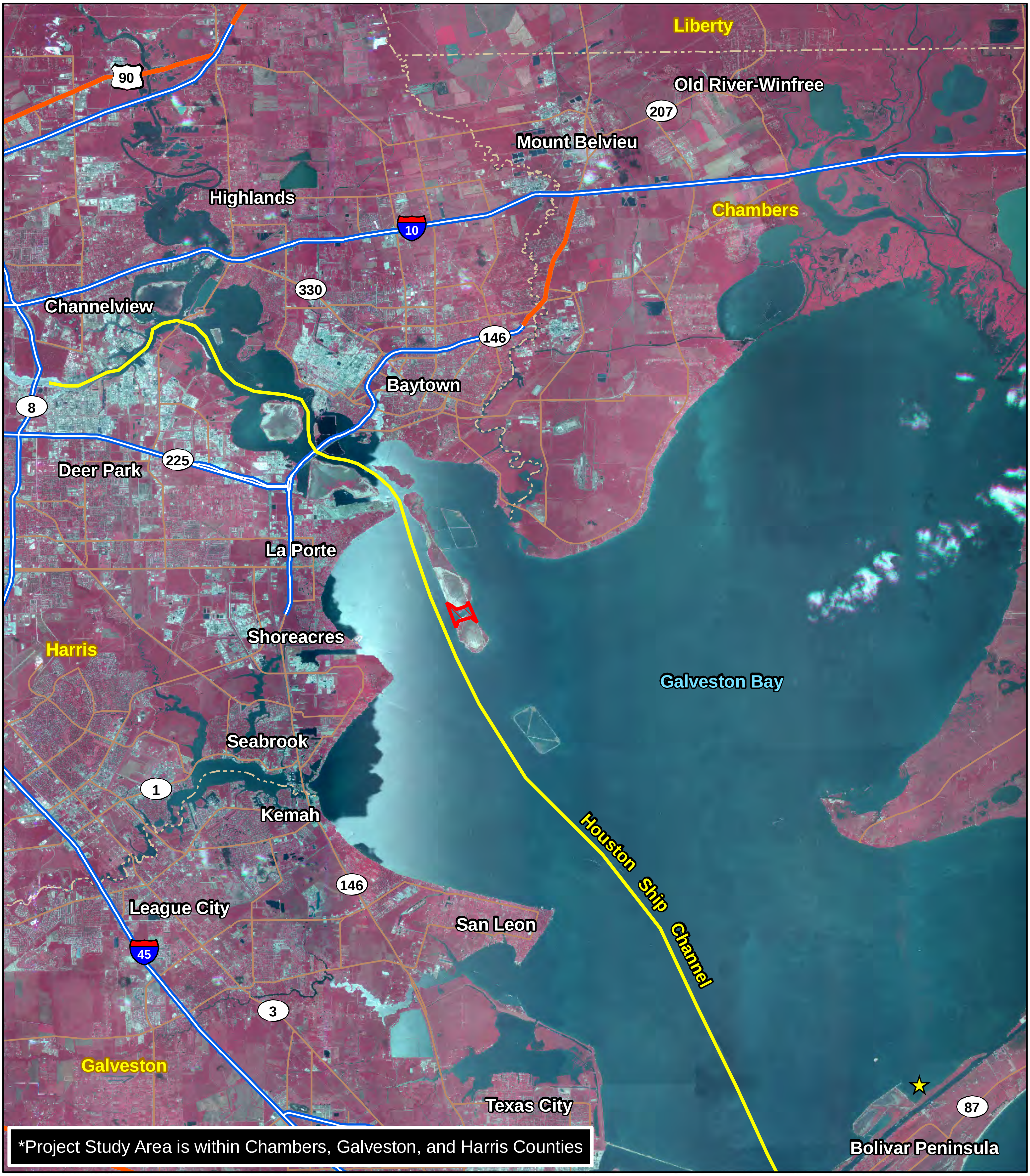
HEP Exhibits



Expansion Area

Approximate Location of Proposed Mitigation Area

Houston Ship Channel

N

0 2 4 Miles

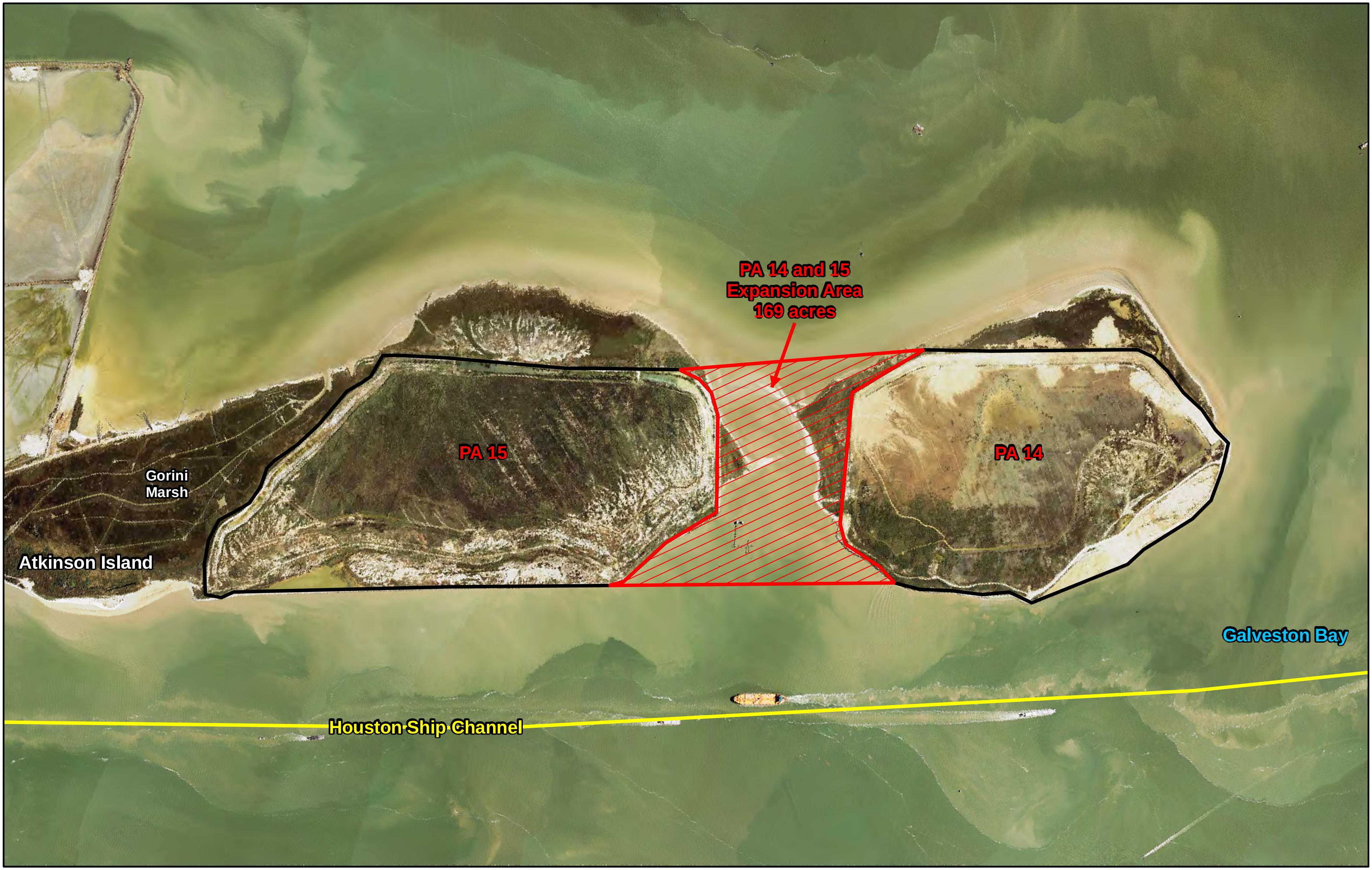
11/17/2009

US Army Corps of Engineers ® Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel

2004 HISTORICAL AERIAL INRFRARED PHOTOGRAPH
WITH PROPOSED EXPANSION AREA DATA OVERLAY
EXHIBIT 1

Chambers, Galveston, Harris and Liberty Counties, Texas



Expansion Area PA Houston Ship Channel

N

0 1,000 2,000 Feet

US Army Corps of Engineers®
Galveston District

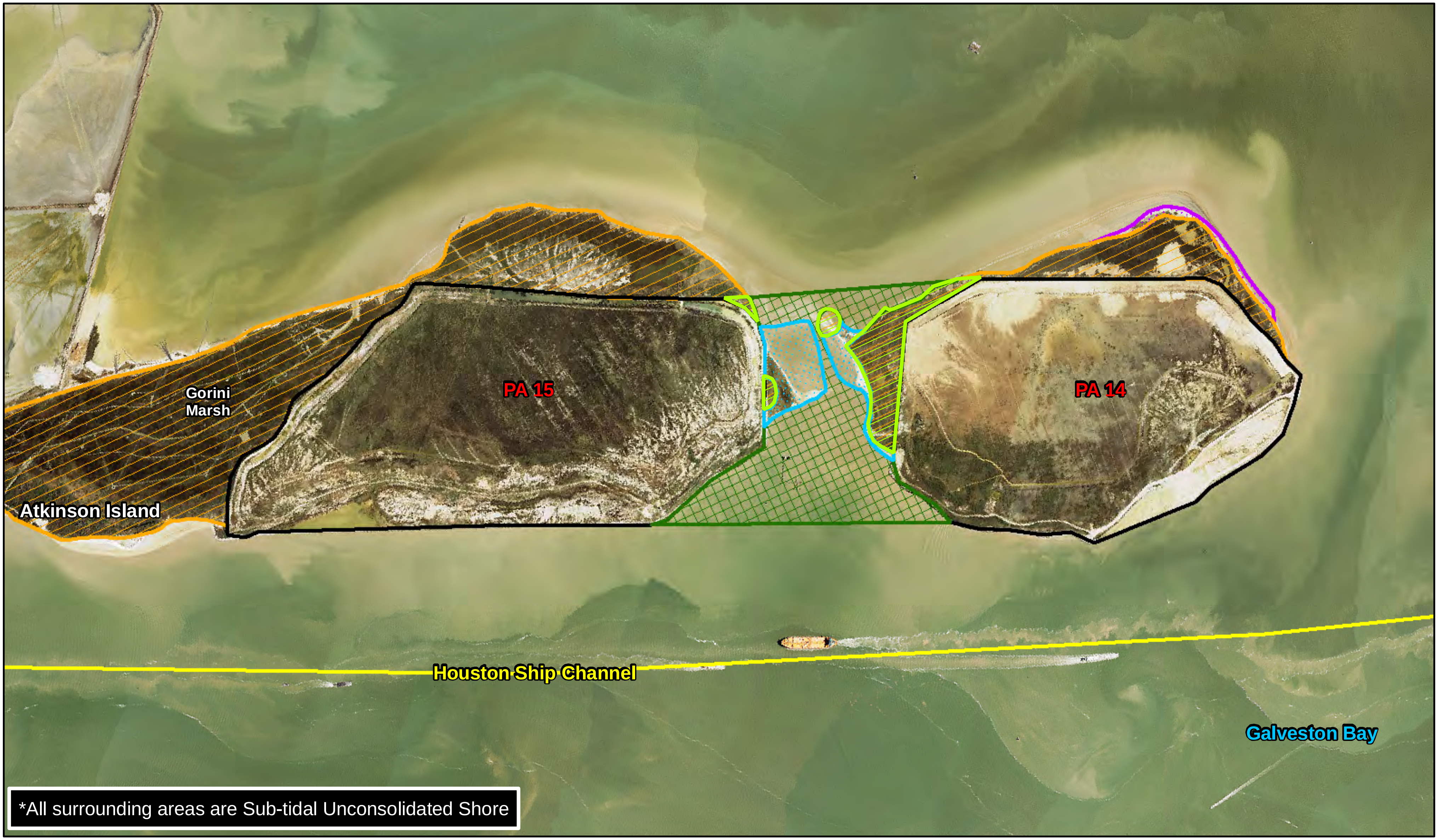
11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA DATA OVERLAYS

EXHIBIT 2

Chambers County, Texas



PA — Intertidal Emergent Marsh — Impacted Intertidal Emergent Marsh (29.38 acres) — Impacted Sub-tidal Unconsolidated Bottom (112.67 acres)

Houston Ship Channel — Intertidal Unconsolidated Shore — Impacted Intertidal Unconsolidated Shore (27.09 acres)

N

0 1,000 2,000 Feet

US Army Corps of Engineers®
Galveston District

11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA AND IMPACTED HABITATS DATA OVERLAYS

EXHIBIT 3

Chambers County, Texas

Approximate Location of Proposed Mitigation Area

N

0 1,500 3,000 Feet

11/17/2009

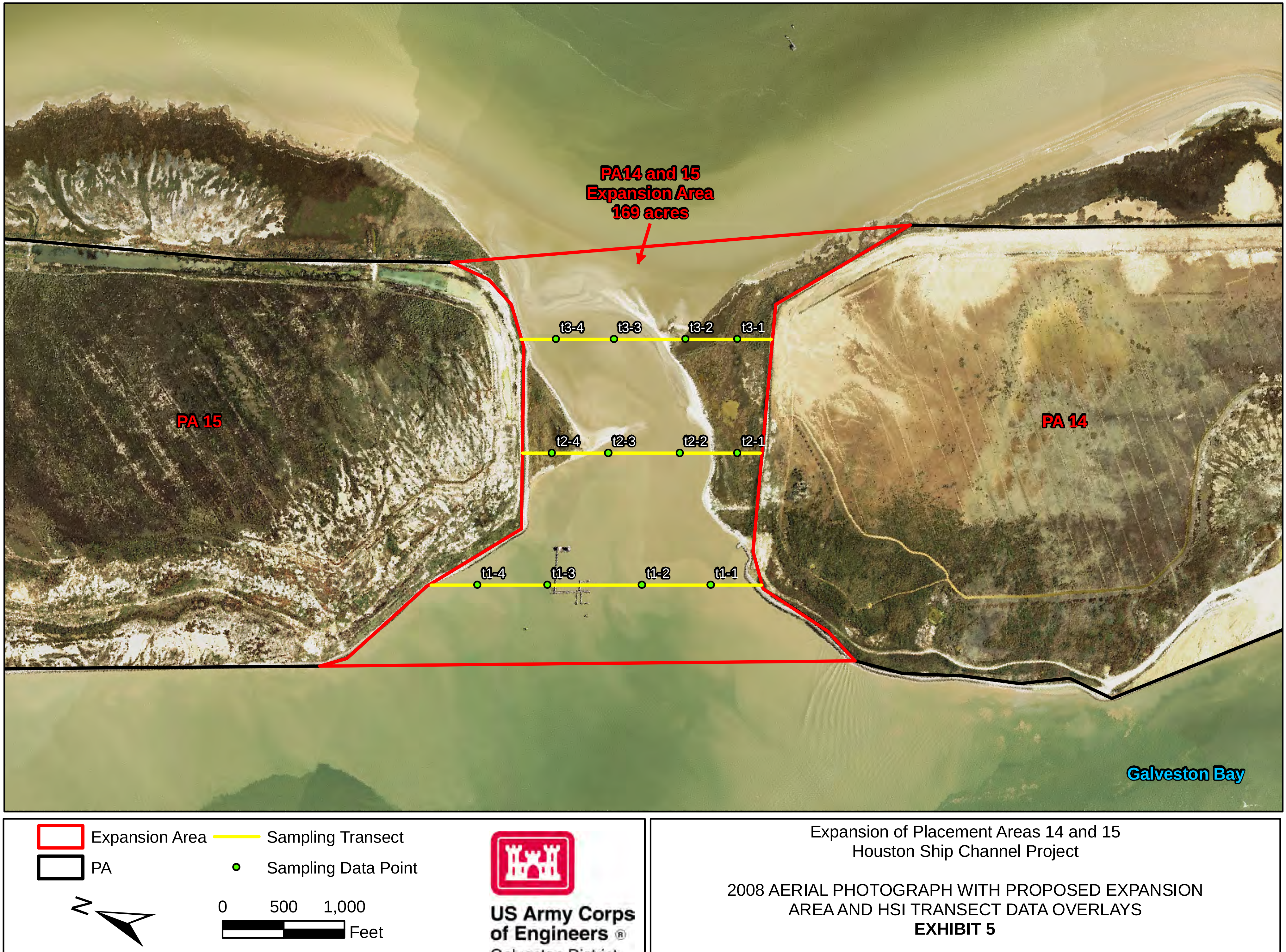
US Army Corps of Engineers ®
Galveston District

Expantion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH APPROXIMATE LOCATION OF PROPOSED MITIGATION AREA

EXHIBIT 4

Galverston County, Texas



US Army Corps of Engineers®
Galveston District

11/17/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA AND HSI TRANSECT DATA OVERLAYS

EXHIBIT 5

Chambers County, Texas

HEP ATTACHMENT A

Baseline and Projected HSI Scores for Project Site

Subtidal Unconsolidated Bottom HSI Scores

Mean Subtidal Unconsolidated Bottom HSI Score 0.35

Great Egret HSI Model

Subtidal Unconsolidated Bottom

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	1.00	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10	10%	0.10
V_2	40-60%	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02	3%	0.02
HSI	$(V_1 + V_2) / 2$		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**		**0.06**

Gulf Menhaden HSI Model

Subtidal Unconsolidated Bottom

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_3	5-20ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_5	Mud	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30	Muddy Sand	0.30
V_8	5-20°C	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00
V_9	5-13ppt	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00
V_{10}	>5ppm	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00
V_{11}	>1000ac.	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00
V_{12}	Brown	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00
V_{13}	40-60%	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00
V_{14}	10-35ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
WQSI	$\{(V_8 + V_{13})^{1/2} + (V_9 + V_{14})^{1/2} + V10\}/3$		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67
FSI	$\{(V_3)^2 \times (V_{12})^2 \times V_5\}^{1/5}$		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79		0.79
CSI	V_{11}		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
HSI	$\{WQSI \times (FSI)^2 X\ CSI\}^{1/4}$		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**		**0.80**

Red Drum HSI Model

Subtidal Unconsolidated Bottom

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	25-30°C	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
V_2	25-30ppt	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10
V_3	100%	10%	0.27	10%	0.27	10%	0.27	10%	0.27	10%	0.27	10%	0.27	15%	0.32	15%	0.32	15%	0.32	15%	0.32	20%	0.35	20%	0.35	30%	0.40	40%	0.50	50%	0.60	60%	0.70	70%	0.80
V_5	Mud	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90	Muddy sand	0.90
V_6	1.5-2.5m	1.5	1.00	1.5	1.00	1.5	1.00	1.5	1.00	1.5	1.00	1.5	1.00	1.5	1.00	1.5	1.00	1.5	1.00	1.5	1.00	1.4	0.94	1.4	0.94	1.3	0.88	1.2	0.81	1.1	0.76	1.0	0.70	0.9	0.67
WQSI	$(V_1^2 x V_2)^{1/3}$		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46
FSI	V_3		0.27		0.27		0.27		0.27		0.27		0.27		0.32		0.32		0.32		0.32		0.35		0.35		0.40		0.50		0.60		0.70		0.80
CSI	$(V_5 \times V_6)^{1/2}$		0.95		0.95		0.95		0.95		0.95		0.95		0.95		0.95		0.95		0.95		0.92		0.92		0.89		0.85		0.83		0.79		0.78
HSI	Lowest among WQSI, FSI, and CSI		**0.27**		**0.27**		**0.27**		**0.27**		**0.27**		**0.27**		**0.32**		**0.32**		**0.32**		**0.32**		**0.35**		**0.35**		**0.40**		**0.46**		**0.46**		**0.46**		**0.46**

Subtidal Unconsolidated Bottom HSI Scores

White Shrimp HSI Model

Subtidal Unconsolidated Bottom

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	100%	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20
V_{2w}	Mud	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60
V_{3w}	0.1-15ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_4	20-30°C	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
WQSI	$(V_{3w} x V_4)^{1/2}$		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
FCSI	$(V_1^2 x V_{2w})^{1/3}$		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29		0.29
HSI	Lowest among WQSI and FCSI		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**		**0.29**

Average HSI

	Great Egret	**Gulf Menhaden**	**Red Drum**	**White Shrimp**	**Avg.**
TY1	0.06	0.80	0.27	0.29	**0.35**
TY2	0.06	0.80	0.27	0.29	**0.35**
TY3	0.06	0.80	0.27	0.29	**0.35**
TY4	0.06	0.80	0.27	0.29	**0.35**
TY5	0.06	0.80	0.27	0.29	**0.35**
TY6	0.06	0.80	0.32	0.29	**0.37**
TY7	0.06	0.80	0.32	0.29	**0.37**
TY8	0.06	0.80	0.32	0.29	**0.37**
TY9	0.06	0.80	0.32	0.29	**0.37**
TY10	0.06	0.80	0.35	0.29	**0.37**
TY11	0.06	0.80	0.35	0.29	**0.37**
TY12	0.06	0.80	0.40	0.29	**0.39**
TY13	0.06	0.80	0.46	0.29	**0.40**
TY14	0.06	0.80	0.46	0.29	**0.40**
TY15	0.06	0.80	0.46	0.29	**0.40**
TY16	0.06	0.80	0.46	0.29	**0.40**

Intertidal Emergent Marsh HSI Scores

Mean Intertidal Emergent Marsh HSI Score **0.38**

Great Egret HSI Model

Intertidal Emergent Marsh

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	1.00	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30	3%	0.30
V_2	40-60%	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25	90%	0.25
HSI	$(V_1 + V_2) / 2$		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**		**0.28**

Gulf Menhaden HSI Model

Intertidal Emergent Marsh

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_3	5-20ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_5	Mud	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00
V_8	5-20°C	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00
V_9	5-13ppt	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00
V_{10}	>5ppm	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00
V_{11}	>1000ac.	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00
V_{12}	Brown	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00
V_{13}	40-60%	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00
V_{14}	10-35ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
WQSI	$\{(V_8 + V_{13})^{1/2} + (V_9 + V_{14})^{1/2} + V10\}/3$		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67
FSI	$\{(V_3)^2 \times (V_{12})^2 x V_5\}^{1/5}$		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
CSI	V_{11}		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
HSI	$\{WQSI \times (FSI)^2 X\ CSI\}^{1/4}$		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**

Red Drum HSI Model

Intertidal Emergent Marsh

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	25-30°C	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
V_2	25-30ppt	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10
V_3	100%	10%	0.27	10%	0.27	10%	0.27	10%	0.27	10%	0.27	10%	0.27	15%	0.32	15%	0.32	15%	0.32	15%	0.32	20%	0.35	20%	0.35	30%	0.40	40%	0.50	50%	0.60	60%	0.70	70%	0.80
V_5	Mud	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00
V_6	1.5-2.5m	1.5	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
WQSI	$(V_1^2 x V_2)^{1/3}$		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46
FSI	V_3		0.27		0.27		0.27		0.27		0.27		0.27		0.32		0.32		0.32		0.32		0.35		0.35		0.40		0.50		0.60		0.70		0.80
CSI	$(V_5 x V_6)^{1/2}$		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
HSI	Lowest among WQSI, FSI, and CSI		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**

Intertidal Emergent Marsh HSI Scores

White Shrimp HSI Model

Intertidal Emergent Marsh

		TY0		TY1		TY2		TY3		TY4	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI
V_1	100%	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20
V_{2w}	Soft Bottom	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00
V_{3w}	0.1-15ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_4	20-30°C	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
WQSI	$(V_{3w} x V_4)^{1/2}$		1.00		1.00		1.00		1.00		1.00
FCSI	$(V_1^2 x V_{2w})^{1/3}$		0.34		0.34		0.34		0.34		0.34
HSI	Lowest among WQSI and FCSI		**0.34**		**0.34**		**0.34**		**0.34**		**0.34**

	TY5		TY6		TY7		TY8		TY9		TY10	
Variable	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI
V_1	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20
V_{2w}	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00
V_{3w}	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_4	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
WQSI		1.00		1.00		1.00		1.00		1.00		1.00
FCSI		0.34		0.34		0.34		0.34		0.34		0.34
HSI		**0.34**		**0.34**		**0.34**		**0.34**		**0.34**		**0.34**

	TY11		TY12		TY13		TY14		TY15		TY16	
Variable	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20
V_{2w}	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00	Soft Bottom	1.00
V_{3w}	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_4	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
WQSI		1.00		1.00		1.00		1.00		1.00		1.00
FCSI		0.34		0.34		0.34		0.34		0.34		0.34
HSI		**0.34**		**0.34**		**0.34**		**0.34**		**0.34**		**0.34**

Average HSI					
	Great Egret	**Gulf Menhaden**	**Red Drum**	**White Shrimp**	**Avg.**
TY1	0.28	0.90	0.00	0.34	**0.38**
TY2	0.28	0.90	0.00	0.34	**0.38**
TY3	0.28	0.90	0.00	0.34	**0.38**
TY4	0.28	0.90	0.00	0.34	**0.38**
TY5	0.28	0.90	0.00	0.34	**0.38**
TY6	0.28	0.90	0.00	0.34	**0.38**
TY7	0.28	0.90	0.00	0.34	**0.38**
TY8	0.28	0.90	0.00	0.34	**0.38**
TY9	0.28	0.90	0.00	0.34	**0.38**
TY10	0.28	0.90	0.00	0.34	**0.38**
TY11	0.28	0.90	0.00	0.34	**0.38**
TY12	0.28	0.90	0.00	0.34	**0.38**
TY13	0.28	0.90	0.00	0.34	**0.38**
TY14	0.28	0.90	0.00	0.34	**0.38**
TY15	0.28	0.90	0.00	0.34	**0.38**
TY16	0.28	0.90	0.00	0.34	**0.38**

Intertidal Unconsolidated Shore HSI Scores

Mean Intertidal Unconsolidated Shore HSI Score 0.31

Great Egret HSI Model

Intertidal Unconsolidated Shore

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	1.00	50%	0.50	50%	0.50	50%	0.50	50%	0.50	50%	0.50	50%	0.50	55%	0.55	55%	0.55	55%	0.55	55%	0.55	55%	0.55	55%	0.55	60%	0.60	65%	0.65	70%	0.70	75%	0.75	80%	0.80
V_2	40-60%	1%	0.11	1%	0.11	1%	0.11	1%	0.11	1%	0.11	1%	0.11	5%	0.20	5%	0.20	5%	0.20	5%	0.20	5%	0.20	5%	0.20	10%	0.33	15%	0.45	20%	0.55	25%	0.70	30%	0.80
HSI	$(V_1 + V_2) / 2$		**0.31**		**0.31**		**0.31**		**0.31**		**0.31**		**0.31**		**0.38**		**0.38**		**0.38**		**0.38**		**0.38**		**0.38**		**0.47**		**0.55**		**0.63**		**0.73**		**0.80**

Gulf Menhaden HSI Model

Intertidal Unconsolidated Shore

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_3	5-20ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_5	Mud	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10	Sand/Shell	0.10
V_8	5-20°C	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00	12.04	1.00
V_9	5-13ppt	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00	6.19	1.00
V_{10}	>5ppm	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00	2.25	0.00
V_{11}	>1000ac.	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00	>1000ac.	1.00
V_{12}	Brown	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00
V_{13}	40-60%	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00	30.7	1.00
V_{14}	10-35ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
WQSI	$\{(V_8 + V_{13})^{1/2} + (V_9 + V_{14})^{1/2} + V10\}/3$		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67
FSI	$\{(V_3)^2 \times (V_{12})^2 \times V_5)^{1/5}$		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63		0.63
CSI	V_{11}		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
HSI	$\{WQSI \times (FSI)^2 X\ CSI\}^{1/4}$		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**		**0.72**

Red Drum HSI Model

Intertidal Unconsolidated Shore

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	25-30°C	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
V_2	25-30ppt	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10	11.83	0.10
V_3	100%	10%	0.27	10%	0.27	10%	0.27	10%	0.27	10%	0.27	10%	0.27	15%	0.32	15%	0.32	15%	0.32	15%	0.32	20%	0.35	20%	0.35	30%	0.40	40%	0.50	50%	0.60	60%	0.70	70%	0.80
V_5	Mud	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00
V_6	1.5-2.5m	1.5	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
WQSI	$(V_1^2 \times V_2)^{1/3}$		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46		0.46
FSI	V_3		0.27		0.27		0.27		0.27		0.27		0.27		0.32		0.32		0.32		0.32		0.35		0.35		0.40		0.50		0.60		0.70		0.80
CSI	$(V_5 \times V_6)^{1/2}$		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
HSI	Lowest among WQSI, FSI, and CSI		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**

Intertidal Unconsolidated Shore HSI Scores

White Shrimp HSI Model

Intertidal Unconsolidated Shore

		TY0		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16	
Variable	Optimal	2009 (Baseline)	SI	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2030	SI	2040	SI	2050	SI	2060	SI	2070	SI
V_1	100%	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20	20%	0.20
V_{2w}	Soft Bottom	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20	Sand	0.20
V_{3w}	0.1-15ppt	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00	11.83	1.00
V_4	20-30°C	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00	29.31	1.00
WQSI	$(V_{3w} x V_4)^{1/2}$		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
FCSI	$(V_1^2 x V_{2w})^{1/3}$		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20		0.20
HSI	Lowest among WQSI and FCSI		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**		**0.20**

Average HSI					
	Great Egret	**Gulf Menhaden**	**Red Drum**	**White Shrimp**	**Avg.**
TY1	0.31	0.72	0.00	0.20	**0.31**
TY2	0.31	0.72	0.00	0.20	**0.31**
TY3	0.31	0.72	0.00	0.20	**0.31**
TY4	0.31	0.72	0.00	0.20	**0.31**
TY5	0.31	0.72	0.00	0.20	**0.31**
TY6	0.38	0.72	0.00	0.20	**0.32**
TY7	0.38	0.72	0.00	0.20	**0.32**
TY8	0.38	0.72	0.00	0.20	**0.32**
TY9	0.38	0.72	0.00	0.20	**0.32**
TY10	0.38	0.72	0.00	0.20	**0.32**
TY11	0.38	0.72	0.00	0.20	**0.32**
TY12	0.47	0.72	0.00	0.20	**0.35**
TY13	0.55	0.72	0.00	0.20	**0.37**
TY14	0.63	0.72	0.00	0.20	**0.39**
TY15	0.73	0.72	0.00	0.20	**0.41**
TY16	0.80	0.72	0.00	0.20	**0.43**

HEP ATTACHMENT B

AAHUs for “With Project” Conditions and “Without Project” Conditions

Without Project AAHUs

Total AAHUs: 71.17

Cumulative habitat units:

$$(T2-T1)\left|\frac{A2H2 + A1H1}{3.00} + \frac{A2H1 + A1H2}{6.00}\right|$$

T1: First Year of time interval
T2: Second year of time interval
A1: Habitat area of first target year
A2: Habitat area of second target year
H1: HSI of first target year
H2: HSI of second target year

Average Annual Habitat Units = Total cumulative HU's/years

Expansion of DMPAs 14 & 15

TY	Year	Subtidal Unconsolidated Bottom					Intertidal Emergent Marsh					Intertidal Unconsolidated Shore				
		Acres	HSI	HU's	Cumulative HU's	AAHUs	Acres	HSI	HU's	Cumulative HU's	AAHUs	Acres	HSI	HU's	Cumulative HU's	AAHUs
TY0	2009	112.67	0.35	39.43			29.38	0.38	11.16			27.09	0.31	8.40		
TY1	2010	112.67	0.35	39.43	39.43		29.38	0.38	11.16	11.16		27.09	0.31	8.40	8.40	
TY2	2011	112.67	0.35	39.43	39.43		29.38	0.38	11.16	11.16		27.09	0.31	8.40	8.40	
TY3	2012	112.67	0.35	39.43	39.43		29.38	0.38	11.16	11.16		27.09	0.31	8.40	8.40	
TY4	2013	112.67	0.35	39.43	39.43		29.38	0.38	11.16	11.16		27.09	0.31	8.40	8.40	
TY5	2014	112.67	0.35	39.43	39.43		29.38	0.38	11.16	11.16		27.09	0.31	8.40	8.40	
TY6	2015	112.67	0.37	41.69	40.56		29.38	0.38	11.16	11.16		27.09	0.32	8.67	8.53	
TY7	2016	112.67	0.37	41.69	41.69		29.38	0.38	11.16	11.16		27.09	0.32	8.67	8.67	
TY8	2017	112.67	0.37	41.69	41.69	49.53	29.38	0.38	11.16	11.16	11.50	27.09	0.32	8.67	8.67	10.15
TY9	2018	112.67	0.37	41.69	41.69		29.38	0.38	11.16	11.16		27.09	0.32	8.67	8.67	
TY10	2019	112.67	0.37	41.69	41.69		29.38	0.38	11.16	11.16		27.09	0.32	8.67	8.67	
TY11	2020	112.67	0.40	45.07	43.38		29.38	0.38	11.16	11.16		27.09	0.33	8.94	8.80	
TY12	2030	112.67	0.42	47.32	461.95		29.38	0.38	11.16	111.64		27.09	0.35	9.48	92.11	
TY13	2040	112.67	0.45	50.70	490.11		29.38	0.38	11.16	111.64		27.09	0.37	10.02	97.52	
TY14	2050	112.67	0.46	51.83	512.65		29.38	0.39	11.46	113.11		27.09	0.39	10.57	102.94	
TY15	2060	112.67	0.47	52.95	523.92		29.38	0.39	11.46	114.58		27.09	0.41	11.11	108.36	
TY16	2070	112.67	0.48	54.08	535.18		29.38	0.40	11.75	116.05		27.09	0.43	11.65	113.78	

With Project AAHUs

Total AAHUs: 9.42

Cumulative habitat units:

$$(T2-T1)\left|\frac{A2H2 + A1H1}{3.00} + \frac{A2H1 + A1H2}{6.00}\right|$$

T1: First Year of time interval
T2: Second year of time interval
A1: Habitat area of first target year
A2: Habitat area of second target year
H1: HSI of first target year
H2: HSI of second target year

Average Annual Habitat Units = Total cumulative HU's/years

Expansion of DMPAs 14 & 15

TY	Year	Subtidal Unconsolidated Bottom					Intertidal Emergent Marsh					Intertidal Unconsolidated Shore				
		Acres	HSI	HU's	Cumulative HU's	AAHUs	Acres	HSI	HU's	Cumulative HU's	AAHUs	Acres	HSI	HU's	Cumulative HU's	AAHUs
TY0	2009	112.67	0.35	39.435		7.60	29.38	0.38	11.164		1.53	27.09	0.31	8.398		0.28
TY1	2010	93.17	0.35	32.610	36.022		21.77	0.38	8.273	9.719		14.43	0.31	4.473	6.436	
TY2	2011	73.67	0.35	25.785	29.197		14.17	0.38	5.385	6.829		1.77	0.31	0.549	2.511	
TY3	2012	73.67	0.35	25.785	25.785		14.17	0.38	5.385	5.385		1.77	0.31	0.549	0.549	
TY4	2013	73.67	0.35	25.785	25.785		14.17	0.38	5.385	5.385		1.77	0.31	0.549	0.549	
TY5	2014	73.67	0.35	25.785	25.785		14.17	0.38	5.385	5.385		1.77	0.31	0.549	0.549	
TY6	2015	73.67	0.37	27.258	26.521		14.17	0.38	5.385	5.385		1.77	0.32	0.566	0.558	
TY7	2016	73.67	0.37	27.258	27.258		14.17	0.38	5.385	5.385		1.77	0.32	0.566	0.566	
TY8	2017	73.67	0.37	27.258	27.258		14.17	0.38	5.385	5.385		1.77	0.32	0.566	0.566	
TY9	2018	73.67	0.37	27.258	27.258		14.17	0.38	5.385	5.385		1.77	0.32	0.566	0.566	
TY10	2019	73.67	0.37	27.258	27.258		14.17	0.38	5.385	5.385		1.77	0.32	0.566	0.566	
TY11	2020	73.67	0.40	29.468	28.363		14.17	0.38	5.385	5.385		1.77	0.33	0.584	0.575	
TY12	2030	0.00	0.42	0.000	149.796		0.00	0.38	0.000	26.923		0.00	0.35	0.000	2.980	
TY13	2040	0.00	0.45	0.000	0.000		0.00	0.38	0.000	0.000		0.00	0.37	0.000	0.000	
TY14	2050	0.00	0.46	0.000	0.000		0.00	0.39	0.000	0.000		0.00	0.39	0.000	0.000	
TY15	2060	0.00	0.47	0.000	0.000		0.00	0.39	0.000	0.000		0.00	0.41	0.000	0.000	
TY16	2070	0.00	0.48	0.000	0.000		0.00	0.40	0.000	0.000		0.00	0.43	0.000	0.000	

HEP ATTACHMENT C

Future Wetland Mitigation Scores

Mitigation Area HSI Scores

Mean Mitigation Area HSI Score 0.70

Great Egret HSI Model

Mitigation Area

		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16		TY17		TY18		TY19		TY20	
Variable	Optimal	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2021	SI	2022	SI	2023	SI	2024	SI	2029	SI	2039	SI	2049	SI	2059	SI	2069	SI
V_1	1.00	12%	0.12	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35	35%	0.35
V_2	40-60%	4%	0.15	10%	0.15	25%	0.70	40%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00	50%	1.00
HSI	$(V_1 + V_2) / 2$		**0.14**		**0.25**		**0.53**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**		**0.68**

Average HSI = 0.62

Gulf Menhaden HSI Model

Subtidal Unconsolidated Bottom

		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16		TY17		TY18		TY19		TY20	
Variable	Optimal	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2021	SI	2022	SI	2023	SI	2024	SI	2029	SI	2039	SI	2049	SI	2059	SI	2069	SI
V_3	5-20ppt	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00
V_5	Mud	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00
V_8	5-20°C	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00	10.96	1.00
V_9	5-13ppt	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00	8.63	1.00
V_{10}	>5ppm	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00	2.88	0.00
V_{11}	>1000ac.	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00	>1000	1.00
V_{12}	Brown	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00	Brown	1.00
V_{13}	40-60%	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00	30.34	1.00
V_{14}	10-35ppt	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00	18.5	1.00
WQSI	$\{(V_8 + V_{13})^{1/2} + (V_9 + V_{14})^{1/2} + V10)/3$		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67		0.67
FSI	$\{(V_3)^2 \times (V_{12})^2 \times V_5\}^{1/5}$		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
CSI	V_{11}		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
HSI	$\{WQSI \times (FSI)^2 X\ CSI\}^{1/4}$		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**		**0.90**

Average HSI = 0.90

Red Drum HSI Model

Mitigation Area

		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16		TY17		TY18		TY19		TY20	
Variable	Optimal	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2021	SI	2022	SI	2023	SI	2024	SI	2029	SI	2039	SI	2049	SI	2059	SI	2069	SI
V_1	25-30°C	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65	21.07	0.65
V_2	25-30ppt	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55	18.5	0.55
V_3	100%	0%	0.20	6%	0.26	50%	0.60	75%	0.80	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00	100%	1.00
V_5	Mud	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00	Mud	1.00
V_6	1.5-2.5m	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70	1	0.70
WQSI	$(V_1^2 x V_2)^{1/3}$		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61		0.61
FSI	V_3		0.20		0.26		0.60		0.80		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
CSI	$(V_5 \times V_6)^{1/2}$		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84
HSI	Lowest among WQSI, FSI, and CSI		**0.20**		**0.26**		**0.60**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**		**0.61**

Average HSI = 0.58

White Shrimp HSI Model

Mitigation Area

		TY1		TY2		TY3		TY4		TY5		TY6		TY7		TY8		TY9		TY10		TY11		TY12		TY13		TY14		TY15		TY16		TY17		TY18		TY19		TY20	
Variable	Optimal	2010	SI	2011	SI	2012	SI	2013	SI	2014	SI	2015	SI	2016	SI	2017	SI	2018	SI	2019	SI	2020	SI	2021	SI	2022	SI	2023	SI	2024	SI	2029	SI	2039	SI	2049	SI	2059	SI	2069	SI
V_1	100%	10%	0.10	20%	0.20	40%	0.40	60%	0.60	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82	82%	0.82
V_{2w}	Mud	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Muddy sand	0.60	Org. Mud	1.00	Org. Mud	1.00	Org. Mud	1.00	Org. Mud	1.00
V_{3w}	0.1-15ppt	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99	15.19	0.99
V_4	20-30°C	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00	29.49	1.00
WQSI	$(V_{3w} x V_4)^{1/2}$		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99		0.99
FCSI	$(V_1^2 x V_{2w})^{1/3}$		0.18		0.29		0.46		0.60		0.74		0.74		0.74		0.74		0.74		0.74		0.74		0.74		0.74		0.74		0.74		0.74		0.88		0.88		0.88		0.88
HSI	Lowest among WQSI and FCSI		**0.18**		**0.29**		**0.46**		**0.60**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.74**		**0.88**		**0.88**		**0.88**		**0.88**

Average HSI = 0.69

Appendix F

Mitigation Cost Effectiveness/Incremental Cost Analysis

1.0 BACKGROUND INFORMATION

1.1 Project Description

The proposed expansion of Placement Area ("PA") 14 and 15 includes the construction of an expanded PA. The project is located in Chambers County, Texas, within upper Galveston Bay at the southern tip of Atkinson Island. Please refer to Exhibits 1 and 2 for the location of the proposed project. The proposed action includes construction of perimeter levees to enclose approximately 169 acres of land between existing PA's 14 and 15. Subsequent to construction of the perimeter levees, dredged material from maintenance dredging activities would be placed within the levees.

The purpose of the project is to allow maintenance dredging activities to continue so that the Houston Ship Channel ("HSC") is maintained at its authorized depth. Existing PA's are reaching capacities. Additional capacity is required so that maintenance dredging activities within the HSC would not be delayed or interrupted. The proposed project would increase available capacity to receive dredged material from the HSC, allow the HSC to accommodate the anticipated mix and volume of future commercial vessel traffic, and maintain navigation safety by providing a safe draft depth in the channel.

Construction of the proposed project would impact approximately 169 acres and three habitat types. Habitat cover types within the proposed project footprint consist of sub-tidal unconsolidated bottom, intertidal emergent marsh, and intertidal unconsolidated shore. Cover types were determined during an on-site field assessment of the project area on October 6, 2009. Cover types within the project footprint were delineated based upon site conditions observed during the on-site field assessment in addition to aerial photographic interpretation. Exhibit 3 depicts the anticipated direct impacts to on-site habitats due to construction of the expanded PA. Impacts from the proposed project will be mitigated through the off-site creation of intertidal emergent marsh.

1.2 HEP Overview

A habitat evaluation procedure ("HEP"), developed by the U.S. Fish and Wildlife Service ("USFWS"), was used to quantify the impacts of the proposed project by quantifying the quality of the habitat to support wildlife in general, being measured through habitat characteristics for representative species (USFWS, 1980). For the HEP analysis, the study area consisted of the project footprint. HEP is a species-habitat approach to impact assessment that quantifies habitat quality for selected evaluation species through the use of a habitat suitability index ("HSI"). The HSI score is derived from an evaluation of the ability of key habitat components to provide the life requisites of selected species of wildlife (USFWS, 1980). HEP is based on the assumption that habitat for selected species can be described by an HSI. Based on the cover types present within the detention complexes, four HSI models were selected to evaluate the habitat quality within the project area: great egret, gulf menhaden, red drum, and white shrimp. The species HSI or the average HSI for multiple species is multiplied by the area of available habitat to determine the total habitat units ("HU") for the species for particular cover types in the project area.

The HEP project impact analysis projects future habitat conditions over the period of analysis in terms of average annual habitat units ("AAHU") and determines the net impact of the proposed project in terms of AAHU's. AAHU's were calculated for the habitat conditions within the project area with and without the proposed project constructed to determine the net impact. The net impact is the difference between the AAHU's without the proposed project and the AAHU's with the proposed project. **The net impact of the proposed project is 61.76 AAHU's**. Please refer to the Habitat Evaluation Procedure report for further details regarding these analyses (U.S. Army Corps of Engineers ["USACE"], 2009).

2.0 INTRODUCTION

This report presents a Cost Effective/Incremental Cost Analysis ("CE/ICA") to determine the most cost-effective mitigation alternative for the habitat impacts associated with the proposed project. Any required mitigation for habitat losses would be mitigated through the creation of saline marsh habitat within the Galveston Bay system. Three viable alternatives for compensatory mitigation for impacts to sub-tidal unconsolidated bottom, intertidal emergent marsh, and intertidal unconsolidated shore were identified and evaluated, as documented in this report (Chapter 4). All three mitigation alternatives were evaluated using the USACE Institute for Water Resources ("IWR") Planning Suite software. Please refer to Chapter 4 for a detailed description of each alternative.

A CE/ICA is required by the USACE for all recommended mitigation alternatives associated with a Federal project. The cost effectiveness analysis evaluates the relationship between the cost and environmental output (AAHU) associated with each mitigation alternative. The term "cost effective" means that for a particular level of output no other plan costs less. Furthermore, no plan yields more output for the same or less cost. The incremental cost analysis evaluates the relationship between the costs incurred to realize each unit of output (AAHU) associated with each alternative. In the incremental cost analysis, those cost effective alternatives that are most efficient in production are identified. These alternatives, known as "best buy" alternatives, provide the greatest increase in output for the least increase in cost. The "best buy" alternative(s) represents the most cost-effective mitigation alternative(s) (USACE, 2000).

3.0 METHODS

The IWR Planning Suite software offers evaluations of cost effectiveness and incremental cost analysis in terms of environmental output. Data for the mitigation alternatives, including AAHU's gained, cost, and acres per mitigation alternative, was input into IWR Planning Suite as the mitigation solutions. The acreage required for mitigation is based on the HSI score for each alternative mitigation area and the AAHU's associated with the habitat impacts as described in Chapter 1. The HEP report identified a mean HSI score at the Bolivar Peninsula Marsh Restoration Area of 0.70. For this analysis, a mean HSI score of 0.70 was assumed at each alternative mitigation area. The AAHU's were divided by the HSI score to determine the mitigation acreage requirements (AAHU/HSI = acres or 61.76/0.70 = 88.23). A CE/ICA was then run on the mitigation alternatives. Each plan was determined to be cost effective, not cost effective, or a Best Buy plan. A plan that provided the same amount of AAHU's for a higher cost compared to another alternative was determined to be not cost effective.

4.0 MITIGATION ALTERNATIVES

Proposed mitigation would consist of creation of saline marsh habitat within the Galveston Bay system. Based upon studies conducted by the National Marines Fisheries Service ("NMFS"), the replacement of open water bay bottom habitat with intertidal brackish and salt marsh habitats would provide a net positive benefit to the Galveston Bay ecosystem (Zimmerman, et al., 1992). The study also determined the areas within the Bay most likely to provide the greatest potential for marsh establishment by comparing various habitats and locations in the bay. In addition, the study concluded that abundance and biomass were usually significantly higher in the marsh than the open bay. Additional marsh creation design studies by NMFS concluded that greater emphasis should be given to constructing low marsh edge habitat by creating large areas of smooth cordgrass, and perhaps small cordgrass (*Spartina maritima*) marsh interspersed with a dense network of shallow channels and interconnected ponds. This design was prepared due to the findings that migratory species (marine fishes and invertebrates that migrate into marshes during favorable conditions or that utilize marsh as nursery habitats) use marsh edge much more frequently than marsh interior.

By constructing saline marsh, the mitigation project would also contribute habitat to the bay that yields significantly higher abundance and biomass of marine organisms. Design principles that would increase utilization of marine species, such as creation of a large amount of marsh edge, would be incorporated into mitigation design.

The HEP analysis was performed on the impact area to determine the appropriate amount of mitigation that would be required to replace the values and functions of the habitat lost due to construction of the proposed project. Based upon the HEP analysis, 88.23 acres of mitigation would be required to fully mitigate for the 61.76 AAHU's of project impacts. Mitigation project design would incorporate a series of marsh mounds designed to increase the amount of available marsh edge habitat.

The mitigation area would be constructed in a location that would be relatively protected from wave and wind energy, thus increasing the likelihood of success. Proposed construction techniques vary based on the proposed location and alternative.

Vegetation to be planted would be comprised of plants that grow well and reproduce easily with minimum care and remain free of disease or pest infestation in the specific environmental conditions in which they would be planted. Considerations regarding the means and methods to vegetate the site are availability and costs, collection and handling ease, storage ease, and planting ease. Species likely to be utilized include smooth cordgrass and saltmeadow cordgrass (*Spartina patens*).

The type of propagule to be used (seed versus transplant) and the method(s) of planting would be considered for each species. The uniqueness of planting large quantities of plant material on dredged material would be a primary consideration of the planting method. Economically feasible mechanical and hand planting methods would be considered.

Based on the mitigation requirements, two mitigation locations were established. The mitigation alternatives analysis evaluates the potential costs and output of AAHU's associated with two mitigation locations (Atkinson Island and Bolivar Peninsula). Within these locations, three alternatives were evaluated. These alternatives include the following:

Alternative 1 Creation of saline marsh habitat features within Atkinson Island.

Alternative 2 Creation of saline marsh habitat features within Bolivar Peninsula using rock dike.

Alternative 3 Creation of saline marsh habitat features within Bolivar Peninsula using geotextile tube.

These alternatives are discussed in detail below.

4.1 Alternative 1: Creation of Saline Marsh Habitat Features Within Atkinson Island

Alternative 1 would consist of creating marsh habitat within Atkinson Island per the HEP results. This area was selected because it is the location of an existing marsh restoration project. The Atkinson Island Marsh Restoration project area is located northeast of the existing upland PA's 15 and 16, east of the HSC, near Barbour's Cut. It is in the north end of Galveston Bay. This is a beneficial use site that uses dredged material from maintenance dredging of the HSC. Based on the HEP project impact analysis, 88.23 acres of habitat creation would be required at this site to mitigate for the 169.14 acres of impacts resulting from the proposed project.

The costs to create the mitigation area were based on the following:

- No land costs are included in the price as land is already procured for the beneficial use site.
- Construction – Construction costs were estimated and the following assumptions were applied. Please see Table 1 for a summary of the construction costs.
  - Includes construction of permanent and temporary structures as needed to fill sites to marsh elevation limits.
  - Various types of containment/semi-containment levees would be constructed and maintained.
  - Riprap erosion protection is included.
  - A 27- to 30-inch dredge is assumed for excavation and two marsh backhoes are assumed for material distribution and final shaping.
  - Fill is provided at no charge from the maintenance dredging of the HSC.
  - Cost of stone for rock dikes is estimated at $80/ton.
  - The cost of rock dike construction varies based on the water depth and displacement depth within the restoration area, increasing costs with increasing depths. In this area, water depths range from 1 foot to 5 feet and displacement depths range from 1 foot to 6.5 feet.
  - Mobilization and demobilization costs will be included as part of existing contracted work.

Table 1: Construction Costs at Atkinson Island

Task	Unit Cost	Unit	Cost
Rock dike construction	$593/foot	1,175	$696,775
Cost of fill	N/A	N/A	$0
Cost of riprap erosion protection	$500/foot	1,175	$587,500
Circulation channels	$500,000	1	$500,000
Total			**$1,784,275**

- Planting - $650 per acre (per previously estimated planting costs at Bolivar Peninsula Restoration Area in Galveston Bay).

Table 2: Planting Costs

Task	Acres	Total Cost ($)
Marsh Planting	88.23	57,350

- Monitoring and corrective measures – $21,400 for five years of monitoring (per the Sabine-Neches Waterway Monitoring Plan estimated costs prepared for USACE).

Total cost for creation of 88.23 acres at Atkinson Island = $1,863,025 ($1,784,275 for construction + $57,350 for planting + $21,400 for monitoring).

4.2 Alternative 2: Creation of Saline Marsh Habitat Features Within Bolivar Peninsula Using Rock Dikes

Alternative 2 would consist of creating marsh habitat within Bolivar Peninsula per the HEP results. This area was selected because it is the location of a new 200-acre marsh restoration project. The Bolivar Peninsula Marsh Restoration site is located on the Galveston Bay side on the southwest end of Bolivar Peninsula, near the south end of Galveston Bay. The NMFS study concluded that marshes created in the southern and eastern sides of the bay have the best chance of achieving commercial and recreational fisheries gains (Zimmerman, et. al, 1992). This site is not a beneficial use site, but would instead create marsh mounds throughout the project area. In this alternative, created mounds would extend north from the peninsula into the deeper portions of Galveston Bay. Based on the HEP project impact analysis, approximately 88.23 acres of habitat creation would be required at this site to mitigate for the 169.14 acres of impacts resulting from the proposed project.

The costs to create the mitigation area were based on the following:

- No land costs are included in the price as land is already procured for the marsh restoration site.

- Construction – Construction costs were estimated and the following assumptions were applied. Please see Table 3 for a summary of the construction costs.

    - Includes construction of permanent and temporary structures as needed to fill sites to marsh elevation limits.
    - Various types of containment/semi-containment levees constructed and maintained.
    - Rock dike erosion protection is included.
    - A 27- to 30-inch dredge is assumed for excavation and two marsh backhoes are assumed for material distribution and final shaping.
    - The cost of rock dike and mound construction varies based on the water depth and displacement depth within the restoration area, increasing costs with increasing depths. In this area, water depths range from 3 feet to 5 feet and displacement depths ranges from 2 feet to 6.5 feet.
    - Cost of silt/sand fill is estimated at $5/cubic yard.
    - Cost of stone for rock dikes is estimated at $80/ton.
    - Mobilization and demobilization costs will be added to existing contracted work.

Table 3: Construction Costs at Bolivar Peninsula Using Rock Dikes

Task	Unit Cost	Unit	Cost
Mound construction	$27,354/mound $41,125/mound $54,172/mound	41 53 34	$5,142,987
Rock dike construction	$2,643/foot	1,293	$3,417,399
Circulation channels	$500,000	1	$500,000
Total			**$9,060,386**

- Planting, monitoring, and corrective measures costs are the same as identified in Alternative 1.

Total cost for creation of 88.23 acres at Bolivar Peninsula with rock dike = $9,139,136 ($9,060,386 for construction + $57,350 for planting + $21,400 for monitoring).

4.3 Alternative 3: Creation of Saline Marsh Habitat Features Within Bolivar Peninsula Using Geotextile Tube

This alternative is similar to Alternative 2; however, erosion control would be accomplished with 3,525 feet of geotextile tube instead of rock dikes. Additionally, the mound creation would occur adjacent to the peninsula and would therefore be within shallower waters. Based on the HEP project impact analysis, approximately 88.23 acres of habitat creation would be required at this site to mitigate for the 169.14 acres of impacts resulting from the proposed project.

The costs to create the mitigation area were based on the following:

- No land costs are included in the price as land is already procured for the marsh restoration site.

- Construction – Construction costs were estimated and the following assumptions were applied. Please see Table 4 for a summary of the construction costs.

  - Geotextile tube construction is included for erosion protection.
  - A 10-inch dredge is assumed for mound creation and two marsh backhoes are assumed for material distribution and final shaping.
  - The cost of mound construction varies based on the water depth and displacement depth within the restoration area, increasing costs with increasing depths. In this area, water depth is 1 foot and displacement depth is 0 feet.
  - Cost of sand fill is estimated at $5/cubic yard.
  - Mobilization and demobilization costs will be added to existing contracted work.

Table 4: Construction Costs at Bolivar Peninsula Using Geotextile Tube

Task	Unit Cost	Unit	Cost
Mound construction	$11,500/mound	128	$1,472,000
Geotextile tube	$300/foot	3,525	$1,057,500
Total			**$2,529,500**

- Planting, monitoring, and corrective measures costs are the same as identified in Alternative 1.

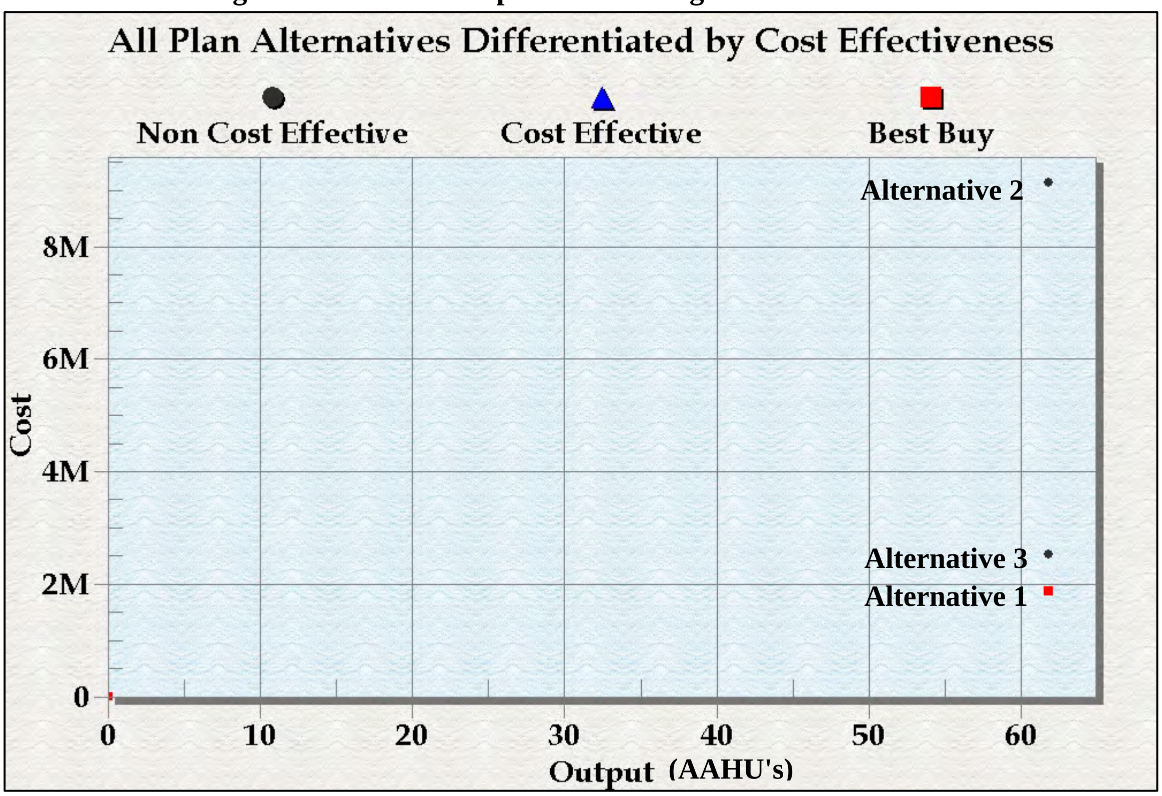
Total cost for creation of 88.23 acres at Bolivar Peninsula using geotextile tube = $2,608,250 ($2,529,500 for construction + $57,350 for planting + $21,400 for monitoring).

5.0 RESULTS

5.1 Best Buy Alternative

Based on the results of the CE/ICA, only one of the alternatives is a Best Buy alternative—Alternative 1: Creation of saline marsh habitat features within Atkinson Island. Figure 1 shows the costs and outputs for all mitigation alternatives differentiated by cost effectiveness.

Figure 1: Cost and Output for All Mitigation Alternatives



Based on the cost effectiveness analysis, Alternative 2 and Alternative 3 produce the same amount of AAHU's as Alternative 1 for a higher cost. Therefore, Alternative 1 is the only cost effective alternative.

The average cost per AAHU was calculated for each mitigation alternative (Table 5). The average costs per AAHU range from $30,165 for Alternative 1 to $147,978 for Alternative 2. Alternative 1 provides the lowest average cost per AAHU.

Table 5: Average Cost of Mitigation Alternative per AAHU

Mitigation Alternative	AAHU	Cost ($)	Average Cost per AAHU ($)
Alternative 1	61.76	1,863,025	30,165
Alternative 2	61.76	9,139,136	147,978
Alternative 3	61.76	2,529,500	40,957

The incremental cost analysis shows that Alternative 1 provides the lowest incremental cost per unit of output (AAHU). Alternative 1 provides 61.76 AAHU's at a cost of $1,863,025, resulting in approximately $30,165 incremental cost per AAHU. Based on the CA/ICA, Alternative 1 provides the lowest average cost per AAHU and the lowest incremental cost per unit of output (AAHU) while providing the 61.76 AAHU's required to mitigate for habitat impacts associated with the proposed project.

5.2 Locally Preferred Alternative

Although Alternative 1 was determined to be the Best Buy alternative, this option is not preferred by the Beneficial Use Group ("BUG"). Created in 1990, the BUG is a coalition of the following eight government agencies: the USACE, the Port of Houston Authority, Environmental Protection Agency, USFWS, NMFS, Natural Resource Conservation Service, Texas Parks and Wildlife Department, and the Texas General Land Office. The BUG's role is to identify environmentally and economically responsible ways to utilize the material dredged from the Houston-Galveston Navigation Channel expansions. Based upon the NMFS study, mitigation for this project is proposed to be located in the lower and eastern side of the bay so that mitigation efforts provide a high rate of success in contributing to commercial and recreational fisheries gains. Alternative 1, marsh creation within Atkinson Island, is located in the north end of Galveston Bay and is therefore not a preferred location. Additionally, this site is a beneficial use site and the BUG's marsh design criteria calls for mound creation.

Alternatives 2 and 3, creation of saline marsh habitat features within Bolivar Peninsula, are located in the southern portion of Galveston Bay. Based on the NMFS report, this location has the best chance of achieving substantial commercial and recreational fisheries gain. These alternatives also incorporate mound creation, which meets the BUG's marsh design criteria. The marsh creation in this alternative would occur adjacent to the peninsula, and per the NMFS study, abundance and biomass were usually significantly higher in marsh compared to the open bay. Alternative 3 was the second least expensive alternative option, while also providing the 61.76 AAHU's required to mitigate for habitat impacts associated with the proposed project. Therefore, Alternative 3 is the preferred alternative.

6.0 SUMMARY

The proposed expansion of PA 14 and PA 15 includes the construction of an expanded PA. The project is located in Chambers County, Texas, within upper Galveston Bay at the southern tip of Atkinson Island. Three alternatives for compensatory mitigation for the impacts to habitat types within the proposed project area have been identified and are described below:

Alternative 1 Creation of saline marsh habitat features within Atkinson Island.

Alternative 2 Creation of saline marsh habitat features within Bolivar Peninsula using rock dike.

Alternative 3 Creation of saline marsh habitat features within Bolivar Peninsula using geotextile tube.

A HEP analysis was used to quantify the impacts of the proposed project by evaluating the ability of the habitat within the study area to provide key components necessary for specific wildlife species. HEP quantifies habitat quality for selected evaluation species through the use of an HSI score. The HEP project impact analysis projects future habitat conditions over the period of analysis in terms of AAHU's and determines the net impact of the proposed project. The acreage required for mitigation is based on the HSI scores for each alternative mitigation area and the AAHU's needed.

A CE/ICA was completed using the IWR Planning Suite software for the purpose of evaluating the relationship between the costs and outputs associated with three mitigation alternatives. Based on the results of the CE/ICA, only one of the alternatives is a Best Buy alternative—Alternative 1: Creation of saline marsh habitat features within Atkinson Island. Alternative 1 provides the lowest average cost per AAHU and the lowest incremental cost per unit of output (AAHU) while providing the 61.76 AAHU's required to mitigate for habitat impacts associated with the proposed project.

Alternative 1, however, is not the locally preferred mitigation alternative. Alternatives 2 and 3, creation of saline marsh habitat features within Bolivar Peninsula, are located in the southern portion of Galveston Bay. This area is noted by NMFS to have potential to contribute to commercial and recreational fisheries gains. Additionally, construction measures at these alternatives meet the BUG's recommended marsh design criteria. Alternative 3 provides the 61.76 AAHU's required to mitigate for habitat impacts associated with the proposed project and is the second least expensive alternative. Therefore, Alternative 3 is the preferred mitigation alternative.

7.0 REFERENCES

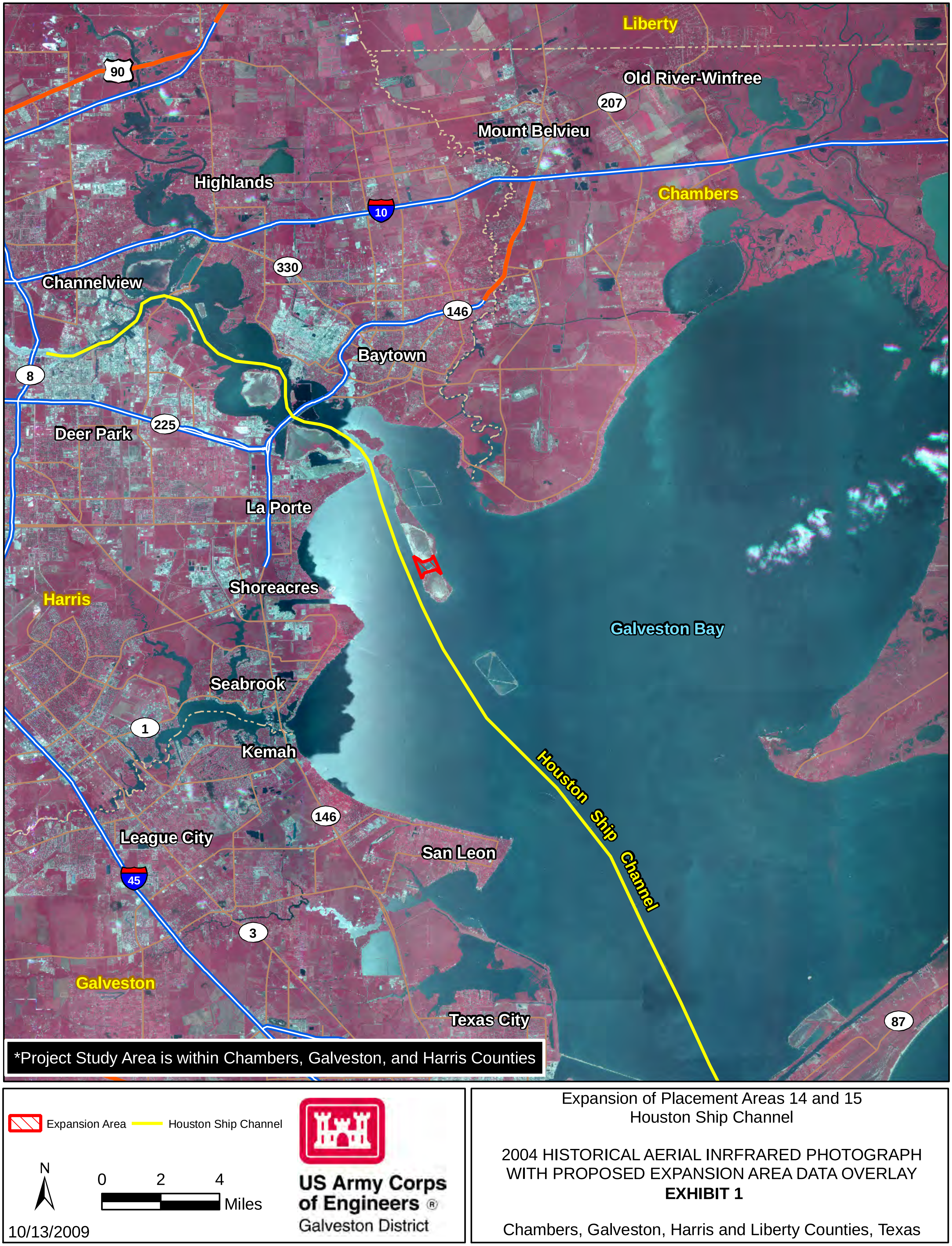
U.S. Army Corps of Engineers. 2000. ER 1105-2-100, Planning Guidance Notebook. Washington, DC.

_______. November 20, 2009. Habitat Evaluation Procedure Analysis. Houston Ship Channel Expansion of Placement Areas 14 and 15. Chambers County, Texas.

U.S. Fish and Wildlife Service (USFWS). 1980. Habitat Evaluation Procedures (HEP), Ecological Services Manual (ESM) 102. Division of Ecological Services, U.S. Fish and Wildlife Service, Department of the Interior, Washington, DC.

Zimmerman, R. J., T. J. Minello, E. F. Klima, T. Baumer, M. Pattillo, and M. Pattillo-Castiglione. 1992. Site Selection for Beneficial Use of Dredged Material through Creation in Galveston Bay. NMFS, Galveston Laboratory, Galveston, Texas.

Exhibits



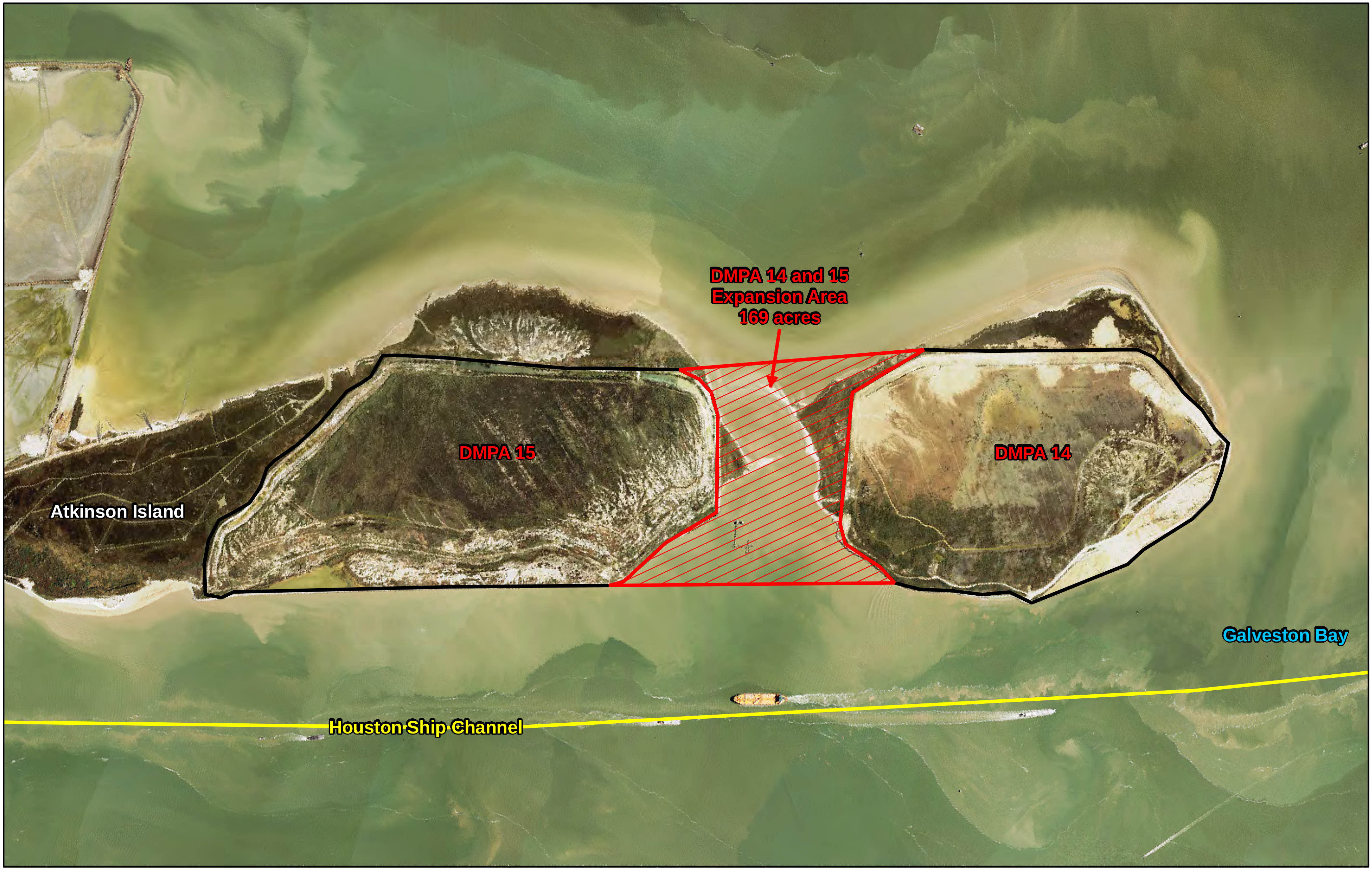
10/13/2009

US Army Corps of Engineers ®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel

2004 HISTORICAL AERIAL INRFRARED PHOTOGRAPH
WITH PROPOSED EXPANSION AREA DATA OVERLAY
EXHIBIT 1

Chambers, Galveston, Harris and Liberty Counties, Texas



Expansion Area | DMPA | Houston Ship Channel

N

0 1,000 2,000 Feet

US Army Corps of Engineers®
Galveston District

10/13/2009

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED
EXPANSION AREA DATA OVERLAYS

EXHIBIT 2

Chambers County, Texas

DMPA
Houston Ship Channel
Intertidal Emergent Marsh
Intertidal Unconsolidated Shore
Impacted Intertidal Emergent Marsh (29.38 acres)
Impacted Intertidal Unconsolidated Shore (27.09 acres)
Impacted Sub-tidal Unconsolidated Bottom (112.67 acres)

N

0 1,000 2,000 Feet

10/8/2009

US Army Corps of Engineers®
Galveston District

Expansion of Placement Areas 14 and 15
Houston Ship Channel Project

2008 AERIAL PHOTOGRAPH WITH PROPOSED EXPANSION AREA AND IMPACTED HABITATS DATA OVERLAYS
EXHIBIT 3

Chambers County, Texas

Attachment A
Cost Effectiveness/Incremental Cost Analysis Results

Total and Average Cost

1/22/2010 11:48:24AM

All Plan Alternatives **Planning Set:** CEICA Analysis 6

Counter	Name	AAHUs (Output) HU	Cost $1000	Average Cost
1	No Action Plan	0.00	0.00	
2	Alt. 3 - Bolivar-GT	61.76	2,529,500.00	40,956.93
3	Alt. 2 - Bolivar-RD	61.76	9,139,136.00	147,978.24
4	Alt. 1 - Atkinson	61.76	1,863,025.00	30,165.56

Incremental Cost of Best Buy Plan Combinations (Ordered By Output)

1/22/2010 12:32:52PM

Planning Set: CEICA Analysis 6

Counter	Plan Alternative	AAHUs (Output) (HU)	Cost ($1000)	Average Cost ($1000 / HU)	Incremental Cost ($1000)	Inc. Output (HU)	Inc. Cost Per Output
1	No Action Plan	0.00	0.00				
2	Alt. 1 - Atkinson	61.76	1,863,025.00	30,165.5602	1,863,025.0000	61.7600	30,165.5602

Appendix G

Additional Agency Coordination

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real #211
Houston, Texas 77058-3051
281/286-8282 FAX: 281/488-5882

October 16, 2009

Colonel David Weston
US Army Corps of Engineers
PO Box 1229
Galveston, TX 77553-1229

Dear Colonel Weston:

The enclosed report provides planning assistance on the Expansion of Placement Area 14 and 15 Houston Ship Channel (HSC), Houston, Texas. This project was initiated by the Galveston District Corps of Engineers and the Port of Houston under the authority of Section 206 of the Water Resources Development Act of 1986, as amended (33 USC 2201), and the American Recovery and Reinvestment Act of 2009 (ARRA; Public Law 111-5) to address the increased need for capacity of dredge material placement for the HSC. In addition to the expansion, the construction of containment levees for the creation of 200-450 acres of tidally influenced marsh will be done adjacent to the expansion site and a containment levee for previously authorized marsh cells, M7, 8 and 9 will be constructed. Marsh habitat in Galveston Bay has been shown to be some of the most productive habitat along the Texas Gulf coast. However, marsh habitat has suffered from increased ship wakes, subsidence and increased salinity flows over the last 40 years. The creation of marsh habitat provides juvenile fish habitat for many commercially and recreational important species upon which the Galveston Bay area economy depends.

The purposes of our report are to identify and describe existing fish and wildlife resources within the proposed project areas; evaluate and compare currently proposed alternatives; identify modifications or additional alternatives needed to address fish and wildlife related problems, opportunities, and planning objectives; and to recommend preliminary measures for resource protection during early project planning. This planning assistance is provided, pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is intended to assist in the preparation of your Environmental Assessment (EA). This information does not represent a final report of the Secretary of the Interior within the meaning of Section 2(b) of the Act. This report was prepared in accordance with the Scope of Work agreed to by our agencies, and it is being provided for equal consideration for fish and wildlife conservation in the planning of this project.

We appreciate the opportunity to participate in the planning of this project. If you have any questions or comments concerning this report, please contact staff biologist Donna L. Anderson at (281) 286-8282.

Sincerely,

Stephen D. Parris

Stephen D. Parris
Field Supervisor Clear Lake ES Office

EXISTING CONDITIONS AND RECOMMENDATIONS FOR THE EXPANSION OF PLACEMENT AREAS 14 AND 15 IN THE HOUSTON SHIP CHANNEL, HOUSTON, TEXAS

Prepared by:
Donna L. Anderson
Ecological Services Field Office
Houston, Texas

Reviewed by:
Stephen D. Parris
Field Supervisor

U.S. Fish and Wildlife Service
Region 2
Albuquerque, New Mexico
October 16, 2009

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EXISTING CONDITIONS AND RECOMMENDATIONS FOR THE EXPANSION OF PLACEMENT AREAS 14 AND 15 IN THE HOUSTON SHIP CHANNEL, HOUSTON, TEXAS

INTRODUCTION

The purposes of this report are to identify and describe existing fish and wildlife resources within the proposed project area; evaluate and compare currently proposed alternatives; identify potentially significant impacts; identify modifications or alternatives which address fish and wildlife related problems, opportunities, or planning objectives; and recommend measures for resource protection early in the project planning process. This planning assistance is provided, pursuant to the Fish and Wildlife Coordination Act (Act) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is intended to assist in the preparation of your Environmental Assessment. This information does not represent a final report of the Secretary of the Interior within the meaning of Section 2(b) of the Act.

The proposed project involves the establishment of new dredge material placement areas adjacent to placement areas (PA) 14 and 15 in the upper bay reach of the Houston Ship Channel (HSC). The new disposal site will consist of a 180 acre upland area and a 200-450 acre created marsh. This marsh will be completed in phases as maintenance dredged material becomes available. To provide mitigation for the conversion of aquatic habitat to upland habitat, marsh will be created at the Bolivar Marsh Site.

The project has been developed in coordination with the Beneficial Use Group (BUG), a multi-agency planning effort established to provide guidance on the use and disposal of dredge material in an environmentally beneficial manner. The BUG will provide technical advice on the design of the marsh and assist with planting criteria.

PROJECT BACKGROUND

Houston Galveston Navigation Channel (HGNC) improvement projects are authorized under the Water Resources Development Act of 1996 and are the culmination of efforts begun in 1989. A Dredge Material Management Plan (DMMP) for the HGNC was created in 1996 which identified dredge material disposal needs for the next 50 years. Currently there are 13 disposal areas. Most of the disposal areas have little remaining capacity.

The Supplemental Fish and Wildlife Coordination Act Report – Houston-Galveston Ship Channels (USFWS 1995) details the important natural resource communities (oysters, marshes, bay bottom, colonial waterbirds and other wildlife) of Galveston Bay as well as estimating the negative and positive environmental impacts of the HGNC improvement project. Ultimately, 4,250 acres of intertidal marshes and a six acre offshore colonial waterbird nesting island were created through the beneficial use of dredge material to offset the project's short term impacts on natural resources. In addition, 12 reef pads totaling 118 acres were created to compensate for oyster impacts (USFWS 2002).

Many fish and wildlife species utilize the marsh creation sites in Galveston Bay. Marsh habitat in Galveston Bay has been shown to be some of the most productive habitat along the Gulf coast, providing habitat for many important commercial and recreational fish species. In addition, marsh sites provide nesting areas for over 20 different colonial waterbird species. However, marsh habitat has been impacted over the last 40 years by an increase in ship wakes, subsidence, and increased salinity.

The average annual sedimentation rate in the bay reach of the HSC is estimated at 1,578,750 cubic yards per year (USACE 2009). The U.S. Army Corps of Engineers' (Corps) Engineering Research and Devolvement Center hydrological modeling suggests that the area between PAs 14 and 15 serves as a conduit for sediment entering the HGNC. This project is not included in the current DMMP. However, recent funding from the American Recovery Reinvestment Act of 2009 (ARRA 2009) allowed the BUG to identify additional areas that can be used for dredge material placement until a new DMMP can be developed.

DESCRIPTION OF THE PROJECT AREA

The project area consists of open bay bottom, mud flats, sandy beaches, tidal wetlands and PAs 14 and 15. The bay bottom is composed of fine silts and sands, undetermined shell hash and submerged aquatic vegetation. The HSC lies approximately one third mile west of the project area.

PAs 14 and 15 are upland sites that are part of a upland/marsh cell complex designed in coordination with the BUG for the placement of material dredged during maintenance of the HSC over a 50 year period, as well as providing habitat for fish and wildlife species in the Galveston Bay area. PA 14 is approximately 370 acres and PA 15 is approximately 450 acres. Both PAs have rock armoring on the ship channel side to withstand the constant wave action from the ships. The bay side of both PAs has less armoring than the ship channel side. Marsh areas have developed on the naturally accreting areas on the bay side of both placement areas.

A large sand spit has formed between PA 14 on the south and PA 15 to the north that impedes commercial and recreational navigation. In addition, wetlands totaling approximately 40 acres in size have developed on the naturally accreting areas on the north side of PA 14 and the south side of PA 15.

ALTERNATIVES UNDER CONSIDERATION

Due to the legislative directive of the ARRA funding, only two alternatives are being considered for the expansion of PAs 14 and 15:

Alternative 1 (No action): The critical need for additional capacity for dredge material placement along the HSC would continue and may lead to the need for offshore disposal. There would be no habitat restoration work.

Alternative 2 (Proposed Plan): This plan will construct new levees to connect PAs 14 and 15 to create an 169 acre upland disposal area. The levee on the bay side initially will be constructed to an elevation of 10 feet. The levee on the ship channel side will initially be constructed lower than the existing PA levees due to a limited amount of available material. In addition, this levee will retain an opening to allow for access to the oil and gas facilities currently located between the PAs. Once these facilities have been relocated, the opening will be filled in and placement of dredged material in the expanded disposal area will begin. The height of the levees will be raised as material becomes available.

Levees will be constructed on the bay side of PA 14 to create a 305 acre cell (Cell M10). Containment levees will also be constructed on the bayside of PA 15 to create a disposal area approximately 399 acres in size (Cells M7/8/9). During maintenance of the HSC, dredged material will be placed into these cells to an elevation suitable for the establishment of wetland plant species. Final design of the cells will be approved by the BUG once dredge material quantities and costs have been determined. In the event that there is a shortage of suitable material or available funding, the U.S. Fish and Wildlife Service (Service) understands that Cells 7, 8 and 9 will be built at a later time. Figure 1 gives an overview of the cells to be created.

Approximately 44 acres of existing wetlands will be covered by fill material and approximately 180 acres of open bay bottom will converted to uplands as a result of the proposed project. Mitigation for the loss of aquatic habitat associated with the expansion of PAs 14 and 15 will occur at the Bolivar Island marsh site. The BUG recently formulated a conceptual design for a 200 acre marsh comprised of mounds, terraces and several sacrificial berms that will utilize dredge material from the other cells located at the Bolivar Island marsh. This design will be modified in close coordination with the BUG to incorporate the additional acreage required for mitigation.

Figure 1 Overview of PA 14 and 15 with marsh cell 7, 8, 9, and 10, 11

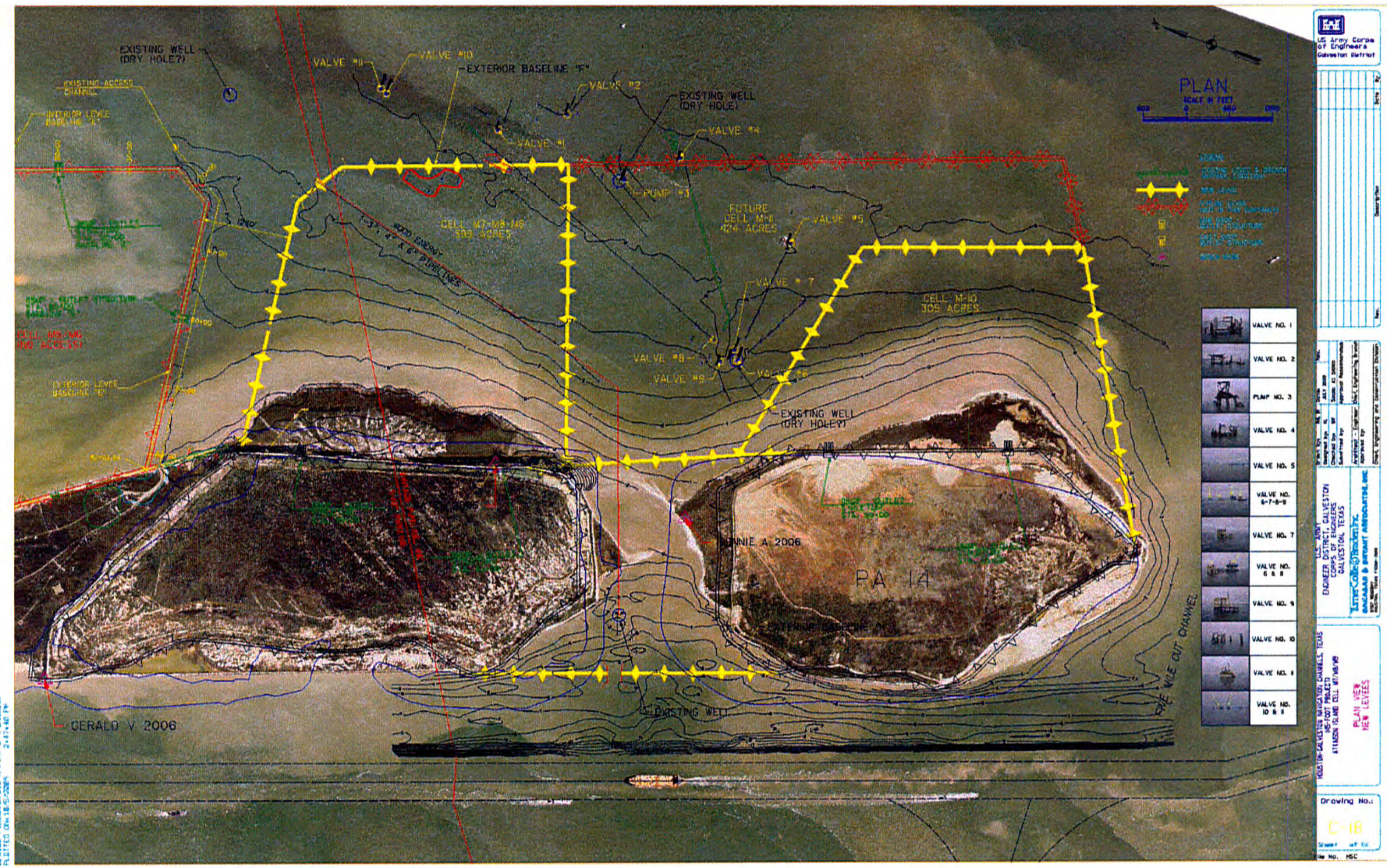

Figure 2 Detailed view of PA 14 and 15 with marsh cells 7, 8, 9 and 10 and 11

EXISTING FISH AND WILDLIFE RESOURCES

Geographic Information System (GIS) and Global Positioning System (GPS) technology and aerial photos were used to identify habitat cover-types in and around the project area. The following habitat types were identified:

1) **Open Bay** - This cover type consists of open water with a muddy substrate and submerged aquatic vegetation. This habitat supports various aquatic species such as brown shrimp, white shrimp, spotted sea trout, red drum and menhaden;

2) **Wetlands** - This cover type is comprised of various species of rushes, sedges, wetland grasses, and aquatic plants. Wetlands provide food and cover for fish, resident and migratory birds, small mammals, invertebrates, and the predators that feed on these species;

3) **Oyster reefs** - Living oyster reefs are made up of fish, plants, invertebrates and other and can be a good indicator of the overall health of a system. Oyster reefs are very productive estuarine habitat and are used by similar numbers but different species of fish and decapod crustaceans compared to salt marsh (Zimmerman et. al 1989). Oysters also provide a basic ecological function of filtering the bay water in which they live and rates range from 5 to 30 quarts of water per hour of feeding time (Hoffstetter 1990).

The Service's *Habitat Evaluation Procedure* (HEP) (USFWS 1980) will be used to evaluate these habitats in the project area. The HEP requires the use of Habitat Suitability Index (HSI) models developed for indicator species that best represent groups of species that use the habitats. Each model contains a group of habitat variables that are measured in the field and used as indicators of habitat value. Baseline habitat conditions are expressed as a numeric function (HSI value) ranging from 0.0 to 1.0, where 0.0 represents no suitable habitat for an indicator species and 1.0 represents optimum conditions for the species. Habitat units (HU) are calculated by multiplying the HSI value by the amount of acres of available habitat type required by each species.

Three aquatic and one bird indicator species were selected that best represent the wildlife communities that use the identified habitats. The great egret (*Casmerodius albus*) represents the suite of colonial waterbirds that utilize both the open bay and the wetlands. The red drum (*Sciaenops ocellatus*), white shrimp (*Penaeus setiferus*) and the gulf mendaden (*Brevoortia patronus*) were selected for their use of the open bay bottoms and marsh habitats.

Crouch Environmental collected the required field data for a HEP analysis on October 6, 2009. As of the deadline for the completion of this report, the Service had not received this data. Consequently, HSI and HU values have not been determined for the project. Coordination with the BUG to determine proper mitigation will be imperative once the HEP analysis has been completed.

PROJECT SITE DESCRIPTION

Open Bay Bottom
The open bay bottom of Galveston bay is the second largest habitat in the bay and is made up of mostly soft rippling mud and silt that is not covered by oysters and vegetation. Over the years, the area of open bay bottom has increased mainly due to oyster removal and dredging activities. Biological decomposition, a major function for the breakdown of plant material, occurs in this habitat, where it is eventually re-suspended in the water column to provide food for other fish and wildlife species.

Oyster Reef
While there is no known reef habitat in the project area, there are historic longitudinal reefs along the ship channel adjacent to the project area (Jan Culbertson, TPWD, personnel communication). This particular area has one 0.0012 acre "shell on mud" reef (number 79) that was documented by Eric Powell in 1990 that is 500-ft away from the proposed levee for the expansion of PA 14 and 15, and two smaller shell on mud reefs that are less than 300-ft away of the proposed levee on the ship channel side of the project area (Figure 4). The majority of oyster habitat along the ship channel has been severely scoured and the majority of oysters from Atkinson Island south past Redfish Reef are dead. However, there has been recent spat set on all the dead shell along the ship channel and key ridge reefs in Galveston Bay with the onset of precipitation during September of 2009.

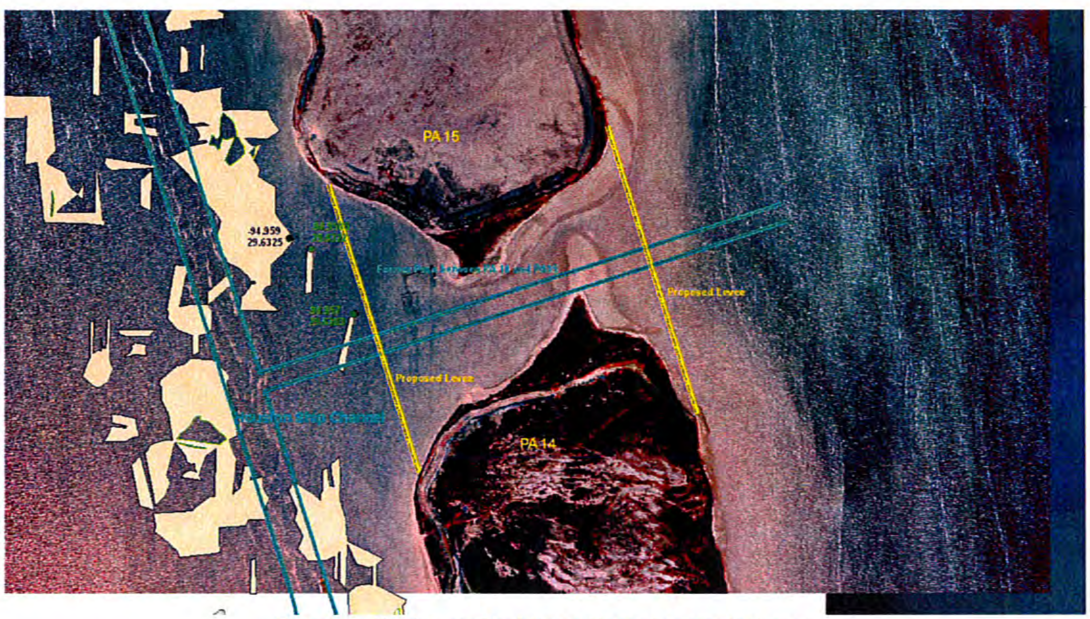

Figure 3 Oyster reef habitat adjacent to project area

THREATENED AND ENDANGERED SPECIES AND BIRDS OF CONSERVATION CONCERN

Our records indicate that the following delisted (DM) and endangered (E) species have been documented, or are known to occur in Harris County:

bald eagle (*Haliaeetus leucocephalus*) – DM
Texas prairie dawn-flower (Hymenoxys texana) - E

The bald eagle was delisted in August 2008 but is still afforded protection under the Migratory Bird Treaty Act and the Bald and Golden Eagle Act. The Texas prairie dawn-flower has very specific habitat requirements and is only located in a few areas in Harris County. There is no designated critical habitat for listed species in Harris County.

The Service published the *Birds of Conservation Concern 2008* (BCC) in December, 2008. The overall goal of the BCC is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent our highest conservation priorities and to draw attention to species in need of conservation action (USFWS 2008). The following are six species on the BCC lists that may utilize the habitat types within the project area:

Reddish egret (*Egretta rufescens*) - coastal marshes and ponds
American Oystercatcher (*Haematopus palliatus*) - sandy beaches, mudflats, and occasionally rocky shores where mollusk prey can be found
Gull-billed tern (*Sterna nilotica*) - sandy beaches and mudflats
Sandwich tern (*Thalasseus sandvicensis*) - sandy beaches and mudflats
Black skimmer (*Rynchops niger*) - sandy or gravelly bars and beaches, shallow bays, estuaries, and salt marsh pools
Least tern (*Sterna antillarum athalassos*) - broad, level expanses of open sandy or gravelly beach, dredge spoil and other open shoreline areas, and more rarely, inland on broad river valley sandbars

RECOMMENDATIONS

The Service has the following recommendations for the proposed project:

1. Conduct oyster sampling efforts at three locations adjacent to the project site to confirm there is no live shell or resent spat set. If these three small reefs no longer show evidence of oyster survival or recent spat set, then there will be no significant impact from this project. If there are live reefs we request avoidance or minimize dredging or siltation impacts that smother live oysters within 500-ft of the project area.
2. Complete the HEP analysis. The Corps should extensively coordinate with the BUG to evaluate all HEP modeling methods and results and to determine proper mitigation for all project impacts.
3. The BUG has requested that impacts from filling approximately 180 acres of open bay including 44 acres of wetlands be mitigated for at the Bolivar Marsh site. The mitigation

process should be closely coordinated with the BUG during the design and construction phases.

4. The Corps closely coordinate the design of all PA and marsh BU sites with the BUG.
5. Coordinate planting of the marsh sites with the BUG at the earliest possible time.
6. Monitoring and maintenance of the project features be coordinated with the BUG and that all BUG guidelines and recommendations are adhered to.

REFERENCES

Hofstetter, R.P., and C.E. Bryan. 1990. The Texas oyster fishery. Bulletin No. 40, Texas Parks and Wildlife Department, Austin. Third revision: 21P.

J. Culberson, personal email communication, October 13, 2009.

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U.S. Fish and Wildlife Service.1980. The habitat evaluation procedures. U.S. Fish and Wildlife Service, Ecological Services Manual 102. 124 pp.

U.S. Fish and Wildlife Service. 2008. Birds of conservation concern 2008. Division of Migratory Bird Management, Arlington, Virginia. 99 pp.

U.S. Fish and Wildlife Service. 2002. Supplemental Fish and Wildlife Coordination Act Report Houston-Galveston Navigation Channels, Texas – Barge Lane Widening. U.S. Fish and Wildlife Service. Houston, TX: 1p

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Zimmerman, R., T. Minello, T. Baumer, and M. Castiglione. 1989. Oyster reef as habitat for estuarine macrofauna. NOAA Technical Memorandum NMFS-SEFC-249: 16p.

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

REPLY TO
ATTENTION OF

November 30, 2009

Environmental Section

Ms. Rebecca Hensley
Texas Parks & Wildlife Department
1502 FM 517 East
Dickinson, TX 77539

Dear Ms. Hensley:

The Galveston District is developing plans to expand Houston Ship Channel Placement Areas 14 and 15 in Chambers County, Texas. A major portion of the work would be performed under the American Recovery and Reinvestment Act of 2009. The proposed work is described in detail in Section 1.3 of the enclosed Draft Environmental Assessment (EA).

Under the Fish and Wildlife Coordination Act, we are required to consider potential impacts to fish and wildlife resources in planning civil works projects and coordinate with the Texas Parks & Wildlife Department (TPWD). Pursuant to the Act, the District is requesting that TPWD review the enclosed Draft EA and provide any comments your agency may have regarding the proposed project. We appreciate your continued cooperation in allowing us to fulfill our obligations under the Act.

If you or your staff have any questions regarding this project, please contact Steve Ireland at (409) 766-3131.

Sincerely,

Richard Medina
Chief, Planning & Environmental Branch

Enclosures

REPLY TO
ATTENTION OF

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

November 30, 2009

Environmental Section

Mr. Rusty Swafford
National Marine Fisheries Service
Environmental Assessment Branch
4700 Avenue U
Galveston, TX 77550

Dear Mr. Swafford:

The Galveston District is developing plans to expand Houston Ship Channel Placement Areas 14 and 15 in Chambers County, Texas. A major portion of the work would be performed under the American Recovery and Reinvestment Act of 2009. The proposed work is described in detail in Section 1.3 of the enclosed Draft Environmental Assessment (EA).

Sections 3.3.4 and 4.3.4 of the Draft EA include discussions of marine fisheries and Essential Fish Habit (EFH) in the project area and the proposed project's potential impacts on these resources. The District has determined that the proposed project would have minimal and temporary impacts on fisheries and EFH with the proposed mitigation for the project. Pursuant to regulations published by the National Marine Fisheries Service (50 CFR 600.805 through 600.930) under the Magnuson-Stevens Fishery Conservation and Management Act, we request that the Service review the enclosed information and provide written comments and concurrence with this determination.

If you or your staff have any questions regarding this project, please contact Steve Ireland at (409) 766-3131.

Sincerely,

Richard Medina
Chief, Planning & Environmental Branch

Enclosures

From:	Ireland, Steven K SWG
To:	"Ray Newby"
Cc:	Worthington, James F SWG; Collins, Christopher A CPT SWG; Behrens, Robert L SWG; Murphy, Carolyn E SWG; Laird, Diana J SWG; Dunn, Dolan D SWG
Subject:	RE: Proposed PA14-15 Connection and BU Cells M7-11 - Evaluation ofaccess to State-owned Minerals
Date:	Wednesday, January 13, 2010 8:49:36 AM

Ray,

Thank you for your comments on the proposed Placement Areas 14 and 15 expansion project. Please note that, as stated in Section 1.3 of the draft Environmental Assessment, we have not yet made a final determination on the configuration (or footprint) and size of future Cell M-11. This cell is not included in the work that we are proposing to begin this year and would be constructed sometime in the future. We will continue to coordinate with the Texas General Land Office and the Beneficial Uses Group before making a final determination on the size and configuration of Cell M-11 and we will take into consideration your agency's concerns regarding access to underlying mineral resources.

Steve Ireland
Environmental Section
USACE, Galveston District

From: Ray Newby [mailto:Ray.Newby@GLO.STATE.TX.US]
Sent: Friday, January 08, 2010 11:19 AM
To: Ireland, Steven K SWG; Worthington, James F SWG
Cc: Lorrie Council; Peter Boone; Tracey Throckmorton; David Casebeer
Subject: Proposed PA14-15 Connection and BU Cells M7-11 - Evaluation ofaccess to State-owned Minerals

The Texas General Land Office is proud to be a member of the Houston-Galveston Navigation Channel Beneficial Uses Group. We also applaud the efforts of the Port of Houston and the US Army Corps of Engineers (USACE) to beneficially use dredged material to restore lost wetland habitats in Galveston Bay. We will strive to support the continued beneficial use of dredged material (BUDM) while at the same time fulfilling our fiduciary duties to ensure the reasonable access to and development of State-owned minerals to fund the Available School Fund, an endowment for public school education in Texas.

We have reviewed the proposed placement of a connection between dredged material placement areas (DMPAs) 14 and 15 and BUDM cells M7-11 in upper Galveston Bay with respect to access to State-owned minerals. The evaluation was based on the assumption that the maximum horizontal offset for conventional oil and gas drilling technology to reach producing zones in this area is 4,000 feet. A drilling setback of 2,500 feet from the centerline of the Houston Ship Channel and the Bayport Channel was also assumed since a specific setback distance could not be determined from inquiries with Port of Houston or USACE staff.

Existing oil production on leased State tracts is active in the project area with the presence of numerous wells with multiple directional well stems. Development of deeper natural gas resources is expected to increase in the near future within the project area.

The proposed location of the connection between DMPAs 14 and 15, as well as BU cells M7-9 and cell M10 do not appear to pose significant access limitations to State-owned minerals. However, the proposed footprint of BU cell M11 does pose a serious access obstacle to minerals underlying DMPA 14 and 15, the proposed connection between DMPA 14 and 15, and the western portions of BU cells M7-11. There is also concern that, in the absence of cell M11, accretion and marsh formation along the eastern levee of the DMPA 14-15 connection could eventually hinder access to minerals under the connection.

We hereby request that the proposed footprint of BU cell M11 be reconfigured to allow access up to the eastern levee of the DMPA 14-15 connection. Such access could be in the form of a 500-foot wide by 12-foot deep channel approaching from the east between cells M7-9 and M10 with a 1,000 by 1,000 foot operating area fronting the east levee of the DMPA 14-15 connection. We also request that an area for access to minerals be preserved east of the DMPA 14-15 connection in the event cell M11 is not constructed and accretion occurs east of the east levee. We are preparing maps showing the affected areas to forward to you in the near future to illustrate our concerns.

Please feel free to contact me if you need any additional information regarding this matter.

Sincerely,

Ray Newby, P.G.
Geomorphologist/Project Manager
Texas General Land Office
Coastal Resources Program
ph. (512) 475-3624, fx (512) 475-0680

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue S
St. Petersburg, Florida 33701-5511

January 27, 2010

Ms. Carolyn Murphy
Chief, Environmental Section
Department of the Army, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Ms. Murphy:

The NOAA National Marine Fisheries Service (NMFS) has reviewed the Draft Environmental Assessment and Public Notice HGNC-09-01 for the "Expansion of Placement Areas 14 and 15 Houston Ship Channel Project, Chambers County, Texas". Our review of the Habitat Evaluation Procedure (HEP) model, found serious deficiencies in the way the HEP model was constructed. For several reasons, it is NMFS view that inputs and assumptions used to develop the HEP model essentially under valued the impact area and over valued the proposed mitigation. Therefore, we believe the Corps of Engineers original proposal to provide 75 acres of mitigation for approximately 160 acres of impacts to essential fish habitats (EFH) is insufficient to offset project impacts. However, during a telephone conversation on January 14, 2010, with Mr. Steve Ireland of your staff, NMFS was informed that the Corps of Engineers' Agency Technical Review process also found deficiencies in the HEP model and had concluded that an additional 13 acres of mitigation would be required to offset adverse project impacts to EFH. Mr. Ireland assured us that the plans being submitted in the final environmental assessment would now include 88 acres of EFH mitigation. Consequently, the NMFS concurs with the Corps of Engineers' EFH assessment that 88 acres of mitigation will be sufficient to offset adverse project impacts to EFH and associated federally managed fisheries. Therefore, NMFS has no further comments to provide regarding the proposed plans and no further consultation with NMFS is required.

If we may be of further assistance, please contact or Mr. Rusty Swafford of our Galveston Facility at (409) 766-3699.

Sincerely,

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

Appendix H

Sea Level Rise Analysis

Relative Sea Level Rise Calculation

Recent climate research by the Intergovernmental Panel on Climate Change predicts continued or accelerated global warming through the 21st century (Bindoff et al., 2007). The USACE requires all phases of Civil Works programs to consider impacts from sea-level change (USACE, 2009).

Relative sea level rise (RSLR) rates were calculated for the project area through 2070. This project involves the construction of additional dredged material placement areas in Galveston Bay. Construction of these placement areas is not expected to affect future RSLR therefore RSLR is expected to be the same with or without the project. Consequently, the future RSLR described below should satisfy the requirement to calculate the future RSLR “with” and “without” project conditions.

A low rate of RSLR is calculated as required (USACE, 2009) using the historical rate of sea-level change. Data from the Pier 21 tide gage (CO-OPS station 8771450) in Galveston were used since the gage is in the project’s bay system. The gage also meets the requirements described in Appendix C (USACE, 2009) for use in calculating RSLR because it is the nearest tide station to the proposed project areas with over 40 years of data. The period-of-record for the Pier 21 tide gage extends from 1908 to present. The historic RSLR rate at the tide station is 6.39 ±0.28mm/yr (Mean Sea Level Trend, 8771450, Galveston Pier 21, Texas, NOAA, 2009). Use of the historic RSLR rate of 6.39 mm/yr indicates a RSLR of 0.153 m will occur over the period from 1986 to 2010 (Table 1). The sea level is estimated to rise 0.537 m over the project period from 1986 to 2070 at the historic RSLR rate (Table 1) (Figure 1).

Table 1. Calculated relative sea level rise in meters from 1986.

	2010 Project Construction	2020 Placement Areas Filled	2070 End of Project
Low Rate, Historic Sea-Level Rise	0.153 m	0.217 m	0.537 m
Intermediate Rate, Modified NRC Curve I	0.167 m	0.245 m	0.703 m
High Rate, Modified NRC Curve III	0.211 m	0.333 m	1.246 m

The predicted intermediate sea level rise is calculated using the equation in USACE (2009).

$$\text{Intermediate sea level rise} = (0.0017 + 0.00469)(t_2 - t_1) + b(t_2^2 - t_1^2)$$

Where:

- t_1 = time in years between the project construction date and 1986
- t_2 = time in years between the relevant project date (either 2020 or 2070) and 1986
- 0.0017 = value assigned for eustatic sea level rise in mm (USACE, 2009)
- 0.00469 = relative sea level rise rate for Galveston Bay in mm (NOAA, 2009). Calculated by subtracting the eustatic sea level rise rate of 0.0017 mm from the measured mean sea level rise rate at Pier 21 in Galveston of 0.00639 mm.
- b = 0.0000236, value assigned to this coefficient for intermediate sea level rise provided in USACE (2009)

The intermediate RSLR calculated for the project area is estimated to be 0.245 m above the sea level in 1986 in 2020 when the placement areas are filled, and 0.703 m above the sea level in 1986 in 2070 when the project is complete (Table 1) (Figure 1).

The predicted high sea level rise is calculated using the equation in USACE (2009) and is intended to accommodate sea level rise resulting from the possible rapid loss of ice from Antarctica and Greenland.

$$\text{High sea level rise} = (0.0017 + 0.00469)(t_2 – t_1) + b(t_2^2 – t_1^2)$$

Where:

- t_1 = time in years between the project construction date and 1986
- t_2 = time in years between the relevant project date (either 2020 or 2070) and 1986
- 0.0017 = value assigned for eustatic sea level rise in mm (USACE, 2009)
- 0.00469 = relative sea level rise rate for Galveston Bay in mm (NOAA, 2009). Calculated by subtracting the eustatic sea level rise rate of 0.0017 mm from the measured mean sea level rise rate at Pier 21 in Galveston of 0.00639 mm.
- b = 0.0001005, value assigned to this coefficient for intermediate sea level rise provided in USACE (2009)

The high RSLR calculated for the project area is estimated to be 0.333 m above the sea level in 1986 in 2020 when the placement areas are filled, and 1.246 m above the sea level in 1986 in 2070 when the project is complete (Table 1) (Figure 1).

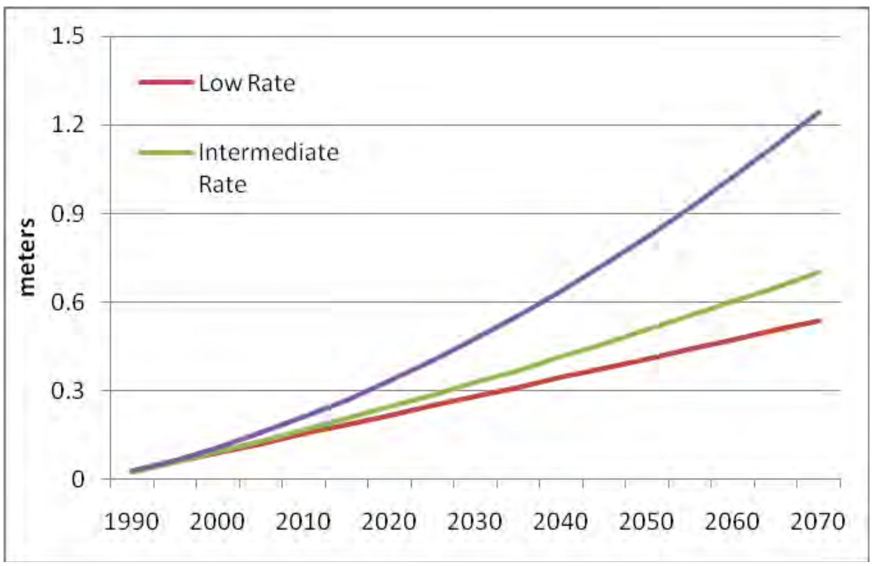

Figure 1. Relative sea level rise in meters from 1986 through 2070 under three different rates of relative sea level rise.

Literature Cited

Bindoff, N.L., J. Willebrand, V. Artale, A, Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C. K. Shum, L. D. Talley, and A. Unnikrishnan. 2007. Chapter 5, Observations: Oceanic Climate Change and Sea Level. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. http://www.ipcc.ch/pdf/assessmentreport/ar4/wg1/ar4-wg1-chapter5.pdf

National Oceanic and Atmospheric Administration. 2009. Sea Levels Online. http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8771450 Galveston Pier 21, TX

USACE. 2009. Water Resources Policies and Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs. CECW-CE Circular No. 1165-2-211. 31 pp.

Appendix I

Public Notice, Public Comments, and District Response

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

November 30, 2009

Environmental Section

JOINT PUBLIC NOTICE
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
AND
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PUBLIC NOTICE NO. HGNC-09-01

EXPANSION OF PLACEMENT AREAS 14 AND 15
HOUSTON SHIP CHANNEL PROJECT
CHAMBERS COUNTY, TEXAS

PURPOSE

This public notice is to inform interested parties that the U.S. Army Corps of Engineers, Galveston District (the District) has prepared a draft Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), Public Law 91-190, and regulations for implementing the Procedural Provisions of the NEPA, 40 Code of Federal Regulations 1500-1508. This notice is being distributed to interested State, Federal, and local agencies, private organizations, and individuals in order to assist in collecting facts and recommendations concerning the proposed expansion of Placement Areas (PAs) 14 and 15 along the Houston Ship Channel (HSC) in Chambers County, Texas. The purpose of the expansion of PAs 14 and 15 is to increase dredged material placement capacity and reduce future maintenance costs associated with the HSC. A major portion of the construction work is being funded by the American Recovery and Reinvestment Act of 2009.

PROJECT LOCATION

The proposed project site is located in Chambers County, Texas, about 4.5 miles southeast of the City of La Porte, Texas. The site is within upper Galveston Bay, east of the HSC, and at the southern extent of Atkinson Island.

PROJECT DESCRIPTION

The proposed work is associated with the maintenance of the HSC, which is part of the Houston-Galveston Navigation Channels Project, Texas (HGNC). The deepening and widening of the HSC to its current dimensions were addressed in the 1995 Limited Reevaluation Report (LRR) and Supplemental Environmental Impact Statement (SEIS) for the HGNC, which was completed and filed with the U.S. Environmental Protection Agency in November 1995. The LRR and SEIS recommended both navigational and environmental restoration improvements. The navigational improvements included the deepening and widening of the HSC to 45 feet deep and 530 feet wide. The environmental restoration improvements included the incremental development of 4,250 acres of intertidal marsh over the life of the project and the construction of a colonial water bird nesting island through the beneficial use of dredged material. The deepening and widening of the HSC was authorized for construction on October 12, 1996 by the Water Resources Development Act of 1996. Project construction began with the receipt of construction general funds in October of 1997. PAs 14 and 15 are operated as upland placement areas for dredged materials from maintenance activities associated with the HSC project, as well as from the Bayport Ship Channel, which also is maintained by the District.

NEED FOR WORK

The purpose of the proposed project is to address the shortage of capacity for the placement of dredged material during maintenance dredging operations on the Upper Bay Reach of the HSC and on the Bayport Ship Channel. Since the deepening and widening of the HSC, the channel has experienced increased shoaling rates and existing and planned PAs do not have sufficient capacity for projected volumes of maintenance dredged material. Additional placement capacity is needed to continue to maintain existing navigation channels to their authorized depths.

PROPOSED WORK

The proposed action includes the expansion of HSC PAs 14 and 15 to provide additional capacity for placement of dredged material during maintenance dredging activities along the HSC and the Bayport Ship Channel. This work would involve the construction of an approximate 169-acre upland placement area between PAs 14 and 15 and the construction of up to three marsh placement areas, or beneficial use (BU). The BU sites would be constructed east of PAs 14 and 15 and would include a 305-acre site, a 392-acre site, and an up to 424-acre site. In addition, a mitigation marsh site of at least 75 acres would be constructed adjacent to the Bolivar Marsh Site in lower Galveston Bay near Bolivar Peninsula to provide compensation for the conversion of estuarine habit to uplands as a result of the construction of the proposed upland PA expansion.

COMPLIANCE WITH LAWS AND REGULATIONS

This proposed plan is being coordinated with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and other Federal, state, and local agencies. Informal consultation procedures have begun with the USFWS and NMFS in compliance with the Endangered Species Act, as amended. Our initial determination is that the proposed action will not have any adverse impacts on threatened or endangered species.

This notice initiates Essential Fish Habitat consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Our initial determination is that the proposed action will not have a substantial adverse impact on Essential Fish Habitat or federally-managed fisheries in the Gulf of Mexico. Our final determination relative to project impacts and the need for mitigation measures is subject to review by and coordination with the NMFS.

The proposed dredged material placement plan will also be evaluated with regard to the requirements of Section 404(b)(1) of the Clean Water Act (Appendix E in the draft EA). Water quality certification has been requested from the Texas Commission on Environmental Quality (TCEQ).

It is also our preliminary determination that the proposed action is consistent with the Texas Coastal Management Program (TCMP) to the maximum extent practicable (Appendix C in the draft EA).

The proposed activity is being coordinated with the State Historic Preservation Officer (SHPO). The SHPO concurred with our determination that no additional survey was needed in the area between PAs 14 and 15. The District is in the process of surveying the remaining portion of the project area and will coordinate the results of this work with the SHPO.

The following is a list of Federal, State, and local agencies with which these activities are being coordinated:

U.S. Environmental Protection Agency, Region 6
U.S. Department of Commerce
U.S. Department of the Interior
Eighth Coast Guard District
Budget and Planning Office, Office of the Governor of Texas
Texas Historical Commission
Texas Parks and Wildlife Department
Texas Commission on Environmental Quality
Texas General Land Office
Coastal Coordination Council
The Texas Office of State-Federal Relations
Texas Department of Transportation
Texas Water Development Board
Port of Houston Authority

STATE WATER QUALITY CERTIFICATION

TCEQ certification is required. The TCEQ is reviewing the proposed project under Section 401 of the Clean Water Act and in accordance with Title 31, Texas Administrative Code Section 279.1-13 to determine if the work would comply with State water quality standards. By virtue of an agreement between the U.S. Army Corps of Engineers and the TCEQ, this public notice is also issued for the purpose of advising all known interested persons that there is pending before the TCEQ a decision on water quality certification under such act. Any comments concerning this work may be submitted to the Texas Commission on Environmental Quality, Attention: 401 Coordinator, MC-150, P.O. Box 13087, Capitol Station, Austin, Texas 78711-13087. The public comment period extends 30 days from the date of publication of this notice. A copy of the public notice with a description of work is made available for review in the TCEQ's Austin office.

The TCEQ may conduct a public meeting to consider all comments concerning water quality if requested in writing. A request for a public meeting must contain the following information: the name, mailing address, and telephone number of the person making the request; a brief description of the interest of the requester, or of persons represented by the requester; and a brief description of how the project would adversely affect such interest.

EVALUATION FACTORS

The decision whether to proceed with the proposed action will be based on an evaluation of the probable impact of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources as well as public and environmental safety and economic concerns.

ENVIRONMENTAL DOCUMENTATION

The work described in this notice represents a change to the existing project. A preliminary review of this proposed plan indicates that an Environmental Impact Statement (EIS) is not required. This preliminary determination of EIS requirement will be changed if information brought forth in the coordination process is of a significant nature. Based on this determination, a draft Environmental Assessment (EA) has been prepared. The EA assesses potential impacts to the human and natural environment that would result from the proposed project. The document is available online at: http://www.swg.usace.army.mil.

PUBLIC COMMENT

Persons desiring to express their views or provide information to be considered in evaluating the impact of this work and the future maintenance operations are requested to mail their comments within 30 days of the date of this notice to:

District Engineer
U.S. Army Engineer District, Galveston
ATTN: CESWG-PE-PR
P.O. Box 1229
Galveston, Texas 77553-1229

The comments should make specific reference to Public Notice No. HGNC-09-01.

Any person who has an interest that may be affected by this action may request a public hearing. The request must be submitted in writing within 30 days of the date of this notice and must clearly set forth the interest that may be affected and the manner in which the interest may be affected by this activity.

Any questions concerning the proposed action may be directed to Mr. Steve Ireland at (409) 766-3131.

Dolan Dunn
Chief, Planning, Environmental
and Regulatory Division
Galveston District

From:	sjones@galvbay.org
To:	Ireland, Steven K SWG
Subject:	Fwd: Galveston Bay Foundation comments on HGNC-09-01
Date:	Wednesday, December 30, 2009 11:54:34 AM

Trying this e-mail address...

----- Forwarded message from sjones@galvbay.org -----
Date: Wed, 30 Dec 2009 12:37:10 -0500
From: sjones@galvbay.org
Reply-To: sjones@galvbay.org
Subject: Galveston Bay Foundation comments on HGNC-09-01
To: steven.r.ireland@usace.army.mil
Cc: carlton.brown@usace.army.mil

Dear Mr. Ireland-

I am submitting the following comments on HGNC-09-01 on behalf of the Galveston Bay Foundation's Wetland Permit Review (WPR) Committee. I am out of the office and sending this message from our remote e-mail system; if needed, I will send in a formal comment letter as soon as I return to the office.

Our comments/questions on the Preliminary Draft Environmental Assessment are as follows:

1. Section 3.3.2. - Aquatic and Terrestrial Habitats.
It appears that no studies have been completed since Ike for current liable oyster reefs locations or what benthic species are present in marsh areas. Is this the case? If so, why not?

GBF-1

2. Section 3.4.12 - Dredging and Dredged Material Placement and 4.2.3.2 - Proposed Alternative
What are the impacts to the water circulation/salinity patterns after this channel is dredged (mined) to -80 feet MLT? How long would it take until the channel is filled back to the original design depth of 45 plus over dredge depth? On page 41, the doucment states that "The permanent nature of the hydrological impact to the project site is not anticipated to adversely affect the hydrological regime of the project study area." How is this known? What studies were conducted?

GBF-2

3. Mitigation.
As stated by other commenters is issue of Cell M3/GIWW in the BUG Plan as part of the 50-year HSC project includes the Bolivar Cell 3 in this EA. This seems to be an overlap or double counting in this area. WPR requests clarification of the mitigation accounting regarding Cell M3/GIWW.

GBF-3

If possible, please e-mail back to confirm that you received these comments.

Last, please disregard my phone message requesting an extension to submit these comments.

Sincerely-

Scott A. Jones
Wetland Permit Review Committee Facilitator

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GBF-1: Post-Ike oyster reef and benthic species surveys are outside the scope of this Environmental Assessment. Both the USFWS and the TPWD were coordinated with regarding oyster reefs and both agencies agreed that project specific oyster reef surveys were not warranted.

GBF-2: Due to the limited reach, in Upper Galveston Bay, of proposed mining activities, impacts to water circulation/salinity patterns after the channel is dredged to -80 feet would be minimal. Impacts would be expected to be higher than minimal if the entire HSC was dredged to this depth into the higher salinity waters of the Gulf of Mexico. The length of time that it would take for the channel to fill back to the project depth of -45 feet is uncertain, although it could be inferred that future regularly scheduled maintenance activities for this reach of channel would not be required for some time. On page 41, the "permanent nature of the hydrological impact to the project site" is referring to the direct impact of placing dredged material into the footprint of the proposed placement area expansion. Although no hydrological studies were conducted as part of this assessment, it is anticipated that this particular action would not adversely affect the hydrological regime of the project study area. Tidal flow and water currents would continue to flow around Atkinson Island with construction of the proposed project.

GBF-3: The first three Bolivar BU Cells have already been constructed during the original deepening of the HSC. The fourth BU cell will not be constructed as previously planned because it was determined that capacity was not needed to support the placement of maintenance material from the lower bay reach of the HSC. Mitigation marsh for the proposed project will be constructed within the area where the fourth cell was originally planned.