U.S. Army Corps of Engineers
Galveston District

U.S. Army Corps of Engineers
Galveston District
Draft Environmental Impact Statement

for

Proposed Port Freeport Channel Widening
Brazoria County, Texas

November 2006

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE PROPOSED PORT FREEPORT CHANNEL WIDENING
BRAZORIA COUNTY, TEXAS

The responsible lead agency for the permit action is the U.S. Army Corps of Engineers, Galveston District (USACE), under the authority of Section 404 (33 U.S.C. 1344) of the Clean Water Act, Section 10 (33 U.S.C. 403) of the Rivers and Harbors Act, and Section 103 of the Marine Protection Research and Sanctuary Act (33 U.S.C 1413).

This Draft Environmental Impact Statement (DEIS) was prepared as required by the National Environmental Policy Act (NEPA) to present an evaluation of potential impacts of the Brazos Harbor Navigation District's (Brazoria County) proposed Port Freeport Channel Widening. The proposed project includes widening portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Entrance Channel. The DEIS addresses the potential impacts of the proposed project on the human environment, as identified during the public interest review, including placement of dredged material. All factors that may be relevant to the proposed project were considered. Among those factors are: dredged material management, air quality, shoreline erosion, economics, general environmental concerns, historic resources, protected species, navigation, recreation, water and sediment quality, energy needs, safety, hazardous materials, and, in general, the welfare of the people. The DEIS provides relevant information to the public and the USACE on the potential impacts of the proposed project. The public response to the findings of the DEIS will be addressed in the Final EIS. The Final EIS will be an informational document used by the USACE in its decision to grant or deny the permit, which will be described in the Record of Decision (ROD).

Comments on this DEIS must be postmarked by:

January 9, 2007
Date

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DRAFT
ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED PORT FREEPORT CHANNEL WIDENING BRAZORIA COUNTY, TEXAS

U.S. Army Corps of Engineers, Galveston District
2000 Fort Point Road
Galveston, Texas 77550

October 2006

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Acronyms and Abbreviations

°F	degrees Fahrenheit
ANS	aquatic nuisance species
ARI	American Rice Inc.
BA	Biological Assessment
BG	block group
BO	Biological Opinion
BRHND	Brazos River Harbor Navigation District
BU	beneficial use
BWM	ballast water management
CAA	Clean Air Act
CAR	Center for Archaeological Research
CCC	Coastal Coordination Council
CEPRA	Coastal Erosion Protection and Response Act
CEQ	President's Council on Environmental Quality
cfs	cubic feet per second
CO	carbon monoxide
CT	census tract
cy	cubic yards
dB	decibels
dBA	A-weighted sound level
DMMP	Dredged Material Management Plan
DMPA	Dredged Material Placement Area
DO	dissolved oxygen
DOD	Department of Defense
DOE	U.S. Department of Energy
DOT/FAA	Department of Transportation/Federal Aviation Administration
EFH	essential fish habitat
EH&A	Espey, Huston & Associates, Inc., now PBS&J
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERL	effects range low
ERM	effects range medium
ESA	Endangered Species Act
FERC	U.S. Federal Energy Regulatory Commission
FH-EC	Freeport Harbor-Entrance Channel
FM	Farm-to-Market Road
Freeport LNG	Freeport LNG Development, L.P.

Freeport LNG Project	Freeport LNG Import Terminal Project
ft	feet/foot
Fugro	Fugro Consultants, Inc.
FWS	U.S. Fish and Wildlife Service
GIWW	Gulf Intracoastal Waterway
GLO	Texas General Land Office
GMFMC	Gulf of Mexico Fisheries Management Council
gpm	gallon-per-minute
GSMFC	Gulf States Marine Fisheries Commission
HDR/SMA	HDR/Shiner, Moseley & Associates, Inc.
HGA	Houston-Galveston Area
HTRW	hazardous, toxic, and radioactive waste
HUD	Department of Housing and Urban Development
Hz	frequency of a sound corresponding to the human sensation of pitch and measured in Hertz
LEP	Limited English Proficiency
L_{eq}	equivalent sound level
LOA	length over all
LUST	leaking underground storage tank
mcy	million cubic yards
mcy/yr	million cubic yards per year
mg/kg	milligram per kilogram
mg/L	milligrams per liter
MLT	mean low tide
MPN/dL	Most Probable Number/deciliter
MPRSA	Marine Protection and Sanctuaries Act
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NBIC	National Ballast Information Clearinghouse
NCDC	National Climatic Data Center
NDD	Natural Diversity Database
NEPA	National Environmental Policy Act
NFRAP	No Further Remedial Action Planned
NMFS	National Marine Fisheries Service
NO	nitric oxide
NO_2	nitrogen dioxide
NO_3	nitrate radical
NOAA	National Oceanic and Atmospheric Administration
NO_X	nitrogen oxide
NPS	National Park Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory

NWR	National Wildlife Refuge
NYSDEC	New York State Department of Environmental Conservation
O_3	ozone
ODMDS	Ocean Dredged Material Disposal Site
PA	Placement Area
Pb	lead
PM_{10}	particulate matter with particle diameters of 10 microns or less
$PM_{2.5}$	particulate matter with diameters of 2.5 microns or less
PST	petroleum storage tanks
RIA	Regional Implementation Agreement
SAV	submerged aquatic vegetation
SCS	Soil Conservation Service
SH	State Highway
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPP	suspended particulate phase
SPR	Strategic Petroleum Reserve
SSA	sole source aquifers
TAMU	Texas A&M University
TARL	Texas Archeological Research Laboratory
TCEQ	Texas Commission on Environmental Quality (formerly the Texas Natural Resources Conservation Commission)
TCMP	Texas Coastal Management Program
TCWC	Texas Colonial Waterbird Census
TDH	Texas Department of Health
THC	Texas Historical Commission
THM	Texas Historic Markers
TNC	The Nature Conservancy
TNRCC	Texas Natural Resources Conservation Commission (now the Texas Commission on Environmental Quality)
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TSDC	Texas State Data Center
TWC	Texas Workforce Commission
TWDB	Texas Water Development Board
TWQS	Texas Surface Water Quality Standards
UCPA	Upland Confined Placement Area
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard

USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VLCC	very large crude carriers
VOC	volatile organic compounds
W/B	channel width (W) versus the maximum vessel beam (B) allowed to transit the channel
WQC	water quality discrete criteria

1.0 INTRODUCTION, PURPOSE AND NEED

1.1 INTRODUCTION

The Brazos River Harbor Navigation District (BRHND) of Brazoria County, Texas (also known as Port Freeport) applied to the U.S. Army Corps of Engineers (USACE), Galveston District, for a Clean Water Act Section 404 permit and Rivers and Harbors Act Section 10 permit for dredge and fill activities related to the widening of portions of the Freeport Ship Channel on April 14, 2005. Activities subject to the jurisdiction of the USACE would include dredging in navigable waters to widen portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Entrance Channel and placement of fill in waters of the U.S. Based on the Section 10/404 permit application submitted by Port Freeport to the USACE, the USACE determined that the permitting action for the proposed dredge and fill activities constitutes a major Federal action. In accordance with the National Environmental Policy Act (NEPA), this Environmental Impact Statement (EIS) has been prepared to analyze and disclose the potential impacts of the proposed project and reasonable alternatives on the natural and human environment. A permit application reflecting the applicant's plans for the proposed project is included in this document as Appendix A.

The Old Brazos River, a cutoff meander from the Brazos River, is present to the northwest of the project area. The Stauffer and Brazosport Turning Basins are present northwest of the project area and were originally part of the Old Brazos River prior to channelization for shipping into the Port of Freeport. The GIWW is present within the project area and provides a protected navigational shipping route along most of the Texas Gulf Coast. The Lower Turning Basin is present in the northern portion of the project area and connects to the Freeport Harbor Channel which extends southeasterly approximately 5 miles into the Gulf of Mexico. The Freeport Harbor Channel is located between the beach communities of Quintana and Surfside, southeast of the City of Freeport, Texas.

The proposed project site is located along the northern edge of the Freeport Harbor Jetty and Entrance Channels, between Surfside and Quintana, in Brazoria County, Texas (Figure 1.1-1). The Freeport Harbor Jetty and Entrance Channels are currently maintained by the USACE to a depth of -47 feet (ft) mean low tide (MLT) at a width of 400 ft. These existing channels are approximately 6.3 miles in length and approximately 400 ft in width. The side slopes of the channel are maintained at approximately 3 ft horizontal to 1 ft vertical (USACE, 1978).

Port Freeport proposes to widen, but not deepen, portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Entrance Channel. Beginning at Channel Station 63+35 (see Figure 1.1-1), which is just about even with the center of the U.S. Coast Guard (USCG) Station access channel, the Jetty Channel will be gradually widened, at the authorized depth, up to an additional 150 ft over the next 1,835 ft to Channel Station 45+00. Over the next 500 ft, to Channel Station 40+00, the widening will be less gradual and will go from the additional 150 ft to an additional 200 ft. From Channel Station 40+00, through the rest of the Jetty Channel and to the end of the Entrance Channel at Channel Station -260+00, the channel

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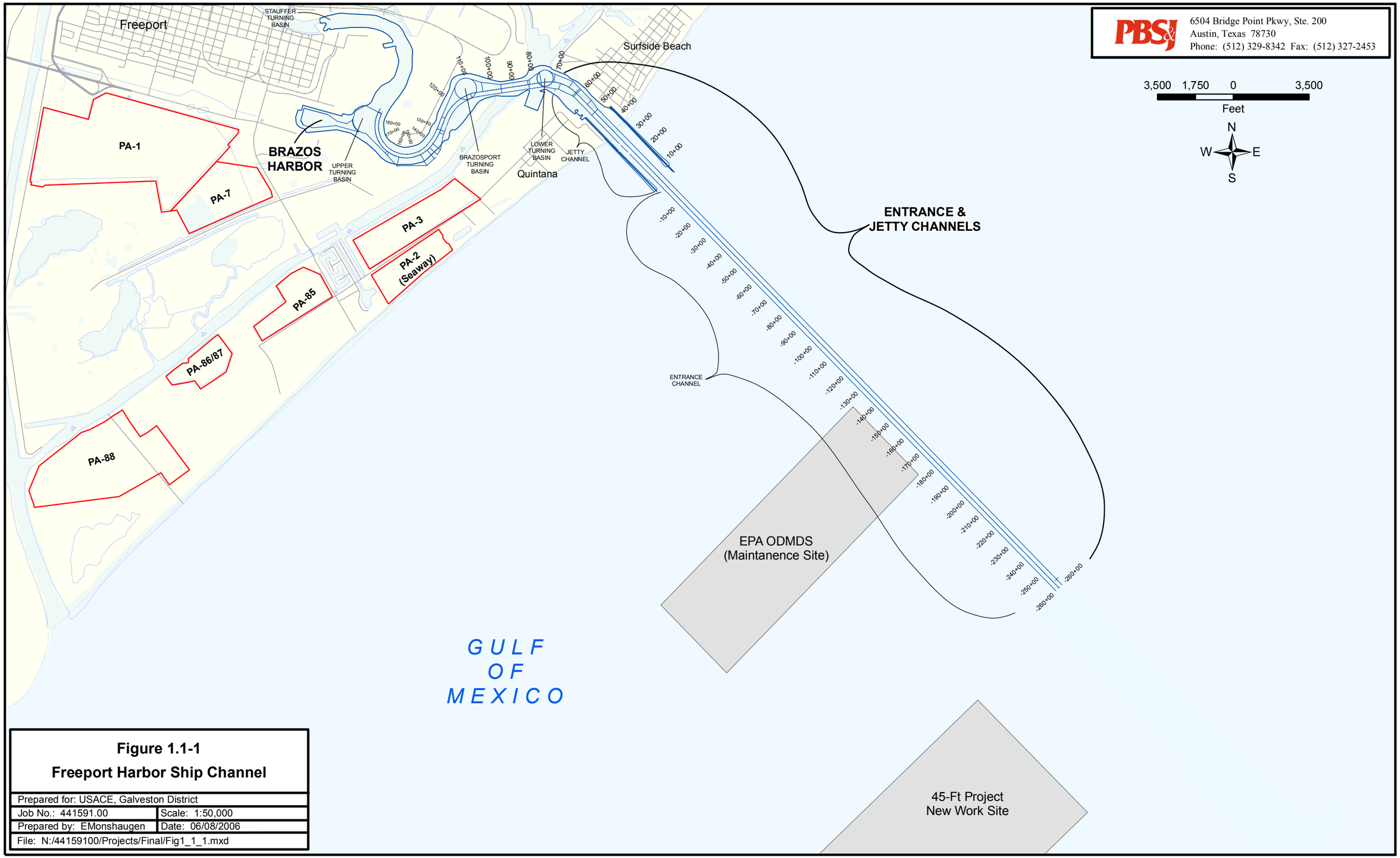

Figure 1.1-1
Freeport Harbor Ship Channel

Prepared for: USACE, Galveston District	
Job No.: 441591.00	Scale: 1:50,000
Prepared by: EMonshaugen	Date: 06/08/2006
File: N:/44159100/Projects/Final/Fig1_1_1.mxd	

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will be widened an additional 200 ft. The length of channel that is proposed for widening is 32,335 ft or 6.1 miles, of which 5.7 miles will be widened by 200 ft. Additional information regarding the proposed project is presented in Section 2.0.

1.2 PURPOSE

The purpose of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight-only operations for larger vessels, and (c) restrictions that do not allow the larger vessels to enter the Port when winds exceed 20 knots or crosscurrents exceed 0.5 knots. The maximum ship dimensions permitted by the pilots at Freeport Harbor are: 825-ft length over all (LOA), 145-ft maximum beam, and 42-ft draft. Estimates by Hackett (2003) for Gulf Coast ports indicate an expected annual increase in tanker calls of 1.9% and dry bulk calls of 2.0%. Economic pressure and technological advances have generally influenced a trend toward larger ships, which has increased channel improvement needs. It is projected that there will be a significant overall increase in demand for shipping, because of globalization and large increases in commodity trade (Hackett, 2003). The existing fleet will grow and newer ships will likely be larger in pursuit of economic efficiency (Waters et al., 2000). The widening project is consistent with other regional navigation channel improvements in response to world fleet trends and contributes to NED goals. These problems are discussed in more detail below.

LOA Restrictions. The length limitation of 825 ft is enforced because cross winds and currents force tankers to “crab” at an angle through the entrance channel. Ships of greater length than 825 ft are not able to clear the jetties under adverse wind and current conditions. Waivers on ship length are granted on a case-by-case basis for ships as large as 900-ft LOA and 160-ft beam to transit the Freeport Harbor Channel, provided that winds are less than 15 knots and that there is no more than a 0.5 knot cross current at the mouth of the jetties. About three to four ships per month are granted these waivers. Numerous requests have been submitted for ships in the 920- to 950-ft LOA range to transit the Channel and these requests have been denied. When denied access to Freeport Harbor, these ships normally divert to Corpus Christi or New Orleans.

Beam Restrictions. The maximum beam permitted under normal operations is 145 ft. Vessels with larger beams require waivers to enter port.

One-Way Traffic Restriction. Because of the 400-ft width of the entrance and main channels, one-way ship traffic is always in effect in the Freeport Harbor Channel. This can result in delays when ship schedules coincide.

Daylight-Only Operation Restriction. Because of channel dimensions as well as the nature of the cargo of ships calling at Freeport Harbor, daylight-only operation is enforced on all vessels greater than 750 ft LOA or over 107 ft wide. This can result in waiting time of up to 12 hours, if ship arrival/departure occurs at dark.

1.3 NEED

The project need is the elimination of the operational constraints to allow vessels to avoid delays, thereby reducing shipping costs (more than $24MM over the 50-year life of the project [Martin Associates, 2006]) and logistical problems and increasing vessel safety.

The concept of public and private need for the proposed project is important to the balancing process of the USACE public interest review (33 CFR 320.4(a)(2)(i)). A private applicant's proposal may satisfy a public as well as a private need (e.g., providing the public with needed goods and services). A public sector applicant's project is presumed to address some public need, such as public recreation. With regards to private projects, Department of the Army regulations (33 CFR 320.4 (q)) state that the USACE will generally not concern itself with the question of whether a proposed project will earn a profit or become economically viable, or whether it is needed in the market place. In regards to public projects, the USACE can defer to a state or other government entity decision to spend non-Federal public money. However, regulations indicate that the USACE should make an independent review of the public need for a project from the perspective of the overall public interest. This independent review is relevant to the USACE permit decision. The USACE will question the public need for a project if the proposed project appears to be unduly speculative. In the public interest review, the USACE has the responsibility to balance public interest need or benefits against public interest detriments. The decision of whether to authorize a proposed project and the conditions under which it will be allowed are determined by the outcome of this general balancing process.

In the 905(b) analysis (USACE, 2002), the USACE noted the problems mentioned above; i.e., "that the relatively narrow (400-ft wide) entrance and main channels limit the Freeport Harbor Channel to one-way for all vessels and daylight-only operation for the larger vessels." It is also noted that "the light-loading, one-way traffic, and daylight-only operation result in significantly higher costs to users of Port Freeport than would be experienced if the harbor were enlarged and deepened. The transportation savings that would result from improvements at Freeport Harbor would be economic benefits to the nation." Thus the USACE has confirmed the need for the project and that the project serves the national interest. However, to reduce the time that is required for a Federal project to come to fruition and because of uncertainty in future Federal funding, Port Freeport has decided to undertake the widening project as a permit action. This will allow the economic benefits that will result from a widened channel to accrue more quickly.

2.0 DESCRIPTION AND EVALUATION OF ALTERNATIVES

2.1 INTRODUCTION

This section discusses the alternatives considered during the preparation of the EIS, including those that were eliminated from further study, those considered in detail, and the No-Action alternative. Although it fails to meet the Purpose and Need of the proposed project, the No-Action alternative always remains as an alternative to the applicant's proposed action (i.e., widening of portions of the Freeport Harbor Jetty and Entrance Channels).

This discussion is intended to form the basis for the USACE's permit decision. As a result of the decision process, the USACE may issue the permit, deny the permit, or issue the permit with modifications or conditions. As discussed in Section 2.4.1, the No-Action alternative is considered to be equivalent to denial of the permit by the USACE.

While alternate sites might be considered alternatives for some projects that address a national or statewide-need, such is not the case for the present Permit Application. Therefore, the types of alternatives addressed were widening alternatives and dredged material placement alternatives at the project location.

2.2 WIDENING ALTERNATIVES

The restrictions on traffic at Port Freeport arising from the channel width are noted in Section 1.2 and in the USACE 905(b) evaluation document (USACE, 2002): vessel length, vessel beam, one-way traffic at all times, and daylight only traffic. Design parameters for channel dimensions are normally based on the channel width (W) versus the maximum vessel beam allowed to transit the channel (B). ASCE (2004) provides information from three manuals on ship channel design. Table 2.2-1 is based on the latest of these (USACE, 2002) and shows the suggested conservative (minimum) values of W/B for various conditions and one- and two-way traffic, assuming best aids to navigation.

TABLE 2.2-1

MINIMUM CHANNEL WIDTH/MAXIMUM BEAM (W/B) FOR VESSELS ALLOWED TO TRANSIT A CHANNEL UNDER VARIOUS CONDITIONS

	Current in Knots		
	0.0 to 0.5	0.5 to 1.5	1.5 to 3.0
Minimum W/B for one-way traffic	2.75	3.25	4.0
Minimum W/B for two-way traffic	4.5	5.5	6.5

Two possible widths (500 and 600 ft) were examined as alternatives. Since studies (Fugro Consultants, Inc. [Fugro], 2005) showed that the maximum channel width should not exceed 600 ft to maintain jetty stability (550 ft inside Channel Station 38+00) and since the USACE had selected 600 ft as the maximum

width alternative (USACE, 2002), 600 ft was the maximum width examined. Table 2.2-2 shows values of W/B for the existing channel width (400 ft) and the two alternatives for a series of vessel beams: 107 ft (width requiring daylight-only transits), 125 ft (typical maximum beam [Rodino and Moseley, 2005]), 138 ft (maximum presently calling on Seaway and ConocoPhillips terminals (Permit Application 23752), 145 ft above which waivers are required (Permit Application 23752), and 148 ft (SUEZMAX), the maximum that Seaway and ConocoPhillips terminals would likely to be able to accommodate (Permit Application 23752).

TABLE 2.2-2

W/B VALUES FOR VARIOUS VESSEL BEAMS AT A 400-, 500-, AND 600-FT CHANNEL WIDTH

Ship Beam (ft)	400 ft	500 ft	600 ft
		Channel width to beam ratio (W/B)	
107	3.73	4.67	5.61
125	3.20	4.00	4.80
138	2.90	3.62	4.35
145	2.75	3.44	4.13
148	2.70	3.38	4.05

As can be seen, the existing channel (400 ft) is marginal for the 145-ft beam vessel even with one-way traffic and ideal conditions (less than 0.5 knot cross current), thus the need for waivers above this beam. A channel width of 500 ft allows two-way traffic only for the 107-ft beam vessels under ideal conditions, while a 600-ft channel allows two-way traffic for vessels up to 133-ft beam (extrapolating from the data in Table 2.2-2 such that W/B = 4.5) under ideal conditions and one-way traffic for 148-ft beam vessels, even with a 3 knot cross current (which occurs roughly 5% of the time [Permit Application 23752]). Since the benefits from the widening are directly related to reducing limitations on transits, the 600-ft width is the proposed alternative, and the 500-ft width is eliminated from further consideration because it does not effectively meet the purpose and need for the project, as defined in Section 1.

2.3 DREDGED MATERIAL PLACEMENT ALTERNATIVES

The proposed action, as described in Section 1.1, involves widening portions of the Freeport Harbor Jetty Channel (from Channel Station 63+35) and all of the Freeport Harbor Entrance Channel. The proposed widening would generate approximately 3.2 million cubic yards (mcy) of new dredged material. Approximately 2.9 mcy of the new work material would consist of clay material and about 300,000 cubic yards (cy) would consist of silty/sand material.

A Dredged Material Management Plan (DMMP) Workgroup, comprising the following agencies and other entities, met to discuss the potential alternatives for dredged material placement:

USACE

National Marine Fisheries Service (NMFS)

U.S. Fish and Wildlife Service (FWS)

U.S. Environmental Protection Agency (EPA)

Texas Parks and Wildlife Department (TPWD)

Texas General Land Office (GLO)

Texas Commission on Environmental Quality (TCEQ)

Port Freeport

HDR/Shiner, Moseley & Associates, Inc. (HDR/SMA)

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Seventeen placement alternatives were identified and considered by the DMMP Workgroup (Table 2.3-1 and Figure 2.3-1). These alternatives included upland confined placement areas (UCPA), beach nourishment, marsh restoration, upland beneficial use (BU), offshore BU, and use of an Ocean Dredged Material Disposal Site (ODMDS). Use of the material for BU was given primary consideration by the DMMP Workgroup. A total of five types of BU placement options (habitat berm, feeder berm, energy dissipating berm, beach nourishment, and marsh restoration) were subjected to a preliminary screening process to determine feasibility. The process took material characteristics, environmental effects and permanence, dredge type applicability, pumping cost versus distance, reliability, permanence, public perception, and overall performance into consideration. Through this process, it was determined that the physical characteristics of the clay material made it unsuitable for the BUs being considered.

The three offshore potential BU sites (habitat, feeder, and energy dissipating berms) were removed from further consideration by the DMMP Workgroup or the Applicant for various reasons, including reliability as a BU, lack of permanence, and/or overall performance. Studies (SMA, 2005) determined that the offshore berms (alternatives 8 and 9 in Table 2.3-1), as designed, would not provide wave protection or function as a feeder berm or surf break. The fisheries habitat benefits of the offshore topographic high (alternative 7 in Table 2.3-1) were questioned by the DMMP Workgroup and since there was already a previously designated offshore dredged material disposal site (ODMDS) for construction material, the DMMP Workgroup determined that any benefits that would accrue from a topographic high would be just as substantial at the ODMDS as at a previously undisturbed area nearer shore. Therefore, the topographic high was also eliminated from further consideration.

Two potential beach nourishment locations were identified (placement on Surfside Beach and placement on Quintana Beach in front of the Seaway UCPA). The placement of the 300,000 cy of silty/sand new work material at either of these locations was determined to be another BU option (alternative 5 in Table 2.3-1).

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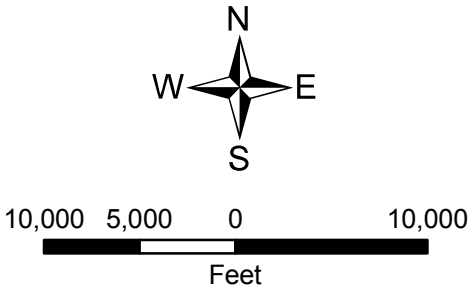

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Figure 2.3-1
Freeport Channel
Ocean Dredged Material
Placement Area Alternatives

Prepared for: USACE, Galveston District	
Job No.: 441591.00	Scale: 1:120,000
Prepared by: Emonshaugen	Date: 10/19/2006
File: N:/44159100/Projects/ODMDS.mxd	

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TABLE 2.3-1

NEW WORK PLACEMENT ALTERNATIVES

Alternative	Placement Alternative	Dredge Methodology	Potential Capacity Silty-Sand Material[1]	Potential Capacity Clay Material[2]	Potential Beneficial Use	Containment Requirements	Issues
1	Swan Lake Marsh Restoration/Creation	Hydraulic	~ 100K CY (33%)	~ 250K CY (20%)	Yes	GIWW Interface	• Presence of oyster beds • Active fishing area • Freeport Wiggles Sect. 216 study conflict
2	Bryan Lake Marsh Restoration/Creation	Hydraulic	~ 60K CY (20%)	~ 150K CY (12%)	Yes	None	• Presence of oyster beds • Strategic Petroleum Reserve security concerns • Potential Port Freeport future mitigation or development site
3	332 Bridge Marsh Restoration/Creation	Hydraulic	~ 300K CY (10%)	~ 0 CY (0%)	Yes	Drainage Canal Interface	• Presence of oyster beds • Active fishing area
4	GIWW Bank 'Stabilization'	Hydraulic	Not Suitable (0%)	??%[3]	Yes	Yes	• Construction difficulty (long, narrow placement corridor) • Containment needs along bank a major factor
5	Beach Placement – Quintana or Surfside	Hydraulic	100%	Not Suitable (0%)	Yes	None	• Quality of sandy material
6	DMPA "Seaway" Levee Protection/Stabilization	Hydraulic	Not Suitable (0%)	~ 150K CY (12%)	Yes	None	• Would most likely preclude driving on this section of beach • Material would be sacrificial in nature, fines would be on beach for a long time
7	Offshore Berm – Fish Habitat	Mechanical/ Hydraulic	100%	100%	Yes (See Issues)	None	• Workability
8	Offshore Berm – Wave Protection	Mechanical / Hydraulic	100%	100%	Yes (See Issues)	None	• Workability
9	Nearshore Berm – Beach Feeder Berm/ Surf Break	Hydraulic	100%	Not Considered for Clayey Mat'l	Yes	None	• Workability
10	Upland Confined Placement DMPA "Seaway"	Hydraulic	Not Considered	~ 150K CY (12%)	No	Dike Raising Required	• Freeport LNG borrow pit not large enough to accommodate material without additional dike raising efforts

Table 2.3-1 (Cont'd)

Alternative	Placement Alternative	Dredge Methodology	Potential Capacity Silty-Sand Material[1]	Potential Capacity Clay Material[2]	Potential Beneficial Use	Containment Requirements	Issues
							• Port Freeport prefers not to place material in this Port controlled DMPA
11	Upland Confined Placement DMPA "85"	Hydraulic	Not Considered	~ 0 CY (0%)	No	Dike Raising Required	• DMPA Capacity would be exceeded without significant dike raising
12	Upland Confined Placement DMPA "3"	Hydraulic	Not Considered	~ 0 CY (0%)	No	In Place	• Limited existing capacity is already designated for use
13	Upland Confined Placement DMPA "86 / 87"	Hydraulic	Not Considered	~ 0 CY (0%)	No	In Place	• DMPA is designated for GIWW maintenance material placement
14	Upland Confined Placement DMPA "88"	Hydraulic	Not Considered	~ 0 CY (0%)	No	In Place	• DMPA is designated for GIWW maintenance material placement
15	Upland Confined Placement DMPA "7"	Hydraulic	Not Considered	~ 0 CY (0%)	No	In Place	• DMPA capacity has been reached • Adjacent property restrictions do not allow expansion
16	Upland Confined Placement DMPA "1"	Hydraulic	Not Considered	~ 0 CY (0%)	No	In Place	• Limited existing capacity is already designated for use
17	ODMDS Placement	Mechanical/ Hopper	100% (Including Entrance Channel)	100% (Including Entrance Channel)	No	None	• Not BU

[1] Based on preliminary analysis of geotechnical information, the quantity of silty-sand materials in the Jetty Channel is assumed to be approximately 300,000 cubic yards.
[2] Based on the overall quantity of material in the Jetty Channel with the aforementioned estimated quantity of silty-sand materials removed, the quantity of clay materials is assumed to be approximately 1,300,000 cubic yards (the remaining 1.6 MCY of material is located in the Entrance Channel.
[3] GIWW 'Bank Stabilization' Capacity was not calculated because of the multiple factors that make this alternative non-viable.

Three potential marsh restoration BU areas (alternatives 1, 2, and 3 in Table 2.3-1) were identified during a DMMP workshop in December 2005:

1. Swan Lake
2. Wetland areas near the SH 332 Bridge
3. Bryan Lake

These areas were targeted after reviewing aerial photographs of the area, based on the experience of the agency personnel and because of the significant size of the potential open water area in each that could be built up to wetland habitat. During a follow-up meeting in January 2006 and a subsequent desktop investigation and field visit, the consensus of the Workgroup was that Swan Lake could be removed as a viable BU area because of the significant presence of oysters and fishing activities and potential conflict with improvements to the Gulf Intracoastal Waterway (GIWW) at an area near Swan Lake, known as the Freeport Wiggles. However, the DMMP Workgroup requested that a habitat assessment be conducted for the 332 Bridge and Bryan Lake marsh areas.

Therefore, a more extensive field visit was conducted at the 332 Bridge Site and the Bryan Lake Site, which was documented by photographs and a habitat assessment report (Appendix B). Based on the analysis of the data from this field effort, the Bryan Lake Site was eliminated from further consideration because of the presence of oysters, shallow water depth, health and value of the existing fringing marsh, and value as a loafing and foraging area for waterfowl. These findings were reported at the next meeting of the DMMP Workgroup, in February 2006.

To complete the analysis, costs were developed for the 332 Bridge Site and beach nourishment (SMA, 2006), as the only two remaining feasible BU alternatives for the 300,000 cy of silty/sand new work material. The cost estimate took into consideration the type of dredge used, dredging time, dredging conditions (i.e., depth of water), the use of heavy equipment to manipulate the material, and the amount of material manipulation required. Based on the cost estimate, the 332 Bridge Site was estimated to be much more costly (over $500,000) than the beach nourishment option. Thus, the 332 Bridge Site was eliminated from further consideration.

Beach nourishment at either Quintana or Surfside remained as a viable BU placement option for the 300,000 cy of new work material. The two alternative locations, Surfside and Quintana, will both be carried through the EIS for complete analysis, along with the No-Action alternative. Since a BU was available for the sandy material, all non-BU options, including ocean placement, were eliminated for the sandy material.

Once it was determined the 2.9 mcy of clay material were not viable for the BU alternatives being considered, several upland placement options were considered. However, as seen in Table 2.3-1, the upland PAs either didn't have capacity to accept the material or were designated for other uses. The major

portion of the dredging of the clay material will be dredged by hopper dredge and, therefore, ocean placement was selected as the proposed alternative for placement of this material.

2.4 ALTERNATIVE DESCRIPTIONS

The following subsections provide a description of the alternatives carried through and evaluated in this EIS. The alternatives include the No-Action alternative and the proposed action with two alternative BU PAs.

2.4.1 Alternative 1: No-Action Alternative

The No-Action alternative for this project is one which would result in no construction requiring a USACE permit. Since the proposed project requires dredging activities in navigable waters, it could not be constructed without a permit from the USACE. Thus, the No-Action alternative is equivalent to USACE denial of the permit for widening the Freeport Harbor Jetty and Entrance Channels. In the event of permit denial, the channel would not be widened.

Although a Federal Freeport Harbor Channel Improvement project has been proposed that includes widening and deepening the Freeport Harbor Jetty and Entrance Channels, the approval and implementation of the project is uncertain. Thus, under the No-Action alternative, current navigation restrictions, as described in Section 1.2, would continue and the Port of Freeport would not benefit from the elimination of those operational constraints. Vessels entering the Port of Freeport would continue to be delayed by one-way traffic and daylight-only restrictions and vessel safety would not be improved.

2.4.2 Alternative 2: Proposed Action with Placement at Quintana

The proposed action is the widening of the Freeport Harbor Jetty Channel from Channel Station 63+35, using a combination of mechanical, pipeline, and hopper dredges. The Jetty Channel would be gradually widened, at the authorized depth, up to an additional 150 ft for 1,835 ft to Channel Station 45+00. From that station for about 500 ft to Channel Station 40+00, the widening would go from an additional 150 ft to an additional 200 ft. The remainder of the Jetty Channel and the entire Freeport Harbor Entrance Channel (to Channel Station -260+00) would then be widened an additional 200 ft. The total channel length proposed for widening is 32,335 ft (6.1 miles).

The proposed action would result in approximately 3.2 mcy of new work dredged material consisting of approximately 2.9 mcy of clay/silt material and about 300,000 cy of silty/sand material. If approved by the EPA, the clay/silt material would be placed in an ODMDS that would be redesignated for use by EPA under USACE authority (Appendix C).

Under Alternative 2, the 300,000 cy of silty/sand material would be used beneficially and placed on Quintana Beach in front of the Seaway UCPA. The beach on either side of this location has been enhanced through GLO or other programs, leaving a “gap” in front of the Seaway UCPA. Placement of

the material in this location would fill in the gap, allowing for continuous beach use and providing some protection from erosion for the Seaway UCPA.

2.4.3 Alternative 3: Proposed Action with Placement at Surfside

The proposed action under Alternative 3 is the same as that described for Alternative 2. However, under Alternative 3, the 300,000 cy of silty/sand material would be placed on Surfside Beach. Placement of the material in this area would provide some protection from erosion for homes located along the beach.

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3.0 AFFECTED ENVIRONMENT

For the purposes of analysis in this EIS, unless otherwise defined, the project area is defined as the footprint of the construction area within the channel plus a 1-mile buffer area and the PAs (Figure 3.0-1). Because impacts may affect resources outside of this project area, unless otherwise noted, the study area consists of all of Brazoria County (Figure 3.0-2). If the project or study area differs from this for a specific resource, it will be defined in that section.

3.1 AIR QUALITY

Brazoria County is part of the Houston-Galveston Air Quality Control Region, also referred to as the Houston-Galveston Area (HGA). The HGA includes Harris County and the seven surrounding counties of Montgomery, Liberty, Chambers, Galveston, Brazoria, Fort Bend, and Waller. Existing air quality conditions for the HGA were used as a baseline for comparison because air quality impacts generally are more regional than localized. Therefore, the Project Area for Air Quality purposes is defined as the HGA, unless otherwise noted.

3.1.1 Regulatory Context

The Clean Air Act (CAA) of 1970, 42 United States Code (USC) 7401 et seq. amended in 1977 and 1990 and Title 40 Code of Federal Regulations (40 CFR) Parts 50–99, are the basic Federal statutes and regulations governing air pollution. The provisions that are potentially relevant to this project are the National Ambient Air Quality Standards (NAAQS) and the General Conformity Rules promulgated by the EPA and incorporated into corresponding state rules by the TCEQ.

3.1.1.1 National Ambient Air Quality Standards

The CAA requires the EPA to establish NAAQS for pollutants considered harmful to public health and the environment. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

The EPA has established NAAQS for six principal pollutants, which are called "criteria" pollutants. They are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), lead (Pb), particulate matter with particle diameters of 10 microns or less (PM_{10}), particulate matter with diameters of 2.5 microns or less ($PM_{2.5}$), and sulfur dioxide (SO_2). The NAAQS are codified in 40 CFR Part 50 and are summarized in Table 3.1-1.

CO is a colorless, odorless, tasteless gas. It may temporarily accumulate at harmful levels, especially in calm weather during winter and early spring, when fuel combustion reaches a peak and CO is chemically more stable due to the low temperatures. CO usually dissipates quickly over a large area, posing minimal

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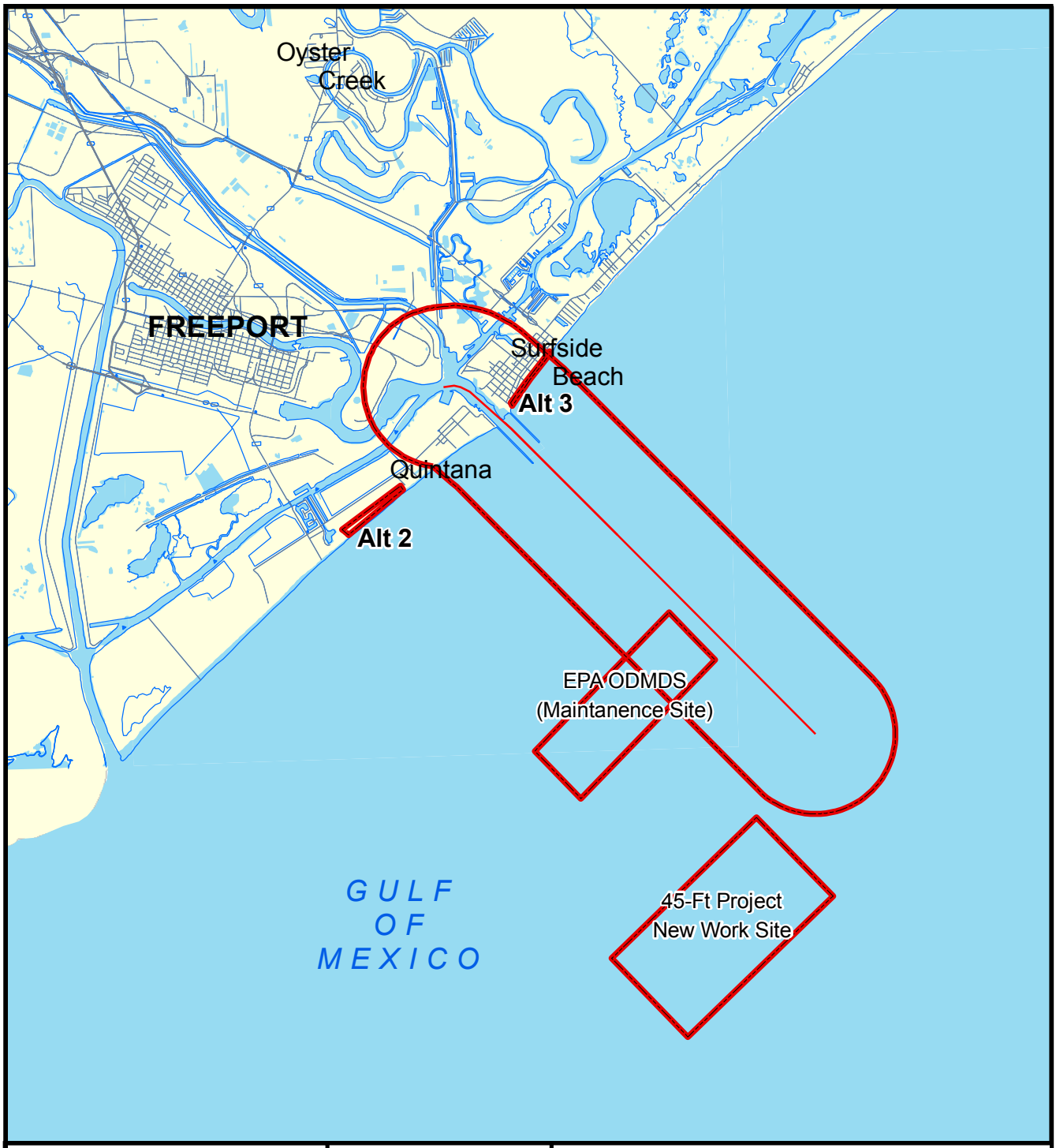

Legend

Channel Centerline

Project Area Components

N
W E
S

0 0.5 1 2
Miles

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Austin, Texas 78730
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Figure 3.0-1
Port Freeport
Channel Widening
Project Area

Prepared for: Martin Arhelger	
Job No.: 441591	
Prepared by: TBrown/A Pugh	Date: 08/30/2006
File: N:/44159100/Projects/Project_Area.mxd	

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Legend

Freeport Channel Widening Project Area

Study Area

N W E S

10 5 0 10 Miles

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Figure 3.0-2
Port Freeport Channel Widening Study Area

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threat to human health. Transportation activities, indoor heating, and open burning are among the anthropogenic (man-made) sources of CO.

TABLE 3.1-1

NATIONAL AMBIENT AIR QUALITY STANDARDS FOR THE PROJECT AREA

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Carbon Monoxide (CO)	1-Hour[a]	35 ppm (40,000 μg/m^3)	-
	8-Hour[a]	9 ppm (10,000 μg/m^3)	-
Nitrogen Dioxide (NO_2)	Annual[b]	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)
Ozone (O_3)	1-Hour[c, d]	0.12 ppm (235 μg/m^3)	0.12 ppm (235 μg/m^3)
	8-Hour[e]	0.08 ppm (157 μg/m^3)	0.08 ppm (157 μg/m^3)
Fine Particulate ($PM_{2.5}$)	24-Hour[f, j]	65 μg/m^3	65 μg/m^3
	Annual[g, j]	15 μg/m^3	15 μg/m^3
Lead (Pb)	Quarter[h]	-	1.5 μg/m^3
Respirable Particulate (PM_{10})	24-Hour[a, j]	150 μg/m^3	150 μg/m^3
	Annual[i, j]	50 μg/m^3	50 μg/m^3
Sulfur Dioxide (SO_2)	3-Hour[a]	-	0.5 ppm (1,300 μg/m^3)
	24-Hour[a]	0.14 ppm (365 μg/m^3)	-
	Annual[b]	0.030 ppm (80 μg/m^3)	-

[a] Standard is not to be exceeded more than once per year
[b] Standard is met when the annual arithmetic mean is not exceeded
[c] Standard is met when the expected number of days the standard is exceeded is equal to or less than once per year.
[d] The 1-hour standard does not apply after June 4, 2005.
[e] Standard is met when the three-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations is less than or equal to 0.08 ppm
[f] Standard is met when the three-year average of the 98th percentile of 24-hour concentrations is less than or equal to 65 μg/m^3
[g] Standard is met when the three year average of the weighted annual mean $PM_{2.5}$ concentrations does not exceed 15.0 μg/m^3
[h] Standard is met when the arithmetic mean average over a calendar quarter is not exceeded
[i] Standard is met when the three-year average of the weighted annual mean does not exceed 50 μg/m^3
[j] EPA revised the air quality standards for particle pollution in 2006. The 2006 standards tighten the 24-hour fine particles ($PM_{2.5}$) standard from the current level of 65 μg/m^3 to 35 μg/m^3, and retain the current annual fine particle ($PM_{2.5}$) standard at 15 μg/m^3. The Agency decided to retain the existing 24-hour PM_{10} standard of 150 μg/m^3. The Agency revoked the annual PM_{10} standard (effective December 17, 2006), because available evidence does not suggest a link between long-term exposure to PM_{10} and health problems.
ug/m^3 = micrograms per cubic meter
ppm = parts per million

NO_2, nitric oxide (NO), and nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_X). These three species are interrelated, often changing from one form to another in chemical reactions. NO_2 is the species commonly measured in ambient air monitors. NO_X is generally emitted in the form of NO, which is oxidized to NO_2. The principal man-made source of NO_X is fuel combustion in motor vehicles and

power plants. Reactions of NO_X with other atmospheric chemicals can lead to the formation of O_3 and acidic precipitation.

Ground level O_3 is a secondary pollutant, formed from daytime reactions of NO_X and volatile organic compounds (VOC) rather than being directly emitted by natural and anthropogenic sources. VOCs that have no NAAQS, are released in industrial processes and from evaporation of organic liquids such as gasoline and solvents.

Dominant industrial sources of Pb emissions include waste oil and solid waste incineration, iron and steel production, lead smelting, and battery and lead alkyl manufacturing. The lead content of motor vehicle emissions, which was the major source of lead in the past, has significantly declined with the widespread use of unleaded fuel.

Particulate matter is separated into two different sizes for purposes of the NAAQS: PM_{10} and $PM_{2.5}$. PM_{10} is considered inhalable and $PM_{2.5}$ is considered to be in the respirable range, meaning these particles can reach the alveolar region of the lungs and penetrate deeper than PM_{10}. There are many sources of particulate matter, both natural and man-made, including dust from construction activities, industrial activities, and combustion of fuels.

SO_2 is emitted in natural processes, such as volcanic activity, and by anthropogenic sources such as combustion of fuels containing sulfur, sulfuric acid manufacturing, etc. SO_2 emissions in the atmosphere can lead to the formation of acidic precipitation; i.e., acid rain formation.

The CAA also requires the EPA to assign a designation of each area of the United States regarding compliance with the NAAQS. The EPA categorizes the level of compliance or noncompliance as follows:

- Attainment – area currently meets the NAAQS
- Maintenance – area currently meets the NAAQS, but has previously been out of compliance
- Nonattainment – area currently does not meet the NAAQS.

The HGA is classified as a "moderate" nonattainment area for O_3 and is in attainment for other air contaminants for which a NAAQS has been established.

The TCEQ has the responsibility for developing a plan for attaining the O_3 air quality standard in the HGA. This plan, which was submitted to and approved by the EPA, is called the State Implementation Plan (SIP). The SIP describes how the area will reach attainment of the air quality standard for O_3. The SIP sets emissions budgets for point sources such as power plants; area-wide sources such as dry cleaners and paint shops; off-road mobile sources such as boats and lawn mowers; and on-road sources such as cars, trucks, and motorcycles.

The TCEQ has the lead responsibility for monitoring air and water quality within the state and for reporting that information to the public. The staff examines and interprets the causes, nature, and behavior

of air pollution in Texas. The TCEQ also operates central and mobile laboratories based in Austin and a laboratory in Houston that provide analytical services for air, water, and waste samples. Numerous monitors are located in the HGA that are operated by the TCEQ, the City of Houston, and the Houston Regional Monitoring Network in cooperation with the TCEQ.

Most of the monitoring stations measure the concentrations of the criteria pollutants in the air, as well as air temperature, wind velocity, and other meteorological parameters. Some of the monitoring stations also measure the levels of selected chemicals and some measure pollen and mold spores. The O_3 monitors operate continuously 24 hours a day, seven days a week, and are checked by technicians who perform equipment maintenance and conduct quality assurance checks.

3.1.1.2 Conformity of General Federal Actions

As required by the CAA, the EPA has also promulgated rules to ensure that Federal actions conform to the appropriate SIP. Two rules were promulgated: (1) the Transportation Conformity Rule and (2) the General Conformity Rule. The Transportation Conformity Rule applies to Federal Highway Administration and Federal Transit Authority projects within maintenance or nonattainment areas. The General Conformity Rule applies to Federal actions, except Federal Highway Administration and Transit Authority actions, within maintenance or nonattainment areas.

The CAA prohibits Federal agencies from funding, permitting, or licensing any project that does not conform to an applicable SIP. The General Conformity Rule establishes conformity in coordination with and as part of the NEPA process. The rule takes into account air pollution emissions associated with actions that are Federally funded, licensed, permitted, or approved, to ensure emissions do not contribute to air quality degradation, thus preventing the achievement of State and Federal air quality goals. In short, a general conformity determination refers to the process of evaluating plans, programs, and projects to determine and demonstrate they meet the requirements of the CAA and the SIP. The purpose of this General Conformity Rule is to assure Federal agencies consult with state and local air quality districts to assure these regulatory entities know about the expected impacts of the Federal action and would include expected emissions in their SIP emissions budget.

The EPA promulgated the General Conformity Rule as codified in 40 CFR Part 51, Subpart W, and Part 93, "Determining Conformity of Federal Actions to State or Federal Implementation Plans." The TCEQ has promulgated its own corresponding regulations in 30 TAC § 101.30, "Conformity of General Federal Actions to State Implementation Plans." Pursuant to these regulations, a Federal agency must make a general conformity determination for all Federal actions in nonattainment or maintenance areas where the total of direct and indirect emissions of a nonattainment pollutant or its precursors exceeds de minimis levels established by the regulations.

The proposed project would be located in the HGA, classified as a "moderate" nonattainment area. It will require a permit from the USACE to carry out activities related to the channel widening including the dredging and dredged material management activities. The issuance of a Section 404/10 permit from

USACE for project activities is considered a "Federal Action" by the USACE. Therefore, the USACE, in consultation with the TCEQ, must assess whether the emissions that would result from the approval of the project are in conformity with the applicable SIP for the HGA. Only those air contaminant emissions related to the Federal action should be considered in the general conformity determination.

A general conformity determination is required for each year where the total of direct or indirect emissions caused by the Federal action would equal or exceed 100 tons per year (tpy) of NO_X or 100 tpy of VOC. The rule does not apply (i.e., a general conformity determination is not required) to actions where the total of direct or indirect emissions is below these emissions levels. In addition, even if the total of direct and indirect emissions of VOC or NO_X is below 100 tpy, when the total of direct and indirect emissions of any pollutant from the Federal action represents 10% or more of a nonattainment or maintenance area's total emissions of those pollutants, then the action is defined as a regionally significant action and a general conformity determination would be applicable.

3.1.2 Climatology

The primary factors affecting local ambient air quality are the locations of air pollutant sources; the amounts of pollutants emitted; and the meteorological conditions. Atmospheric conditions such as wind speed, wind direction, and air temperature gradients determine the movement and dispersal of air pollutants. Another important factor is the proximity to the Gulf of Mexico, which moderates temperatures and helps create consistent wind gradients.

The local climate is predominantly marine, with periods of modified continental influence during the colder months when cold fronts from the northwest sometimes reach the coast. Because of its coastal location and relatively low latitude, cold fronts that do reach the area seldom have severe temperatures.

Climate normals for Brazoria County were taken from the National Climatic Data Center (NCDC) public database. Climatology data have been recorded since 1946 at three weather stations located in Alvin, Angleton, and Freeport, Texas. Monthly normals of temperature and precipitation as recorded at these three weather stations for the period of 1971 to 2000 are provided in Table 3.1-2.

Mean daily temperatures range from about 55 degrees Fahrenheit (°F) in December and January to above 80°F in the summer months. Minimum temperatures fall as low as 43°F and maximum temperatures rise as high as 92°F.

Monthly rainfall is evenly distributed throughout the year. Average annual precipitation is about 52 inches, 57 inches, and 51 inches for Alvin, Angleton, and Freeport, respectively. Monthly precipitation averages range from about 2.82 inches to 7.80 inches.

Freeze occurrence data was also extracted from the NCDC database for the three monitoring stations in Brazoria County. Table 3.1-3 shows probable dates of the first freeze in fall and the last freeze in spring.

Snowfall is rare. In 95% of the winters, there is no measurable snowfall. In 5%, the snowfall, usually of short duration, is no more than 4 inches. The heaviest 1-day snowfall on record was more than 2 inches.

TABLE 3.1-2

MONTHLY NORMALS OF TEMPERATURE AND PRECIPITATION (1971–2000)
BRAZORIA COUNTY

	Temperature									Precipitation		
	Alvin			Angleton			Freeport			Alvin	Angleton	Freeport
Month	Avg Daily Max °F	Avg Daily Min °F	Avg Daily °F	Avg Daily Max °F	Avg Daily Min °F	Avg Daily °F	Avg Daily Max °F	Avg Daily Min °F	Avg Daily °F	Avg inches	Avg inches	Avg inches
January	62.2	43.1	52.7	62.8	43.7	53.3	62.6	45.4	54.0	4.76	4.76	4.29
February	65.7	46.1	55.9	65.9	46.9	56.4	65.4	47.9	56.7	2.91	3.50	2.84
March	72.0	53.0	62.5	72.1	53.6	62.9	71.5	54.7	63.1	3.11	3.76	2.87
April	77.3	59.6	68.5	77.5	59.6	68.6	76.5	61.4	69.0	3.22	3.74	2.82
May	83.6	67.3	75.5	83.8	67.3	75.6	82.6	69.2	75.9	4.92	5.20	4.02
June	88.8	72.5	80.7	89.1	72.7	80.9	87.8	75.1	81.5	5.35	6.44	4.65
July	91.2	74.2	82.7	91.8	74.2	83.0	90.2	77.2	83.7	4.78	4.24	4.74
August	91.6	73.8	82.7	91.9	73.7	82.8	90.2	76.5	83.4	3.84	4.83	4.18
September	87.7	69.6	78.7	88.1	69.8	79.0	86.7	72.2	79.5	7.12	7.49	7.80
October	80.8	60.4	70.6	81.2	60.3	70.8	80.2	63.5	71.9	3.93	4.25	4.52
November	72.2	52.1	62.2	72.4	52.0	62.2	72.0	54.1	63.1	4.43	4.86	4.42
December	64.7	45.1	54.9	65.1	45.2	55.2	65.0	47.4	56.2	3.36	4.17	3.51
Annual	78.2	59.7	69.0	78.5	59.9	69.2	77.6	62.1	69.8	51.73	57.24	50.6

Source: NCDC, 2006a.

TABLE 3.1-3

FREEZE DATES IN SPRING AND FALL (1971–2000)
BRAZORIA COUNTY

	Freeze Dates (Below 32°F)		
Probability	Alvin	Angleton	Freeport
Last Freeze in Spring			
10	Mar 20	Mar 26	Mar 03
50	Feb 15	Feb 15	Jan 31
90	Jan 10	Jan 04	-
First Freeze in Fall			
10	Jan 01	Dec 29	-
50	Dec 09	Dec 05	Dec 28
90	Nov 19	Nov 13	Nov 28

Source: NCDC, 2006b.

The average humidity in midafternoon is about 60%. Humidity is higher at night, and the average at dawn is about 90%. The sun shines 60% of the time possible in summer and in winter. The prevailing winds are from the south and southeast. Average windspeed, 10 miles per hour, is highest in March (Source: Soil Survey of Brazoria County, Texas, June 1981).

3.1.3 Air Quality Baseline Condition

NO_X and VOCs are considered primary contributors in the formation of O_3; therefore, while neither of these criteria pollutants exceeds the nonattainment criteria individually, they are the targeted pollutants for controlling O_3 formation and, as such, are highly regulated in this area. The HGA is currently in attainment with the NAAQS for all other criteria pollutants; CO, SO_2, PM_{10}, and Pb.

3.1.3.1 Existing Air Emissions Inventory

Based on the most recently available air emissions inventory information provided in the EPA's public database, Table 3.1-4 is a summary of emissions for Brazoria County and the HGA. The emissions information is broken out by area source, point source, highway vehicle, and off-highway vehicle emission categories based on emissions inventory for 2001. Although this emissions inventory is not from more recent years, it is the most current data that has been reviewed and posted by the EPA, and it provides a base from which to compare the proposed project emissions.

TABLE 3.1-4

SUMMARY OF AIR EMISSIONS FOR BRAZORIA COUNTY AND HGA (2001)
BY SOURCE CATEGORY (tpy)

	Source Category	CO	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Brazoria County								
	Area	7,728	966	3,180	37,688	6,678	25	4,373
	Point	11,783	0	32,766	1,285	1,229	10,922	4,907
	Highway Vehicle	45,327	227	6,555	188	141	158	4,112
	Off-Highway Vehicles	17,855	2	11,289	582	535	1,555	2,366
	Total	82,693	1,195	53,790	39,743	8,583	12,660	15,759
HGA								
	Area	89,341	8,652	14,465	289,906	56,660	221	54,928
	Point	82,725	327	164,546	12,719	11,053	118,196	45,764
	Highway Vehicle	858,163	4,806	119,943	3,250	2,339	2,933	78,681
	Off-Highway Vehicles	471,555	44	123,447	6,738	6,186	16,433	35,031
	Total	1,501,784	13,829	422,400	312,613	76,238	137,782	214,403
Brazoria County as a Percent of HGA Emission Source Categories								
	Area	8.7	11.2	22.0	13.0	11.8	11.3	8.0
	Point	14.2	0.0	19.9	10.1	11.1	9.2	10.7
	Highway Vehicle	5.3	4.7	5.5	5.8	6.0	5.4	5.2
	Off-Highway Vehicles	3.8	4.5	9.1	8.6	8.7	9.5	6.8
	Total	5.5	8.6	12.7	12.7	11.3	9.2	7.4

Source: U.S. EPA, 2006a.

Information from the EPA's Air Database identified several point sources in Brazoria County for 1999. The type and number of major industries of these point sources are listed in Table 3.1-5. The major point sources for NO_X, CO, $PM_{10}/PM_{2.5}$, and VOC emissions are from industrial organic chemicals, electrical, petroleum refining, and natural gas industries. Petroleum refining and secondary nonferrous metals industries are the major point sources for SO_2 emissions.

TABLE 3.1-5

TYPE AND NUMBER OF MAJOR INDUSTRIES
IN BRAZORIA COUNTY (1999)

Industry Type (SIC)	Number of Facilities
Industrial Organic Chemicals	13
Electric & Other Services Combined	1
Petroleum Refining	1
Natural Gas Liquids	3
Natural Gas Transmission	5
Crude Petroleum & Natural Gas	11
Plastics Materials And Resins	2
Pipe Lines	5
Gas Transmission And Distribution	2
Petroleum Bulk Stations and Terminals	4
Secondary Nonferrous Metals	1
Miscellaneous	5

Source: U.S. EPA, 2006a.

3.1.3.2 Existing Air Monitoring Data

Table 3.1-6 is a summary of ambient air quality monitored values for criteria pollutants that have been monitored in Brazoria County and the HGA from 1995 through 2005. Monitored values for a specific air contaminant are shown for the duration of time the monitor was actually in operation, and therefore only represent specific periods of time. Currently, there are two operational monitors located in Brazoria County. These monitors are used to measure concentrations of NO_2, O_3, and $PM_{2.5}$ in the ambient air.

As shown in Table 3.1-6, monitored values for NO_2 and $PM_{2.5}$ show that Brazoria County is in attainment with the NAAQS for these air contaminants and monitored values appear to be on the decline. Like the HGA, Brazoria County is in nonattainment with the NAAQS for O_3 with the data showing no clear trend in the concentrations shown.

TABLE 3.1-6

MONITORED VALUES[1] SUMMARY FOR BRAZORIA COUNTY AND HGA[2] (1995–2005)[3]

Year	2nd Max 1-hr Value for CO (ppm)	2nd Max 8-hr Value for CO (ppm)	Annual Mean Value for NO_2 (ppm)	2nd Max 1-hr Value for O_3 (ppm)	4th Max 8-hr Value for O_3 (ppm)	2nd Max 24-hr Value for SO_2 (ppm)	Annual Mean Value for SO_2 (ppm)	98th Percentile – 24-hr Value for $PM_{2.5}$ ($\mu g/m^3$)	Annual Mean Value for $PM_{2.5}$ ($\mu g/m^3$)	2nd 24-hr Value for PM_{10} ($\mu g/m^3$)	Annual Mean Value for PM_{10} ($\mu g/m^3$)	Quarterly Mean Value for Pb ($\mu g/m^3$)
Brazoria County												
1995	--	--	--	0.148	0.113	--	--	--	--	--	--	--
1996	--	--	--	0.11	0.079	--	--	--	--	--	--	--
1997	--	--	--	0.137	0.085	--	--	--	--	--	--	--
1998	--	--	--	0.111	0.09	--	--	--	--	--	--	--
1999	--	--	--	0.161	0.112	--	--	--	--	--	--	--
2000	--	--	--	0.136	0.079	--	--	25	10.5	--	--	--
2001	--	--	0.012	0.12	0.086	--	--	25	10.2	--	--	--
2002	--	--	0.009	0.143	0.095	--	--	23	9.5	--	--	--
2003	--	--	0.009	0.121	0.097	--	--	14	8.8	--	--	--
2004	--	--	0.009	0.142	0.103	--	--	--	--	--	--	--
2005	--	--	0.008	0.126	0.092	--	--	--	--	--	--	--
HGA												
1995	11.1	5.2	0.026	0.204	0.14	0.089	0.006	0	0	92	42	0.0225
1996	11.7	7.0	0.023	0.180	0.123	0.067	0.014	0	0	68	40	0.02
1997	9.2	6.7	0.025	0.210	0.134	0.053	0.006	0	0	134	43	0
1998	7.8	5.2	0.023	0.203	0.121	0.039	0.004	0	0	127	54	0
1999	6.3	4.1	0.024	0.203	0.124	0.040	0.007	38	17.1	116	44	0.02
2000	5.7	4.2	0.021	0.194	0.117	0.037	0.006	44	15.4	102	46	0.01
2001	5.7	4.4	0.029	0.170	0.110	0.045	0.005	40	14.8	92	39	0.01
2002	4.4	3.3	0.019	0.171	0.101	0.025	0.004	39	14.5	95	34	0.01
2003	5.4	4.2	0.019	0.193	0.113	0.033	0.006	29	14.7	95	39	0.01
2004	3.6	2.9	0.020	0.152	0.104	0.046	0.007	31	15.0	102	39	0.01
2005	3.0	1.9	0.018	0.153	0.100	0.030	0.007	32	16.6	107	48	0.01
NAAQS	35	9	0.053	0.12	0.08	0.14	0.030	65	15.0	150	50	1.5

-- No monitoring data available.

[1]Selection of monitored values based on criteria established in 40 CFR, Part 50. Parameters and data reported here represent those available in EPA's Aerometric Information Retrieval database: "Air Data-Monitor Values Report."

[2]Data for Chambers, Fort Bend, Liberty, and Waller counties not available in EPA Air Data Report.

[3]2005 available data to date.

Source: EPA, 2006a.

For the HGA, monitored values for O_3 appear to be declining, probably as a result of increased regulations to meet the NAAQS for O_3. Monitored values for CO, NO_2, SO_2, $PM_{10}/PM_{2.5}$, and Pb show the HGA is currently in attainment with the NAAQS for these air contaminants and monitored values generally appear to be declining. However, concentrations of $PM_{10}/PM_{2.5}$ appear to show a slight increase in the last two years compared to the previous year.

3.2 NOISE

3.2.1 Fundamentals and Terminology

Noise is defined as unwanted sound that disrupts or interferes with normal activities, or that diminishes the quality of the environment. Noise is usually caused by human activity and is added to the natural, or ambient, acoustic setting of an area. Exposure to high levels of noise over an extended period can cause health hazards such as hearing loss, however, the most common human response to environmental noise is annoyance. Individuals respond to similar noise events differently based upon various factors that may include the existing background level, noise character, level fluctuation, time of day, the perceived importance of the noise, the appropriateness of the setting, and the sensitivity of the individual.

Sound is sensed by the human ear when a source emits oscillations through an elastic medium, such as air. The vibrations produce alternating bands of dense and sparse particles of air. This movement of the particles creates a fluctuation in the normal atmospheric pressure known as sound waves. Sound is characterized by two magnitudes; frequency and amplitude. The frequency of a sound corresponds to the human sensation of pitch and is measured in Hertz (Hz). The amplitude of a sound corresponds to the human sensation of loudness. Human reaction to loudness, or sound pressure, is measured in terms of sound pressure levels, and expressed in terms of decibels (dB). Decibels are measured on a logarithmic scale in order to compress the wide range between the human threshold of hearing and the threshold of pain. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels of approximately 120 dB begin to be felt inside the ear as discomfort and increases to pain at higher levels (EPA, 1976). Table 3.2-1 lists examples of common outdoor and indoor sound and noise levels.

Sounds of the same pressure but different frequencies are not perceived by the human ear as equally loud. The human ear is less sensitive to low frequencies and extremely high frequencies, and most sensitive to the mid-range frequencies that correspond with human speech. Therefore, in order to measure sound in a manner similar to human perception, an adjustment known as “A-weighting” is used. All regulatory agencies require that measurements be taken using the A-weighted sound level (dBA).

Although A-weighted sound measurements indicate the level of environmental noise at any given time, community noise levels vary constantly. Typical noise environments consist of numerous noise sources that vary and fluctuate over time. Because of the varying noise levels within a community, it is necessary to use a descriptor called the equivalent sound level (L_{eq}). L_{eq} provides a way to describe the average sound level, in dB, for any time period under consideration.

TABLE 3.2-1

HEARING: SOUNDS THAT BOMBARD US DAILY

Decibels		
140	Shotgun blast, jet 100 ft away at takeoff	Pain
	Motor test chamber	Human ear pain threshold
130		
	Firecrackers	
120	Severe thunder, pneumatic jackhammer	
	Hockey crowd	
	Amplified rock music	Uncomfortably loud
110		
	Textile loom	
100	Subway train, elevated train, farm tractor	
	Power lawn mower, newspaper press	
	Heavy city traffic, noisy factory	Loud
90		
	Diesel truck 40 mph 50 ft away	
80	Crowded restaurant, garbage disposal	
	Average factory, vacuum cleaner	
	Passenger car 50 mph 50 ft away	Moderately loud
70		
	Quiet typewriter	
60	Singing birds, window air conditioner	
	Quiet automobile	
	Normal conversation, average office	Quiet
50		
	Household refrigerator	
	Quiet office	Very quiet
40		
	Average home	
30	Dripping faucet	
	Whisper 5 ft away	
20		
	Light rainfall, rustle of leaves	
		Average person's threshold of hearing
	Whisper	Just audible
10		
0		Threshold for acute hearing

Source: World Book, Rand McNally Atlas of the Human Body, Encyclopedia Americana, "Industrial Noise and Hearing Conversation" by J.B. Olishifski and E.R. Harford (Researched by N. Jane Hunt and published in the *Chicago Tribune* in an illustrated graphic by Tom Heinz).

Another measurement descriptor of the total noise environment is the Day-Night Sound Level (L_{dn}), which is the A-weighted L_{eq} for a 24-hour period with an additional 10 dB weighting imposed on the L_{eq} occurring during nighttime hours (10 P.M. to 7 A.M.). For example, an environment that has a measured daytime L_{eq} of 60 dBA and a measured nighttime sound level of 50 dBA, would have a weighted nighttime sound level of 60 dBA (50 + 10), and an L_{dn} of 60 dBA. Numerous Federal agencies including the EPA, Department of Defense (DOD), Department of Housing and Urban Development (HUD), and Department of Transportation/Federal Aviation Administration (DOT/FAA) have adopted this descriptor in assessing environmental impacts. Regulatory agencies generally recognize an L_{dn} of 55 dBA as a goal

for the outdoor noise environment in residential areas. Studies have found that outdoor noise environments across the United States range from approximately 40 L_{dn} in rural residential areas, to nearly 60 Ldn in older urban residential areas, to as much as 90 Ldn in congested urban settings (EPA, 1974).

3.2.2 Affected Environment

Noise-sensitive receptors are facilities or areas where excessive noise may disrupt normal activity, 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. Noise-sensitive receptors in the vicinity of the study area are located in the communities of Quintana and Surfside Beach. Single-family residences, RV parks, and recreational areas lie on both sides of the ship channel. The existing noise environment of these communities is affected by a number of sources, most of which are transportation-related (i.e., deep draft shipping, barges, railway, roadway, etc.). Other sources that contribute to the existing noise environment of these communities include activities at nearby heavy industrial sites, such as the DOW chemical plant, and the current maintenance dredging of the ship channel. Measured ambient noise levels at noise-sensitive receptors in these communities ranged between 60.9 and 65.1 Ldn (HFP Acoustical Consultants, Inc., 2002).

3.3 PHYSIOGRAPHY, TOPOGRAPHY, AND BATHYMETRY

The primary physiographic environments of the study area include fluvial deltaic systems, barrier island strandplain systems, and eolian (wind) systems. The Coastal Zone within the study area is underlain by sedimentary deposits that originated in ancient, but similar, physiographic environments. These ancient sediments were deposited by the same natural processes that are currently active in shaping the present coastline such as long shore drift, beach wash, wind deflation and deposition, tidal currents, wind generated waves and currents, delta outbuilding, and river point bar and flood deposition (McGowen et al., 1976).

The project area is characterized by interconnected natural waterways, narrow barrier islands, the GIWW, and ship channels. The surface topography of the project area is mainly flat to gently rolling and slopes to the southeast. The Brazos River drains areas to the west of the project area and discharges into the Gulf of Mexico, forming a delta. A few short, low-gradient streams drain directly into the GIWW, channels, and scattered lakes. Most common among coastal features are beach ridges, open sand beaches, dunes, mudflats, marshes and deltas. A topographic map for the project area is presented on Figure 3.3-1.

The Brazos River is a fine grained meanderbelt system characterized by frequent cutoff and abandoned channel courses, relatively high mud load, and narrow to broad floodplains. Natural ponds, lakes, holding ponds, and artificial reservoirs are present on the floodplains of the Brazos River (McGowen et al., 1976). Dredged material has been placed along most of the turning basins, channels and canals in the project area.

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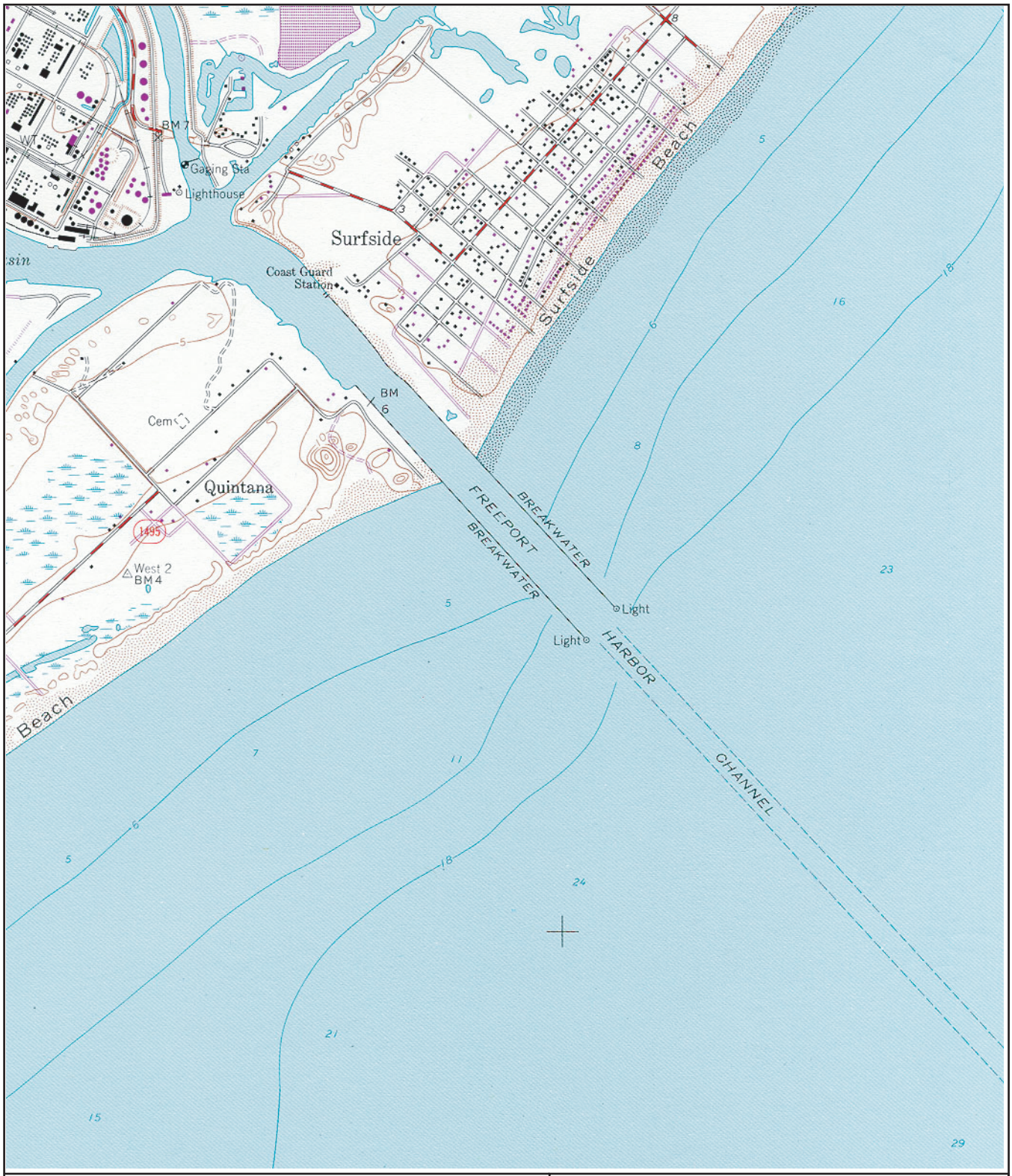

north

0 2000 4000 feet

Base Map: USGS 7.5' Quadrangle; Freeport, Texas (1974)

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Figure 3.3-1

TOPOGRAPHIC MAP
OF PORT FREEPORT, TEXAS

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The portion of the Gulf of Mexico pertinent to the project area is confined to the shelf area and is largely devoid of significant physiographic features. The shelf slopes uniformly in the project area at a rate of approximately 5:10,000, except within approximately 3,000 ft of the coastline where the slope is steeper, about 5:1,000. The turning basin and GIWW are relatively low-energy environments protected on the seaward side by beach-ridges and open sand beaches. The Freeport Harbor Channel is a moderate to high energy environment partially protected by two (north/south) man-made rock jetties. These jetties extend into the Gulf approximately 0.5 mile from the shoreline.

The bathymetry of the project area has been partially modified by human activity, mainly by channel dredging and subsequent formation of Dredged Material Placement Area (DMPA). Water depths in the Freeport Harbor Entrance and Jetty Channels are currently maintained by the USACE to a depth of -47 ft MLT. The existing channel is approximately 5.2 miles in length and is approximately 400 ft in width at the bottom and 1,150 ft wide at the water surface. Area tidal channels, passes, and dredged channels are greater than average depth. Water exchange between the Port of Freeport and the Gulf of Mexico is normally limited to natural and artificial tidal passes through both the Freeport Harbor Channel and the GIWW. Fresh water is supplied to the GIWW by the Brazos River and by small streams that drain local areas adjacent to coastal uplands. The bathymetry of the project area is presented in Figure 3.3-2.

3.3.1 Shoreline Changes in Project Area

The shoreline on both the Surfside Beach (northern) and Quintana Beach (southern) areas has moved substantially over the last 150 years. It has been studied extensively and a number of contributing causes have been identified in the literature. Most of the Texas shoreline is now in retreat because of relative sea level rise and a reduced supply of beach sand from changes to the Mississippi and Atchafalaya systems and from reservoirs built on Texas rivers. A major local factor for the Freeport area has been the relocation of the Brazos River in 1929. This was necessary to control what were excessive dredging requirements in the Port of Freeport, but had the side effect of moving the main source of sand away from the immediate project area beaches. Another factor has been reservoir development in the Brazos River watershed that while essential for water supply and flood control, has greatly reduced that sand supply at the relocated Brazos River mouth. The biggest shoreline changes occur with severe storms including:

- Hurricane Carla 1961
- Hurricane Alicia 1983
- Tropical Storm Francis 1998
- Tropical Storm Allison 2001
- Hurricane Rita 2005

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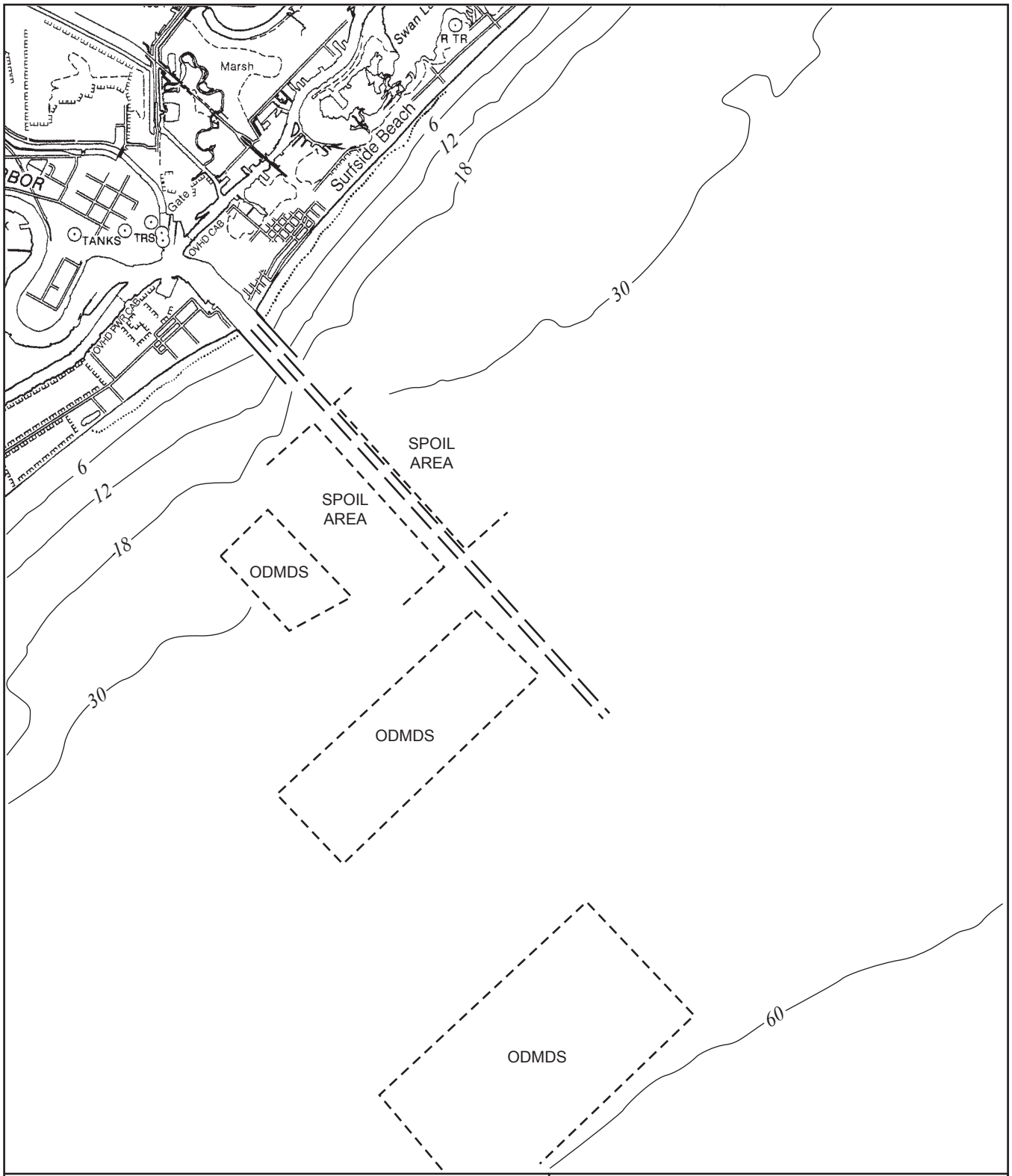

north

0 1 mile

30 Depth in Feet

ODMDS Ocean dredged material disposal site

Base Map: NOAA Navigation Chart 11321 (1990)

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Figure 3.3-2

GENERAL BATHYMETRY
OF PORT FREEPORT, TEXAS

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Other major factors are relative sea level rise that moves the shoreline inland, and a movement of sand from the beach inland by Aeolian drift (wind) aggravated by vehicle traffic on the beaches. Finally, there has been the interception of sand from the longshore system by the navigation channel and jetties. The jetties act as groins to block longshore sediment movement, but some material gets around the jetties and must be periodically dredged from the Freeport Harbor Entrance and Jetty Channels.

Morton (1997) and Gibeaut et al. (2000) have summarized shoreline change information in the project area. Figure 3.3-3 presents data, extracted from Morton (1997) of shoreline positions along transect locations in the Surfside/Quintana area. Figure 3.3-4 is a plot of the shoreline positions for representative years taken from the Morton (1997) transects. All of the shoreline positions are shifted to start with the 1996 position as seen on the shoreline of an aerial photograph from that year. In 1852 the shoreline was well inland from its position today. Between 1852 and 1930 the shoreline at Freeport shows strong accretion. At that point the shoreline was over a mile into what is now the Gulf. However, transects farther west show little change. Following the 1929 relocation of the river, the shoreline at stations 21 and 22, near the new river mouth, advanced substantially while the area around the Freeport jetties retreated rapidly. Between 1958 and 1996 the shoreline has retreated over the entire area.

The shoreline accretion or advance near Freeport between 1852 and 1930 was due to a combination of the deposition of sand supplied by the river and the effect of the jetties (built between 1889 and 1896) (Morton and Pieper, 1975). An intermediate point in the shoreline advance can be seen in Figure 3.3-5, taken from Morton and Pieper (1975). It shows the shoreline at the Brazos River Mouth advancing substantially between 1852 and 1891. Note that the jetty construction began in 1889 and probably had no effect on the shoreline by 1891.

Since 1930 (and the 1929 river relocation), the Surfside stations (13–15) have been relatively stable or slowly retreating and the Quintana stations (16–18) have been retreating more rapidly. This difference appears to reflect the effect of the Freeport jetties acting as groins to block the normal longshore sediment transport towards the southwest. Near the relocated Brazos River mouth (transects 19–22), there was a great advancement of the shoreline between 1930 and 1958. During this period the Brazos River was supplying most of its full sand load. By 1958, reservoir development was substantially reducing the sand supply and since that time the shoreline has been retreating.

A major factor in coastal erosion is the amount of sand supplied to the system. The Brazos River is one of the few that still terminates in the Gulf and historically carried a substantial amount of the sand that advanced the beaches in the area. Mathewson and Minter (1976) analyzed the effect of reservoir development in the Brazos River basin, and found a major reduction in the amount of beach sand supplied since reservoir development started in the 1920s. The first reservoir, Mineral Wells, started impoundment in 1920, and there were 29 completed through 1969. The mechanisms identified and quantified include trapping of sand by reservoirs (95% trapping efficiency for sand is employed) and reduction of peak river flow rates that perform most of the sand transport in the river. The total Brazos River watershed area was noted to be 44,640 square miles, but only 35,400 square miles were contributing in 1975 (Mathewson and

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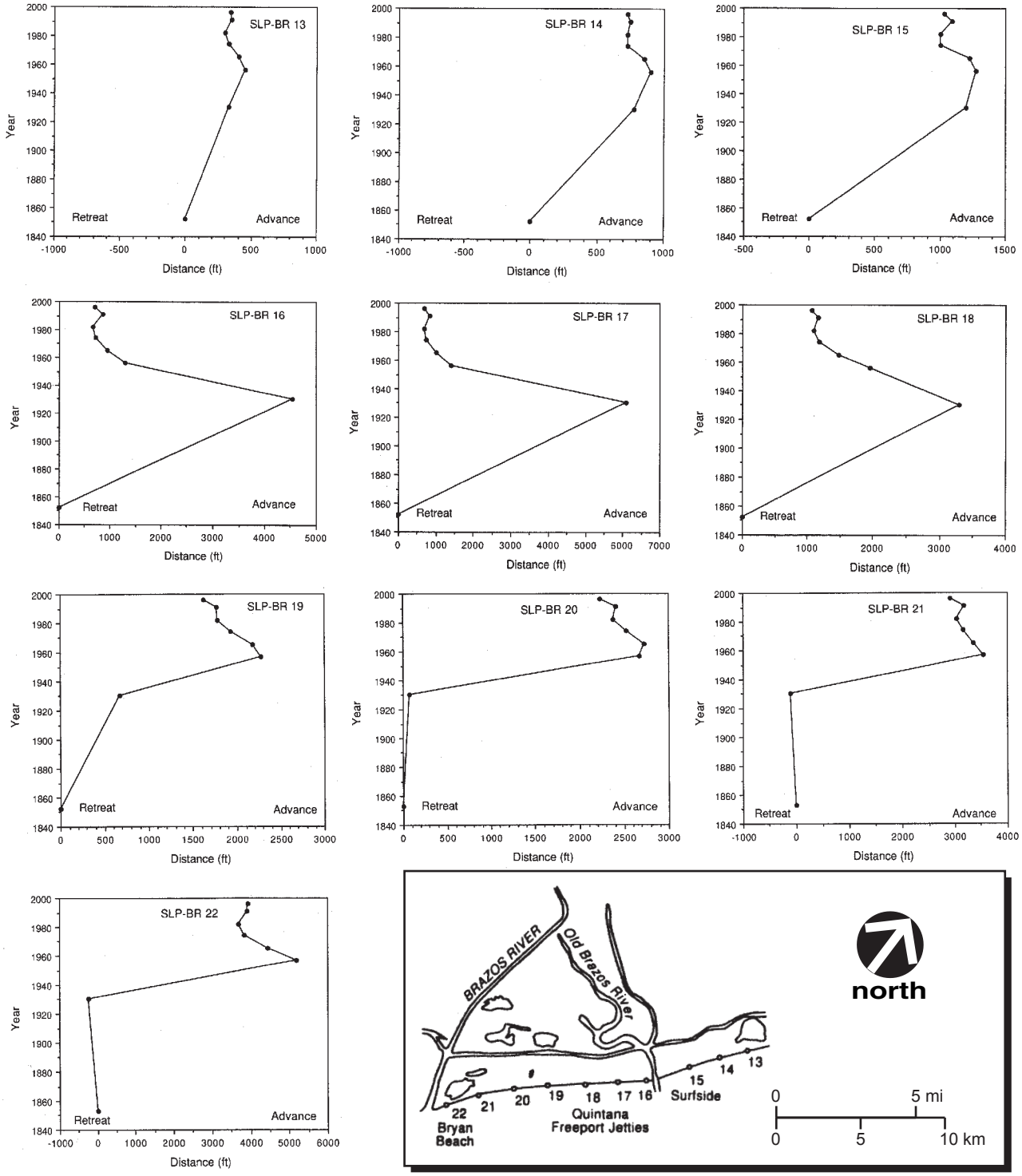

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Figure 3.3-3

SHORELINE CHANGES BY TRANSECT
WITHIN THE PROJECT AREA
1852-1996

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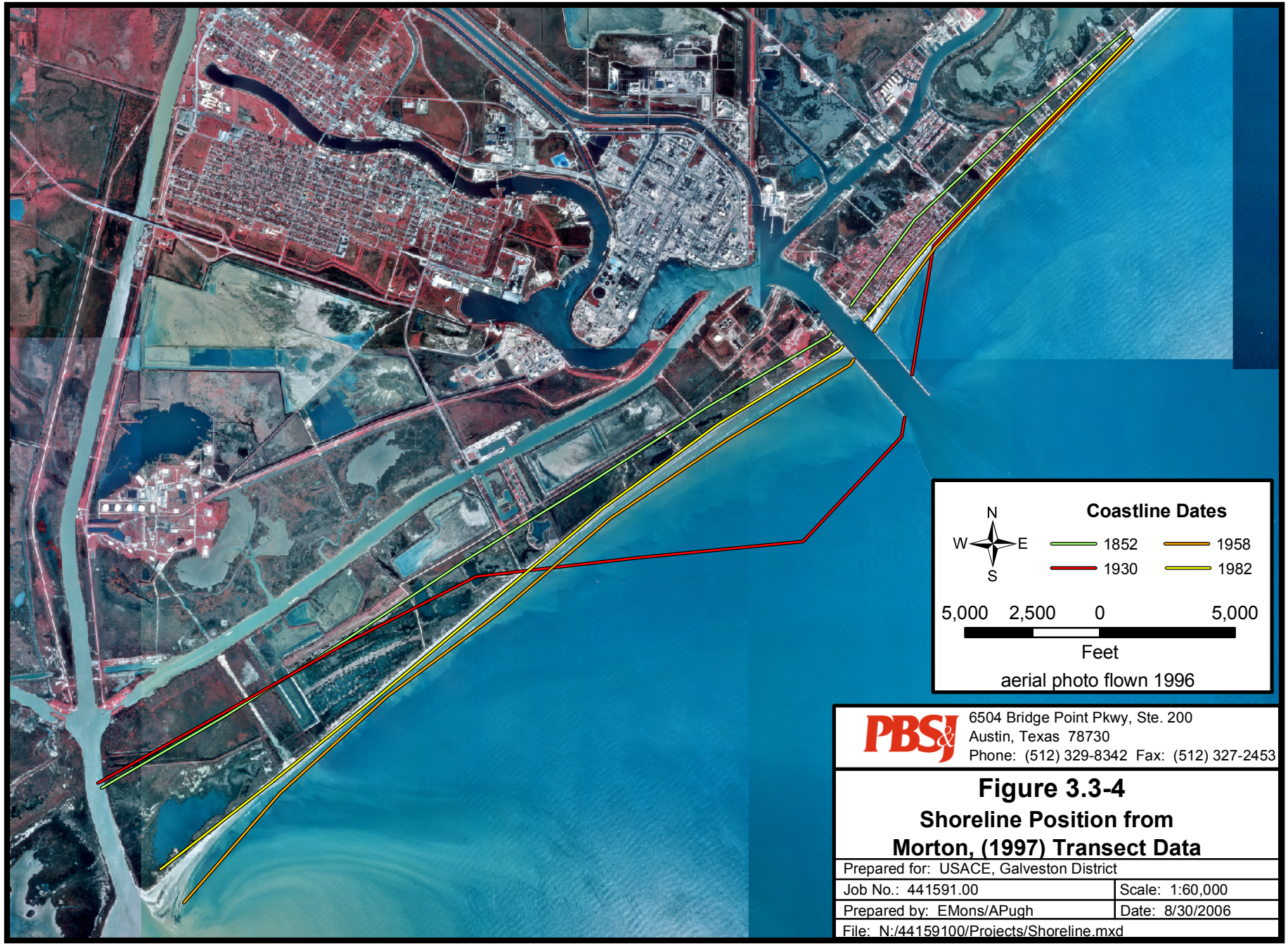

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Austin, Texas 78730
Phone: (512) 329-8342 Fax: (512) 327-2453

Figure 3.3-4

Shoreline Position from Morton, (1997) Transect Data

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Job No.: 441591.00	Scale: 1:60,000
Prepared by: EMons/APugh	Date: 8/30/2006
File: N:/44159100/Projects/Shoreline.mxd	

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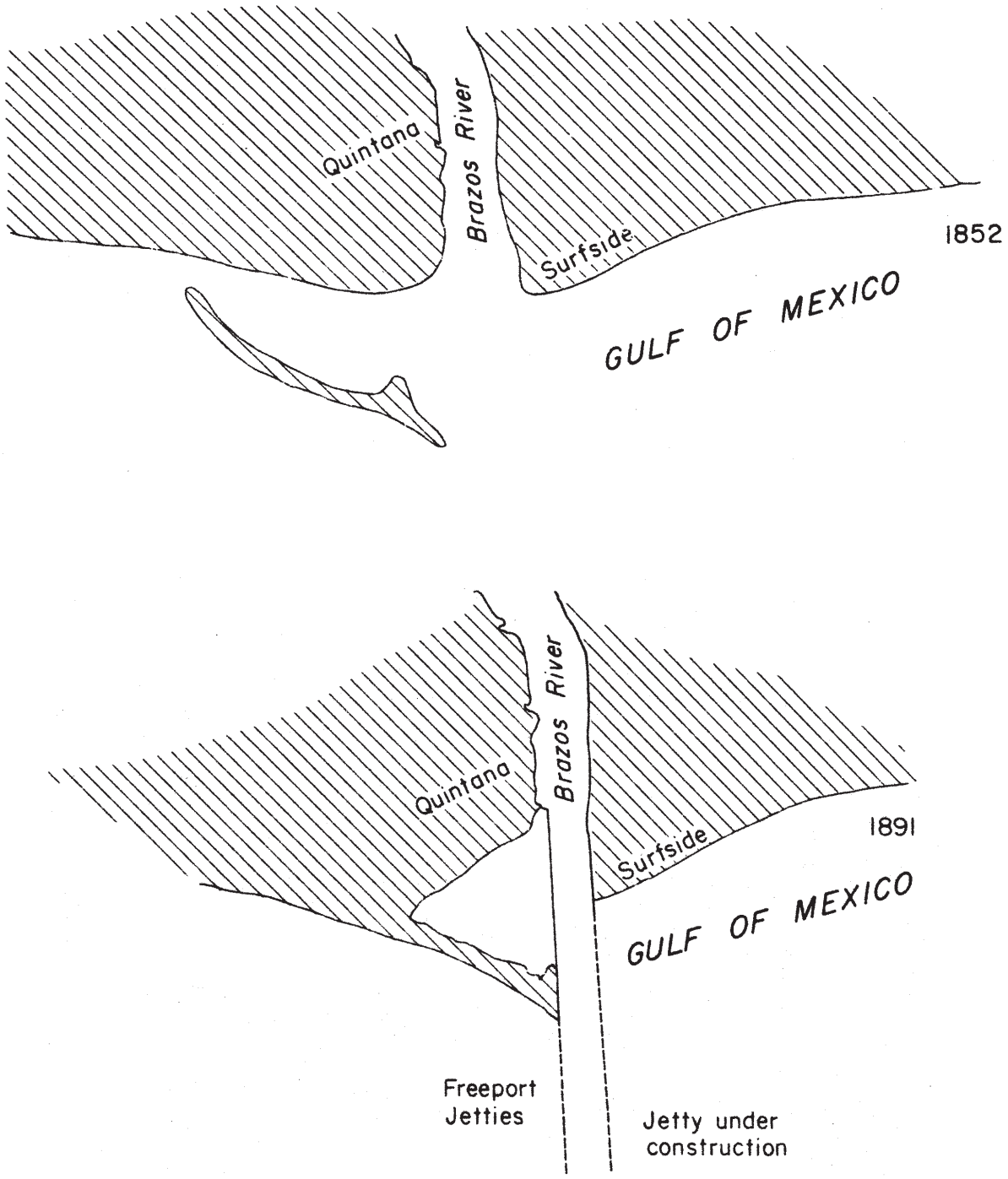

0 2000

scale in feet

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Figure 3.3-5

SHORELINE AT
FREEPORT 1852 AND 1891
(MORTON & PIEPER, 1975)

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Minter, 1976). The watershed not drained by the major reservoirs in 1975 was noted to be only 10,934 square miles, or about 30% of the contributing watershed. The unregulated watershed is smaller today. The additional reservoirs completed since the Mathewson and Minter study include Lake Limestone, 1978; Lake Granger and Lake Georgetown, 1980; Lake Aquilla, 1983; and Lake Alan Henry, 1994.

In addition to the sand trapping in over 70% of the watershed, reservoirs have also reduced the peak flood discharges that are important in conveying sand in the river to the coast. The reduction in peak flood discharge was found to be larger in the upper basin (52% reduction at Waco) than in the lower basin (30% at Richmond). Mathewson and Minter (1976) estimated that the net effect was that about 76% of the sand that historically reached the coast was not reaching it in 1975. The reduction percentage may be higher today. Their calculations indicate that prior to reservoir development the river transported 101 billion ft^3 of sand or 3.75 million cubic yards per year (mcy/yr) and that the transport rate in the early 1970s was 1.14 mcy/yr. This is a reduction in sand supply to the coast of about 2.6 mcy/yr. This sand would have been supplied during short periods of high river flow, and be distributed both east and west of the river, but predominantly to the west because of the prevailing orientation of onshore winds and longshore drift.

Efforts to offset the erosion with beach nourishment have been carried out under the Texas Coastal Erosion Protection and Response Act (CEPRA). These have involved both trucking in at least 950 cy of sand in one project and bringing sand from a DMPA near Baytown by barge for dune rehabilitation (Newby, 2006). A major limitation of beach nourishment in the area is the limited availability of a suitable sand supply that can be supplied efficiently. Nourishing the beach with sand brought by truck or barge from a substantial distance is relatively expensive. In the early 1990s, approximately 300,000 cy of silty-sand from the 45-ft project deepening of Freeport Harbor Channel was placed on the Surfside Beach (Rodino and Moseley, 2005). Beaches on both sides of the jetties are severely eroded at this time. Erosion on the Quintana Beach side is currently threatening the stability of the Seaway UCPA, and erosion of Surfside Beach is currently threatening beachfront homes.

3.4 GEOLOGY

The study area is situated near the seaward margin of the west Gulf Coastal Plain Physiographic Province. Regionally, the area is characterized by nearly continuous series of marginal marine embayments separated from the Gulf of Mexico by a system of barrier islands and peninsulas (Lankford and Rehkemper, 1969). Coastline features are typically the result of several active, geologic processes including long shore drift, beach wash, wind deflation and deposition, tidal currents and waves, delta outbuilding, and river point bar and flood deposits. The coastal zone is underlain by sedimentary deposits that originated in ancient but similar coastal systems (McGowen et al., 1976).

The coastal plain near the Gulf of Mexico is located within the Gulf Coast geosyncline, a major center of sediment deposition since the middle to late Jurassic Period. More than 30,000 ft of Jurassic to Pleistocene age sedimentary deposits dip and thicken toward the Gulf. During part of the Mesozoic Era

(late Triassic to Jurassic), the seas in the area were isolated and water inflow was restricted, resulting in the deposition of evaporate sediments dominated by salt (Wermund et al., 1989). After salt deposition, the region was overlain primarily by prograding sands and muds. Interspersed throughout these layers are salt domes which have migrated upwards through the underlying strata to within a few 1,000 ft of the land surface. In addition, the regional dip is bisected by belts of arcuate growth faults that are typically downthrown to the Gulf, or by faults in the proximity of salt domes.

The project area is characterized as Quaternary (Recent and Holocene) Alluvium containing thick deposits of clay, silt, sand, and gravel (Barnes et al., 1975, 1982), overlying the Pleistocene-age Beaumont Formation. These formations consist mainly of stream channel, point bar, natural levee, and backswamp deposits associated with former and current river channels and bayous. The Alluvium outcrops in a belt that is approximately 70 to 90 miles wide that generally parallels the Texas coastline. The underlying Beaumont Formation is estimated to be less than a 1,000 ft thick and consists mostly of clay, silt, sand, and gravel.

The establishment of GIWW, irrigation and drainage canals, and access channels has resulted in extensive channelization and associated disposal of dredged material in the area (McGowen et al., 1976). The project area is further characterized by recent fill and subaqueous dredged material deposits located on the landward and seaward sides of the barrier beach (Quintana and Surfside), associated with the construction of the Freeport Harbor Channel for the City of Freeport's chemical processing complex. The composition of the material at these locations is dictated by the origin of the material; however, dredging and disposal typically make the material less coherent and more permeable. Typically, fill and dredged material consist of mixed mud, silt, sand, shell and reworked dredged material. Reworked dredged material is commonly sandy and moderately sorted with high to very high permeability and low water-holding capacity.

In 1929, the mouth of the Brazos River was shifted from the area of Surfside, Texas to an area located 6 miles to the west. This diversion of the Brazos River resulted in shoreline erosion in the Surfside area and the construction of a new delta at the mouth of the new Brazos (McGowen et al., 1976). Sediment distributions within the fluviatile-deltaic system consist primarily of sand, silt and mud. Beyond the delta front, is an area of prodelta muds. The sand-mud boundary lies between 2.0 to 2.9 miles offshore from the present Brazos River delta. Muddy sands also occur adjacent to dredged material placement mounds, in the shallow bay margin areas next to the mainland shore and at the edge of wind tidal flats. Muddy sand distribution is not controlled by depth, rather it is related to hurricane washovers, dredging activities, and reworking of relict sediment (McGowen and Morton, 1979).

The shoreface is the gulfward extension of the peninsula and deltaic headland; it extends seaward from the break in slope of the beach to about the 30-ft line (McGowen et al., 1976). The upper shoreface is a zone of high physical energy, especially near the shoreline where waves break (breaker and surf zones). This area extends from mean sea level (msl) to a depth of about 12 ft and consists predominately of sand. The lower shoreface occurs further offshore in the absence of breaking waves, resulting in the deposition of finer grained sediments where biological activity dominates. It consists primarily of extensively

burrowed or mottled muddy sand and mud. The middle part of the shoreface (~12 to 30 ft deep) is less muddy than the lower shoreface and is also extensively burrowed. The shelf mud and sand environments of the inner continental shelf extend seaward from about the 30-ft line.

The inner shelf is an area where sands and muds of the lower shoreface and inner shelf are mixed by burrowing organisms. This area undergoes considerable erosion and resedimentation during the hurricane season. Along the Bryan Beach-Surfside area, the sand-mud boundary is from about 0.5 mile to 2.2 miles offshore (McGowen et al., 1976).

Along the coastal zone, subsurface faults are relatively common and a number of these have been activated as a result of subsidence in the area. Most surface faults are related to long-trending coastal fault systems extending upwards from thousands of feet below surface and/or to faults associated with salt domes (Brown et al., 1974). Coastal zone faults form primarily by natural geologic processes, including deposition and differentiation compaction of sediment, upward movement of salt deposits to form diapirs, gulfward creep of coastal landmass, and warping of landmass due to regional tectonics. There are two types of faults that occur in the region, growth and salt dome. Growth faults form by subsurface slumping, creep, and consolidation of sediments during deposition. These faults are confined to Cenozoic-aged sediments and are typically parallel the Gulf Coast, with lengths exceeding 6 miles. Salt dome faults occur in radial and crestal graben type patterns over and around the dome top revealing linear surface traces that are somewhat curved with numerous intersections. These faults are typically localized (<3 miles long) and numerous.

Subsidence occurs as sudden sinking or gradual downward settling of land with little or no horizontal motion, caused by surface faults and intensified and/or accelerated by subsurface mining or the pumping of oil or groundwater. Subsidence is the major manifestation of surface faulting throughout the Texas Gulf Coast, and typically occurs on the downthrown side of the fault. In addition, the extraction of groundwater, oil and gas, and salt brine in the Freeport area (and subsequent active faulting), has caused land subsidence in the order of 1.5 to 2 ft in the area vicinity. However, subsidence has been observed to lessen and diminish altogether as groundwater, oil, and gas pumping has decreased or ceased (Verbeck and Clanton, 1981; Holzer and Gabrysch, 1982).

Several geotechnical studies have been conducted within the project area over the past 40 years. However, the most recent and pertinent study for sediments (virgin and dredged) located in the immediate vicinity of the Freeport Harbor Channel was conducted by Fugro between January 28, 2005 and February 3, 2005 (Fugro, 2005). According to the Fugro report (2005), a total of seven soil borings were drilled inside the channel side of the north and south jetties. The purpose of the geotechnical study was to (1) explore and evaluate subsurface soil conditions at the project site, and (2) to develop geotechnical recommendations to guide others in the design and construction of the proposed Freeport Ship Channel widening project. The sediments reportedly encountered in the borings were indicative of the local geology. Further information pertaining to specific sediment descriptions for the project area can be referenced in the Fugro report (Fugro, 2005).

3.5 ENERGY AND MINERAL RESOURCES

The project area has numerous natural resources, including oil and gas, sulfur, salt, shell, clay, sand, magnesium, and bromine. Among these the most significant is oil and gas (McGowen, 1976). Oil, natural gas and natural gas liquids are major factors in the economy of the area. The major nonagricultural land use of the Freeport area is directly or indirectly related to oil and gas production.

Sulfur generally occurs in the cap rock of certain salt domes but it can also be extracted from sour gas. Sulfur is not commonly used by individual consumers but rather in the manufacture of a variety of products, prominent among them, sulfuric acid. Salt domes are numerous in the area and provide an abundant supply of high-grade sodium chloride. The bulk of Texas salt production comes from the Texas coastal zone. The nearest brine production site is located 3.8 miles east at the Bryan Mound facility. This facility is the former site of a sulfur mine that produced 5 million tons of sulfur between 1918 and 1935.

Associated with the massive salt domes is the underground storage of crude oil. The oil is stored in the cavities created in the salt domes and the liquid hydrocarbons stored in the Texas coast in this manner account for a significant portion of the total liquid hydrocarbon storage in the U.S. The nearest commercial storage facility is located 3.8 miles east at the Bryan Mound facility.

The nearest conventional source of industrial carbonate is approximately 150 miles inland in central Texas. Within the project area shell occurs as discrete reefs and banks mixed with bottom sand and mud in the shallow bays. The oyster *Crassotrea* is the main source of shell. Parts of certain reefs support living oysters while others are composed entirely of dead shells. The physical and chemical properties of shell make it suitable for use as aggregate, road base and the production of lime, cement and chemicals. Historic shell production has depleted oyster reefs in the region, and oysters are no longer commercially mined.

Sand deposits in the area have the potential for industry or specialty uses such as foundry sands, glass sands and chemical silica. Common clays are used in the manufacture of brick and tile. Gypsum, used mainly as a construction raw material, occurs in the caprock deposits of certain salt domes in the area but unlike salt and sulfur is not easily mined and significant production is unlikely. Magnesium compounds and magnesium metal is produced from magnesium chloride which is extracted from sea water in the Freeport-Velasco area. Historically the area has been the largest producer of magnesium metal in the U.S. Similarly, bromine is extracted from sea water in the Freeport area.

3.6 SOILS

The majority of the project area is inundated with salt water from the Gulf of Mexico and is, therefore, incapable of producing and/or sustaining soil associations and series. Mapping by the Soil Conservation Service (SCS, 1979), Soil Survey of Brazoria County, Texas, shows a total of three soil series located within the proposed beach nourishment areas along Quintana Beach and Surfside Beach. Two of the soil series are located along Quintana Beach, the Galveston fine sand, undulating and the Mustang fine sand,

saline. The third series is located along Surfside Beach, the Edna-Aris unit. It should be noted that the shoreline boundary presented in 1979 for the Brazoria County soil survey has since eroded further inland and the mapped boundaries for these soil series has probably changed.

The Galveston fine sand, undulating is a nearly level, nonsaline, sandy soil that forms on coastal dunes that parallels the Gulf of Mexico (SCS, 1979). This soil is loose, moderately alkaline, light gray fine sand to about 60 inches thick. The underlying layer is loose, moderately alkaline, gray fine sand about 6 inches thick. Below this, from 66 to 80 inches, is loose, moderately alkaline, light gray fine sand. This soil drains very well, surface runoff is very slow and permeability is very rapid. After heavy rains the water table can rise up to 3 ft in the soil, however in most places the water is saline due to its proximity to the Gulf. This soil is used mainly for recreational areas and as rangeland; however it is not suitable for pastureland or crop production. The potential for urban use is low, the most restrictive features being sandy texture, lateral water seepage, hurricane flooding, and soil wetness. This soil is susceptible to wind erosion when disturbed.

The Mustang fine sand, saline is a nearly level, nonsaline, sandy marshy soil that forms on coastal flats and depressions (SCS, 1979). This soil has a surface layer of neutral, saline, light gray fine sand about 8 inches thick. Below is a layer of neutral, saline, light gray fine sand about 32 inches thick. The underlying layer from 40 to 60 inches is neutral, saline, grayish brown fine sand. This soil is poorly drained, surface runoff is very slow and permeability is rapid above the water table. The water table occurs at depths from 6 to 20 inches below the soil surface, however it is generally saline. Main uses are for rangeland and wildlife habitat. Wetness, salinity, and flooding caused by high tides makes this soil unsuitable for crop production and pastureland. Potential for urban use is low, restrictive features being wetness, soil salinity, and susceptibility to flooding by high tides and hurricanes.

The Edna-Aris unit is about 40% Edna soils, 35% Aris soils, and 25% soils of minor extent (SCS, 1979). Edna soils are a nearly level, nonsaline, sandy loam that forms on coastal flats. This soil has a surface layer of dark gray fine sandy loam about 8 inches thick. Below is very dark gray clay that grades into light brownish gray clay to 60 inches. Aris soils occur at elevations slightly higher than those of the surrounding Edna soils, immediately adjacent to the remnants of old stream meanders. This soil has a surface layer of grayish fine sandy loam about 13 inches thick. From 13 to 20 inches the soil is gray sandy clay loam and from 20 to 50 inches it is grayish clay. Below 60 inches is a reddish yellow sandy clay loam. The Edna-Aris unit is used as pastureland, rangeland, and cropland. This soil unit is poorly drained to somewhat poorly drained and very slowly permeable. The potential of the soils for most urban uses is medium, wetness and the shrink-swell potential being the most limiting features. Of minor extent (<25%) in this map unit are Bernard and Leton soils.

3.7 GROUNDWATER HYDROLOGY

In the Freeport area, the Gulf Coast Aquifer system is the principal source of groundwater for public, agricultural and industrial needs. Within the aquifer system, the Chicot Aquifer is the uppermost aquifer,

and all public and private water supply wells in the area are supplied by this aquifer (Texas Water Development Board [TWDB], 2006). The Evangeline aquifer underlies the Chicot Aquifer. The Evangeline aquifer is noted for its abundance of good quality groundwater and is considered one of the most prolific aquifers in the Texas Coastal Plain (Baker, 1979) but is not used in the Freeport area. The Chicot aquifer and Evangeline aquifers are commonly used hydrogeologic-unit designations for subdivisions of the upper, mostly sandy part of the deposits; and the lower permeable zones make up the Jasper aquifer. The geologic and hydrologic units are presented on Figure 3.7-1.

The lithology of the Gulf Coast Aquifer system consists of sand, silt and clay, reflecting three depositional environments: continental (alluvial plain), transitional (delta, lagoon, and beach), and marine (continental shelf). These deposits thicken as they dip toward the Gulf, resulting in a wedge-shaped configuration of the hydrologic units. Numerous retreats and advances of ancient shorelines have resulted in a complex, overlapping mixture of sand, silt and clay. These complex deposits have been divided into seven units (five permeable zones and two confining units) based on permeability differences, water depths and vertical differences in hydraulic head.

As noted above, the Chicot aquifer is the uppermost water-bearing unit in the Gulf Coast Aquifer system. The Chicot-Evangeline boundary runs approximately parallel to the coast, and forms an outcrop about 90 miles inland from Freeport (Baker, 1979). All public, industrial, and private water supply wells in the Freeport area draw from the Chicot aquifer (TWDB, 2006). According to 1999 estimated water use data for Brazoria County, approximately 203 million gallons of groundwater and surface water were withdrawn per day for municipal, manufacturing, irrigation, mining, and livestock uses (TWDB, 2006).

Groundwater recharge into the aquifers occurs primarily by precipitation onto outcropped areas and downward leakage from overlying saturated layers (perched) and/or aquifers. Regional groundwater flow in the aquifers is generally in a southeastward direction from outcrop areas towards areas of natural discharge (Wesselman, 1971). Superimposed upon this natural discharge regime is artificial discharge from groundwater pumping.

A SSA is an aquifer that has been designated by the EPA as the sole or principal source of drinking water for an area. As such, a designated SSA receives special protection. The program for protecting SSA was established by the Safe Drinking Water Act of 1974. The EPA designates an aquifer as a sole source based upon a petition from an individual, company, association, or government entity. The EPA has not designated any sole source aquifers (SSA) within the project area (EPA, 2006b).

Significant changes in groundwater elevation have occurred in the Freeport area over the last 60 years. Water levels dropped nearly 100 ft during the 1940s and 1950s, but began to recover as the rate of groundwater pumping in the area has leveled off (Texas Water Commission, 1963). Depth to groundwater in U.S. Geological Survey (USGS) and TWDB monitored wells remained greater than 70 ft throughout most of the Freeport area through the 1980s (USGS, 2006; TWDB, 2006).

FIGURE 3.7-1
GEOLOGIC AND HYDROLOGIC UNITS WITHIN THE STUDY AREA

<table>
<tr><th>System</th><th>Series</th><th colspan="2">Stratigraphic Unit</th><th colspan="3">Hydrologic Unit</th></tr>
<tr><td rowspan="6">Quaternary</td><td rowspan="2">Holocene</td><td colspan="2" rowspan="2">Quaternary Alluvium</td><td rowspan="6">Chicot Aquifer</td><td colspan="2" rowspan="3">Upper Unit</td><td rowspan="12">Gulf Coast Aquifer</td></tr>
<tr></tr>
<tr><td rowspan="4">Pleistocene</td><td></td><td>Beaumont Clay</td></tr>
<tr><td rowspan="2">Lissie Formation</td><td>Montgomery Formation</td></tr>
<tr><td>Bently Formation</td><td rowspan="3">Lower Unit</td><td rowspan="2">Alta Loma Sand</td></tr>
<tr><td colspan="2">Willis Sand</td><td></td></tr>
<tr><td rowspan="6">Tertiary</td><td>Pliocene</td><td colspan="2">Goliad Sand</td><td colspan="3" rowspan="2">Evangeline Aquifer</td></tr>
<tr><td rowspan="5">Miocene</td><td colspan="2" rowspan="5">Fleming Formation</td></tr>
<tr><td colspan="3">Burkeville Aquiclude</td></tr>
<tr><td rowspan="2">Jasper Aquifer</td><td colspan="2">Upper Unit</td></tr>
<tr><td colspan="2">Lower Unit</td></tr>
</table>

Sources: Baker, 1979; Jorgensen, 1975.

Current water levels in the Chicot aquifer in most of southern Brazoria County have remained relatively constant since the late 1970s, with water level elevations of 30 to 50 ft below msl (Coplin and Lanning-Rush, 2002). However, none of the wells monitored for these surveys are located in the Freeport area, which has typically seen the most dramatic fluctuations in water level in southern Brazoria County (Texas Water Commission, 1963).

Records from the TWDB indicate there are a total of three private water supply wells located within 0.25 mile of the existing ship channel boundaries (TWDB, 2006). The nearest, active public supply well (town of Surfside) is located 0.3 mile due northeast. A former (unused) public supply well (town of Quintana) is located less than 0.10 mile due southwest. This well was reportedly drilled in 1895 and is 650 ft deep. All nearby wells are typically screened in the Chicot aquifer and range from 250 to 650 ft in depth.

3.8 HAZARDOUS MATERIAL

The purpose of the Hazardous, Toxic, and Radioactive Waste (HTRW) assessment is to identify indicators of potential hazardous materials or waste issues relating to the study area. The project area for the HTRW assessment is defined by a 1-mile buffer around the centerline of the project channel (see Figure 3.0-1). A review of a regulatory agency database information search was conducted to determine the location and status of sites regulated by the State of Texas and the EPA. A review of oil and gas wells and pipelines located within the project area was also conducted.

The review of the regulatory agency database search indicated a total of 501 records associated with four facilities located within the study area. The vast majority of these records are associated with the same facility (e.g., a facility containing multiple releases, reported spills or emergency response actions). On the basis of the results of the regulatory database searches, the following sites are located within the subject area:

- 1 Corrective Action (CORRACT) site;
- 1 No Further Remedial Action Planned (NFRAP) site;
- 4 petroleum storage tanks (PST);
- 1 leaking underground storage tank (LUST) site;
- 119 reported emergency response (ERNS) actions at two facilities;
- 375 reported spills (SPILLS) at two facilities.

No National Priority List, Comprehensive Environmental Response, Compensation, and Liability Information System, Resource Conservation and Recovery Information System, State Superfund, Voluntary Cleanup Program, or City/County solid waste landfill sites were located within the study area. The Dow facility, which is a CORRACT site and a NFRAP site, is reported to have 374 spill incidents and 117 releases requiring an emergency response.

Examination of the aerial photographic coverage indicated that the project area includes a variety of land uses including residential, heavy industrial, government land, recreational, and maritime. An offshore drilling platform is in wet storage adjacent to Quintana and the jetty channel. The USCG and the Port of Freeport have made numerous unsuccessful attempts to have the owner remove the vessel from its current location. However, chemical analyses of water samples from the platform in January 2006 for trace metals and organic compounds (data supplied by Lisa McMichael, Port of Freeport) detected only 30 µg/L of lead (versus an acute Water Quality Standard of 133 µg/L, see Section 3.9.2), and no organics except the common plasticizer bis(2-ethylhexyl) phthalate at 30 µg/L. An analysis of paint from the platform found 1.3 mg/kg of lead (versus an effects range low [ERL] concentration of 46.7 mg/kg, see Section 3.9.3). Studies indicate that the vessel is a source of slight to moderate environmental impacts to the surrounding environment.

The results of the oil/gas well review indicate that there are no reported well sites located within the project area. A total of five pipelines were identified within the project area. All of these pipelines are listed as active. The pipelines are reported to transport the following material:

- Two natural gas (Enbridge Offshore PLS and Freeport LNG)
- Two crude oil (ExxonMobil Pipeline Co. and ConocoPhillips Co.)
- One product (Dow Chemical Co.)

Based on the findings of the HTRW survey, there is slight potential of encountering contaminated material during construction of the project. In addition, with the laws and regulations governing the handling of hazardous material, there is a decreased risk of future releases of hazardous material causing long term detrimental impacts to the sediments of the project area. However, any activity regarding releases of hazardous material into the waters of the study area and the resulting remediation should be monitored through the regulatory agencies.

3.9 WATER AND SEDIMENT QUALITY

3.9.1 Water Exchange and Inflows

There are two principal types of water exchanges in the Freeport Harbor system: one is bidirectional, involving the tidal exchange with the Gulf of Mexico, and the other is unidirectional and flows from rainfall runoff and wastewater flows that enter the harbor and flow to the Gulf. Of the two, the tidal exchange is by far the largest. When the Brazos River was diverted out of Freeport Harbor in 1929, the remaining local watershed was very small, about 70 square miles. The precise watershed area is difficult to determine because of the flat terrain and the fact that several tributaries enter common bays.

Tidal influence in the Gulf of Mexico is dominated by the 12.4-hour semidiurnal and the 24.8-hour diurnal lunar tides and the 13.6 day cycle in the magnitude of the declination of the moon (Ward, 1977). Tidal exchange moves a volume of water equal to the tidally influenced water surface area times the tidal

range. Tidal waters in Freeport Harbor have a total surface area (measured from navigation chart 11321) of approximately 2,550 acres. If the tidal range (elevation difference between low and high water) was 1.5 ft, the volume of water that would need to enter or leave the jetty channel would be 166.5 million cubic ft. If this took place during semidiurnal tides (6.2 hours for a flood or ebb tide), the average tidal flow would be 7,460 cubic feet per second (cfs). The cross-sectional area of the jetty channel is approximately 33,000 square ft so the average tidal current velocity through the channel is only about 0.2 ft/second.

Freshwater inflows from the 70-square-mile watershed are much smaller than the tidal flows. There is no flow measurement in this watershed, but a nearby station can provide an idea of the flows. The USGS gage on Chocolate Bayou near Alvin (08078000) has a drainage area of 87.7 square miles. The average flow from 1959–2001 was 118 cfs. Adjusting for the watershed area gives an average freshwater flow at the Jetty Channel of 94 cfs, much smaller than the average semidiurnal tidal flow of 7,460 cfs.

Frontal passages can cause more rapid changes in water levels and exchanges with the Gulf. As a front approaches from the north, onshore airflow increases, forcing water from the Gulf into the harbor. With frontal passage, the wind direction shifts, forcing water from the harbor into the Gulf. The effect is heightened because the front pushes water away from the coast, causing more water to flow outward.

Storm surges associated with hurricanes can be severe. For example, the observed storm surge during Hurricane Claudette in July 2003 was observed to be around 5.8 ft msl at the tide gauge at Freeport Harbor (Edge et al., 2006) and the surge from Hurricane Carla in late September 1961 was calculated to be almost 11 ft msl.

3.9.2 Water Quality

3.9.2.1 Introduction

The TCEQ has designated the old Brazos River Channel Tidal (Freeport Harbor) as segment 1111. This essentially covers Freeport Harbor. The designated uses for segment 1111 are Contact Recreation (swimming) and High quality aquatic habitat.

TCEQ monitors this station quarterly. Table 3.9-1 summarizes results for the last five years for several key parameters. It can be seen that with little watershed area and freshwater inflow, the average salinity is almost the same as the coastal waters. The minimum salinity is over 18 ppt. Dissolved oxygen (DO) concentrations average 7.2 milligrams per liter (mg/L) and all are well above the criterion for High Quality Aquatic Life use of 4 mg/L. The *Enterococci* concentrations are all well below the criterion of 35 Most Probable Number/deciliter (MPN/dL), indicating that the waters of Freeport Harbor are suitable for contact recreation.

TABLE 3.9-1
SUMMARY OF SURFACE MEASUREMENTS AT STATION 11498, OLD BRAZOS RIVER CHANNEL
MID-WAY BETWEEN MOUTH AND TERMINUS

Parameter	Storetcode	Unit	Start date	End date	Num of data	Average	Minimum	Maximum	Std Dev	Criterion
Dissolved Oxygen	00300	mg/L	3/29/2000	1/3/2006	24	7.2	4.9	10.8	1.4	4.0
Salinity	00480	ppt	3/29/2000	1/3/2006	24	26.7	18.4	33.7	4.0	
Enterococci [1]	31701	MPN/dL	3/13/2001	1/3/2006	20	7.8	<1	20	5.7	35

Source: TCEQ SWQM database, http://www.tceq.state.tx.us/compliance/monitoring/crp/data/samplequery.html
[1] For data below reporting limit, half reporting limit used in calculating average and standard deviation.

3.9.2.2 Water and Elutriate Chemistry

The data collected by the USACE since 1987 were analyzed to determine the water quality of the Project Area (Table 3.9-2). Also included below is a discussion of the elutriate, which provides information on those constituents that are dissolved into the water column during dredging and placement (see Table 3.9-2). Since the elutriate represents the dissolved concentrations that would be expected in the water column, they are compared to the Texas Surface Water Quality Standards (TWQS) provided by the TCEQ (Texas Natural Resources Conservation Commission [TNRCC, now the TCEQ], 2000) for the protection of aquatic life and EPA water quality discrete criteria (WQC). Since the values are from grab samples, not long term composites or averages, and are from a marine environment, the acute marine TWQS and WQC are used for comparison. Sediment data are also included since the elutriate is a measure of the release of constituents from the sediment into the water column and it may be informative to be able to compare elutriate results to sediment results. Also provided in Table 3.9-2, and other tables in this section, are the USACE Channel Stations, which can be compared to Figure 1.1-1 to determine station locations.

Of the metals, silver and thallium were not detected in water or elutriate samples. Selenium was only detected in two of the 11 years for which there are data, 2005 in water samples and 1997 in elutriate samples. Chromium was detected in only three years, 1997 and 1998 in water and 1993 and 1998 in elutriates. Mercury was detected once the water samples (1997) but in no elutriate samples. Nickel was detected in three years for water samples (1988, 1997, and 1999) and five (1988, 1997, 1998, 1999, and 2005) for elutriates. Table 3.9-3 shows the years in which the various constituents in Table 3.9-2 were detected in channel stations, including those that were found more frequently than those noted above. While Placement Area (PA) and reference area samples are included in Table 3.9-2, they are not indicative of water quality in the project area and are not included in Table 3.9-3. Channel stations outside the project area are included, however, since water from the channel inland of the Project Area can influence water quality in the Project Area.

An examination of Table 3.9-2 shows no trends between water and elutriate concentrations in 1987 and only one exceedance of the copper WQC but not the TWQS by a water sample from Brazosport Turning Basin. In 1988, there were no trends except that zinc was found in a couple of water samples where it was not found in the elutriates. There were no exceedances. No constituents were detected in either water or elutriate samples in 1989. Only zinc in one water sample and all elutriate samples, and chromium in a couple of elutriate samples were detected in 1993, none above WQC or TWQS. Barium, for which analyses were conducted only from 1995 through 2000, was detected in both water and elutriate samples in all of those years. There is no WQC or TWQS for barium. Cadmium is the only other constituent found in the 1995 water and elutriate samples, and only in the Jetty and Entrance Channel samples, but the values appear to be aberrant. Before and after 1995, the highest water concentration of cadmium was

4.40 µg/L in 1998 and most were below 0.1 µg/L, while in 1995 the values ranged from 13.6 to 22.0 µg/L. For elutriates, except for 1995, the highest value was 3.60 µg/L, again in 1988, while in 1995, the values ranged from 30.3 µg/L to 56.7 µg/L, and some exceeded the WQC and TWQS. The presence

TABLE 3.9-2

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	F-87-02			F-87-03			F-87-04			F-87-05		
					Date:	9/24/1987			9/24/1987			9/24/1987			9/24/1987		
					Channel Station:	70+00			113+00			131+00			164+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%															
Silt		%															
Clay		%															
D50		mm															
Arsenic	µg/L	mg/kg	69	149	8.2	<2.0	<2.0		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0	
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	
Cadmium	µg/L	mg/kg	40	45.4	1.20	<2.0	<2.0		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0	
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<10.0	<10.0		<10.0	<10.0		<10.0	<10.0		<10.0	<10.0	
Copper	µg/L	mg/kg	4.8	13.5	34.0	3.3	1.7		**9.2**	2.7		2.5	5.2		3.2	1.2	
Lead	µg/L	mg/kg	210	133	46.7	13	20		19	19		15	22		24	32	
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.2		<0.20	<0.2		<0.20	<0.2		<0.20	<0.2	
Nickel	µg/L	mg/kg	74	118	20.9	<5.0	<5.0		<5.0	<5.0		<5.0	<5.0		<5.0	<5.0	
Selenium	µg/L	mg/kg	290	564	N/A	<2.0	<2.0		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0	
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	
Zinc	µg/L	mg/kg	90	92.7	150	55.0	55.0		85.0	7.0		65.0	40.0		52.0	20.0	
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-88-01			FH-88-02			FH-88-03			FH-88-04			FH-88-DA1		
					Date:	3/15/1988			3/15/1988			3/15/1988			3/15/1988			3/15/1988		
					Channel Station:	50+00			0+00			-50+00			-100+00					
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						38.1						39.1			46.8			46.8
Silt		%						48.6						56.9			34.7			34.7
Clay		%						13.3						4.0			18.5			18.5
D50		mm															0.07			0.07
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<2.0	<2.0	2.34	<2.0	<2.0	3.03	<2.0	<2.0	2.43	<2.0	<2.0	3.39	<2.0		2.27
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	3.00	2.40	<0.1	4.00	3.20	<0.1	3.20	3.30	<0.1	3.00	3.60	<0.1	4.40		<0.1
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<10.0	<10.0	8.67	<10.0	<10.0	10.64	<10.0	<10.0	6.80	<10.0	<10.0	13.46	<10.0		8.68
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0	<1.0	4.62	<1.0	<1.0	5.32	<1.0	<1.0	2.18	<1.0	<1.0	6.42	4.0		4.20
Lead	µg/L	mg/kg	210	133	46.7	<5.0	<5.0	8.67	<5.0	<5.0	6.72	<5.0	<5.0	4.37	<5.0	<5.0	7.03	<5.0		5.60
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.2	<0.1	<0.20	<0.2	<0.1	<0.20	<0.2	<0.1	<0.20	<0.2	<0.1	<0.20		<0.1
Nickel	µg/L	mg/kg	74	118	20.9	27.0	25.0	6.94	25.8	21.0	8.12	25.2	24.8	5.58	24.6	28.8	11.01	24.2		7.00
Selenium	µg/L	mg/kg	290	564	N/A	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0		<1.0
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
Zinc	µg/L	mg/kg	90	92.7	150	32.2	<5.0	27.46	26.2	28.8	29.41	89.6	<5.0	21.84	88.6	<5.0	33.03	**98.6**		27.45
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5		<5.0
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-88-REF1			FH-89-01			FH-89-02			FH-89-03			FH-89-04		
					Date:	3/15/1988			4/7/1989			4/7/1989			4/7/1989			4/7/1989		
					Channel Station:				50+00			0+00			-50+00			-110+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						23.6			27.9						33.0			
Silt		%						64.2			47.4						48.0			
Clay		%						12.2			24.7						19.0			
D50		mm									0.05						0.06			
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<2.0	<2.0	3.14	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0	<2.0	<2.0	<1.0
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	2.60	2.70	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1	<2.0	<2.0	<0.1
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<10.0	<10.0	10.11	<10.0	<10.0	5.20	<10.0	<10.0	4.40	<10.0	<10.0	5.20	<10.0	<10.0	4.50
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0	<1.0	4.79	<1.0	<1.0	4.50	<1.0	<1.0	2.80	<1.0	<1.0	30.00	<1.0	<1.0	4.90
Lead	µg/L	mg/kg	210	133	46.7	<5.0	<5.0	6.38	<5.0	<5.0	<1.0	<5.0	<5.0	2.20	<5.0	<5.0	2.20	<5.0	<5.0	<1.0
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.2	<0.1	<0.20	<0.2	<0.1	<0.20	<0.2	<0.1	<0.20	<0.2	<0.1	<0.20	<0.2	<0.1
Nickel	µg/L	mg/kg	74	118	20.9	25.6	27.8	9.04	<5.0	<5.0	5.90	<5.0	<5.0	5.10	<5.0	<5.0	5.70	<5.0	<5.0	6.90
Selenium	µg/L	mg/kg	290	564	N/A	<2.0	<2.0	<1.0	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.5
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	39.2	<5.0	30.32	<5.0	<5.0	22.9	<5.0	<5.0	18.5	<5.0	<5.0	20.1	<5.0	<5.0	16.3
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<5.0
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-89-DA1			FH-89-REF1			FH-93-01			FH-93-02			FH-93-03		
					Date:	4/7/1989			4/7/1989			7/20/1993			7/20/1993			7/20/1993		
					Channel Station:							50+00			0+00			-50+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%									56.2			12.1			49.2			31.4
Silt		%									40.3			38.4			35.6			33.1
Clay		%									3.5			49.5			15.2			35.5
D50		mm									0.08			0.00			0.09			0.02
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<2.0		<1.0	<2.0	<2.0	<1.0	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	<2.0		<0.1	<2.0	<2.0	<0.1	<0.10	<0.10	0.90	<0.10	<0.10	1.00	<0.10	<0.10	1.20
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<10.0		4.60	<10.0	<10.0	3.90	<1.0	<1.0	11.47	<1.0	3.2	11.30	<1.0	2.7	13.80
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0		5.90	<1.0	<1.0	2.60	<1.0	<1.0	5.62	<1.0	<1.0	5.30	<1.0	<1.0	6.27
Lead	µg/L	mg/kg	210	133	46.7	<5.0		1.20	<5.0	<5.0	<1.0	<1.0	<1.0	2.84	<1.0	<1.0	4.20	<1.0	<1.0	4.95
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.1	<0.20	<0.2	<0.1	<0.20	<0.2	<0.02	<0.20	<0.2	<0.02	<0.20	<0.2	<0.02
Nickel	µg/L	mg/kg	74	118	20.9	<5.0		7.10	<5.0	<5.0	4.90	<1.0	<1.0	7.80	<1.0	<1.0	8.10	<1.0	<1.0	9.70
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<0.5	<2.0	<2.0	<0.5	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<5.0		14.8	<5.0	<5.0	18.1	2.6	11.1	28.1	<1.0	17.4	30.5	<1.0	15.2	34.7
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5		<5.0	<0.5	<0.5	<5.0	<0.5	<0.5	<50.0	<0.5	<0.5	<50.0	<0.5	<0.5	<50.0
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-93-04			FH-93-05			FH-93-DA1			FH-93-REF1			F-95-01		
					Date:	7/20/1993			7/20/1993			7/20/1993			7/20/1993			2/2/1995		
					Channel Station:	-100+00			-150+00									75+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						14.6			16.6			12.7			21.8			
Silt		%						63.7			56.2			63.2			46.8			
Clay		%						21.7			27.2			24.1			31.4			
D50		mm						0.05			0.05			0.02			0.04			
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	37.9	64.8	
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.10	<0.10	**1.30**	<0.10	<0.10	**1.50**	<0.10		1.10	<0.10	<0.10	1.00	<0.1	<0.1	
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0	<1.0	15.10	<1.0	<1.0	12.60	<1.0		11.70	<1.0	<1.0	12.00	<1.0	<1.0	
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0	<1.0	8.60	<1.0	<1.0	5.40	<1.0		4.70	<1.0	<1.0	4.60	<1.0	<1.0	
Lead	µg/L	mg/kg	210	133	46.7	<1.0	<1.0	4.20	<1.0	<1.0	5.50	<1.0		5.10	<1.0	<1.0	4.70	<1.0	<1.0	
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.2	<0.02	<0.20	<0.2	<0.02	<0.20		<0.02	<0.20	<0.2	<0.02	<0.20	<0.2	
Nickel	µg/L	mg/kg	74	118	20.9	<1.0	<1.0	11.00	<1.0	<1.0	8.80	<1.0		16.30	5.2	<1.0	8.10	<1.0	<1.0	
Selenium	µg/L	mg/kg	290	564	N/A	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0		<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	<1.0	<1.0	
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	
Zinc	µg/L	mg/kg	90	92.7	150	<1.0	12.9	33.54	<1.0	17.3	30.3	<1.0		30.4	<1.0	52.3	29.7	<1.0	<1.0	
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5	<0.5	<50.0	<0.5	<0.5	<50.0	<0.5		<50.0	<0.5	<0.5	<50.0	<0.5	<0.5	
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	F-95-02			F-95-03			F-95-04			FH-95-01			FH-95-02		
					Date:	2/2/1995			2/2/1995			2/2/1995			2/2/1995			2/2/1995		
					Channel Station:	112+00			125+00			175+00			50+00			0+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%															6.0			3.0
Silt		%															49.6			50.5
Clay		%															44.4			46.5
D50		mm															0.01			0.05
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Barium	µg/L	mg/kg	N/A	N/A	N/A	25.6	49.1		21.1	36.5		20.1	37.2		N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		22.00	**56.70**	**240.30**	13.60	**40.60**	**170.10**
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	30.92	<1.0	<1.0	3.45
Lead	µg/L	mg/kg	210	133	46.7	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	13.14	<1.0	<1.0	12.48
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.2		<0.20	<0.2		<0.20	<0.2		<0.20	<0.2	**9.60**	<0.20	<0.2	**7.63**
Nickel	µg/L	mg/kg	74	118	20.9	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Selenium	µg/L	mg/kg	290	564	N/A	<2.0	<2.0		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0	19.02	<2.0	<2.0	17.53
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		N/A	N/A	N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	69.16	<0.5	<0.5	63.45
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-95-03			FH-95-04			FH-95-05			FH-95-DA1			FH-95-REF1		
					Date:	2/2/1995			2/2/1995			2/2/1995			2/2/1995			2/2/1995		
					Channel Station:	-50+00			-100+00			-150+00								
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						1.6			0.8			1.6			5.4			6.0
Silt		%						72.5			61.4			66.2			66.4			75.2
Clay		%						25.9			37.8			32.2			28.2			18.8
D50		mm						0.05			0.05			0.05			0.06			0.06
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0		<0.10	<1.0	<1.0	<0.10
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	14.10	30.90	**152.70**	15.00	35.30	**134.60**	14.60	32.00	**244.60**	14.90		**329.10**	15.30	**42.30**	**145.50**
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0		<0.10	<1.0	<1.0	<0.10
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0	<1.0	17.71	<1.0	<1.0	26.45	<1.0	<1.0	36.55	<1.0		36.04	<1.0	<1.0	27.86
Lead	µg/L	mg/kg	210	133	46.7	<1.0	<1.0	8.76	<1.0	<1.0	12.40	<1.0	<1.0	16.70	<1.0		15.38	<1.0	<1.0	16.04
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.2	**8.71**	<0.20	<0.2	**11.03**	<0.20	<0.2	**15.01**	<0.20		**15.40**	<0.20	<0.2	**8.95**
Nickel	µg/L	mg/kg	74	118	20.9	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0		<0.10	<1.0	<1.0	<0.10
Selenium	µg/L	mg/kg	290	564	N/A	<2.0	<2.0	13.53	<2.0	<2.0	18.45	<2.0	<2.0	24.27	<2.0		23.07	<2.0	<2.0	20.16
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0		<0.10	<1.0	<1.0	<0.10
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5	<0.5	**49.96**	<0.5	<0.5	64.65	<0.5	<0.5	93.38	<0.5		88.51	<0.5	<0.5	67.62
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	F-97-01			FH-97-01			FH-97-03			FH-97-04			FH-97-05		
					Date:	1/25/1997			1/25/1997			1/25/1997			1/25/1997			1/25/1997		
					Channel Station:	75+00			50+00			-50+00			-100+00			-150+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%									17.5			27.1			5.8			20.6
Silt		%									34.0			11.6			40.9			21.9
Clay		%									48.5			61.3			53.3			57.5
D50		mm									0.01						0.00			0.00
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0	<1.0		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Barium	µg/L	mg/kg	N/A	N/A	N/A	26.7	11.3		53.9	45.8	195	41.7	27.8	250	25.1	21.4	124	24.7	22.9	148
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.1	<0.1		<0.1	<0.1	<0.10	1.69	<0.1	<0.10	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	1.32	<1.0		3.42	<1.0	20.7	1.65	<1.0	28.0	<1.0	<1.0	26.3	<1.0	<1.0	34.4
Copper	µg/L	mg/kg	4.8	13.5	34.0	2.35	**5.64**		**10.2**	<1.0	13.6	1.62	**6.01**	16.4	3.99	4.56	18.0	1.25	**6.98**	16.7
Lead	µg/L	mg/kg	210	133	46.7	<1.0	<1.0		<1.0	<1.0	26.8	<1.0	2.4	**47.8**	<1.0	<1.0	19.7	<1.0	1.3	37.2
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.2		<0.20	<0.2	<0.02	<0.20	<0.2	<0.02	<0.20	<0.2	<0.02	<0.20	<0.2	<0.02
Nickel	µg/L	mg/kg	74	118	20.9	<1.0	<1.0		<1.0	<1.0	15.4	<1.0	<1.0	**23.2**	<1.0	<1.0	**25.5**	<1.0	<1.0	**21.6**
Selenium	µg/L	mg/kg	290	564	N/A	<2.0	<2.0		<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20	<2.0	<2.0	<0.20
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0	<1.0		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0	1.9		4.1	8.5	55.8	3.3	4.4	83.1	<1.0	3.3	66.2	<1.0	20.1	59.7
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01	<0.01		<0.01	<0.01	<1.0	<0.01	<0.01	<1.0	<0.01	<0.01	<1.0	<0.01	<0.01	<1.0
Ammonia	mg/L	mg/kg	Var	N/A	N/A	0.14	3.5		0.16	1.9	38.0	<0.03	1.46	23.6	<0.03	0.55	6.30	<0.03	0.63	6.14

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-97-PA1A			FH-97-REF1			F-97-01A			FH-97A-01			FH-97A-02		
					Date:	1/25/1997			1/25/1997			9/30/1997			9/30/1997			9/30/1997		
					Channel Station:							75+00			50+00			0+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						18.1			18.7						1.8			1.2
Silt		%						24.7			33.2						40.2			34.5
Clay		%						57.2			48.1						58.0			64.3
D50		mm						0.00			0.01						0.00			0.00
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	10.3		<1.0	2.3	3.05	<1.0	<1.0	2.27
Barium	µg/L	mg/kg	N/A	N/A	N/A	25.7		110.0	25.1	17.4	217.0	20.4	60.0		21.7	106.0	144.0	19.2	58.0	98.6
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.1		<0.10	<0.1	<0.1	<0.10	<0.1	<0.1		<0.1	<0.1	<0.10	<0.1	<0.1	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0		33.9	<1.0	<1.0	22.1	<1.0	<1.0		<1.0	<1.0	16.7	<1.0	<1.0	20.7
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00		19.3	1.80	4.36	13.6	1.20	<1.00		<1.00	<1.00	11.1	<1.00	<1.00	11.0
Lead	µg/L	mg/kg	210	133	46.7	<1.0		45.0	<1.0	<1.0	25.3	<1.0	<1.0		<1.0	1.0	2.55	<1.0	3.4	3.04
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.02	<0.20	<0.2	<0.02	<0.20	<0.20		<0.20	<0.20	<0.02	<0.20	<0.20	<0.02
Nickel	µg/L	mg/kg	74	118	20.9	<1.0		**23.1**	<1.0	<1.0	18.9	<1.0	1.0		1.0	1.0	14.7	2.8	1.0	16.5
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<0.20	<2.0	<2.0	<0.20	<1.0	<1.0		<1.0	1.8	<0.20	<1.0	2.7	<0.20
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	<1.0		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0		62.4	<1.0	4.3	52.3	2.5	8.9		<1.0	10.6	49.3	1.8	22.5	64.5
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01		<1.0	<0.01	<0.01	<1.0	<0.01	<0.01		<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	<0.03		6.58	<0.03	0.64	6.74	<0.03	<0.03		<0.03	<0.03	41.5	<0.03	<0.03	31.1

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-97A-03			FH-97A-04			FH-97A-PA1A			FH-97A-REF1			F-98-01		
					Date:	9/30/1997			9/30/1997			9/30/1997			9/30/1997			3/3/1998		
					Channel Station:	-50+00			-100+00									75+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						11.1			1.4			6.7			8.8			
Silt		%						28.7			25.8			48.8			38.5			
Clay		%						60.2			72.8			44.5			52.7			
D50		mm						0.00			0.00			0.01			0.00			
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0	<1.0	2.82	<1.0	3.6	2.93	<1.0	8.0	2.96	<1.0	8.0	3.66	<1.00	<1.00	
Barium	µg/L	mg/kg	N/A	N/A	N/A	26.6	46.0	156.0	23.7	61.0	95.1	24.7	56.0	231.0	17.6	28.0	208.0	50.9	59.8	
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10	0.26	1.00	
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0	<1.0	15.9	1.9	<1.0	21.1	<1.0	<1.0	16.1	<1.0	<1.0	22.9	5.9	2.9	
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00	<1.00	9.9	<1.00	<1.00	14.8	<1.00	<1.00	9.77	<1.00	<1.00	11.3	3.25	1.10	
Lead	µg/L	mg/kg	210	133	46.7	<1.0	<1.0	3.36	<1.0	1.5	2.98	1.07	<1.0	3.26	<1.0	<1.0	3.23	<1.00	<1.00	
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.20	0.02	0.3	<0.20	<0.02		<0.20	0.02		<0.20	0.02	<0.20	<0.20	
Nickel	µg/L	mg/kg	74	118	20.9	<1.0	1.0	15.1	<1.0	1.0	19.2	<1.0	1.0	15.6	<1.0	1.0	18.9	<1.00	<1.00	
Selenium	µg/L	mg/kg	290	564	N/A	<1.0	3.5	<0.20	<1.0	3.9	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20	<1.00	<1.00	
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.00	<1.00	
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Zinc	µg/L	mg/kg	90	92.7	150	1.2	27.0	55.8	4.9	21.2	52.9	<1.0	10.3	55.4	6.1	14.4	70.0	8.50	<1.00	
TOC	mg/L	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.90	6.00	
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	
Ammonia	mg/L	mg/kg	Var	N/A	N/A	<0.03	<0.03	29.4	<0.03	<0.03	3.30	<0.03	<0.03	4.10	<0.03	<0.03	3.84	N/A	N/A	

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	F-98-02			F-98-03			F-98-04			FH-98-01			FH-98-02		
					Date:	3/3/1998			3/3/1998			3/3/1998			9/30/1997			9/30/1997		
					Channel Station:	112+00			125+00			175+00			50+00			0+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%															3.6			4.8
Silt		%															28.2			37.3
Clay		%															68.2			57.9
H		mm															0.00			0.00
Arsenic	µg/L	mg/kg	69	149	8.2	<1.00	2.90		2.50	2.50		2.89	1.70		<1.00	<1.00	5.81	<1.00	<1.00	4.87
Barium	µg/L	mg/kg	N/A	N/A	N/A	38.6	152.0		45.6	97.7		71.8	101.0		31.1	66.7	116	34.9	62.2	103
Cadmium	µg/L	mg/kg	40	45.4	1.20	0.18	0.40		0.17	0.40		0.24	0.40		<0.10	<0.10	0.10	<0.10	<0.10	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	3.8	8.5		2.1	5.2		2.5	7.2		<1.0	<1.0	17.4	<1.0	<1.0	17.9
Copper	µg/L	mg/kg	4.8	13.5	34.0	3.50	<1.00		1.40	<1.00		1.00	<1.00		<1.00	3.11	6.53	<1.00	<1.00	12.90
Lead	µg/L	mg/kg	210	133	46.7	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.0	<1.0	4.24	<1.0	<1.0	3.92
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.20		<0.20	<0.20		<0.20	<0.20		<0.20	<0.20	0.07	<0.20	<0.20	0.06
Nickel	µg/L	mg/kg	74	118	20.9	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	1.47	13.1	<1.00	1.94	14.0
Selenium	µg/L	mg/kg	290	564	N/A	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	<1.0	<0.20	<1.00	<1.0	<0.20
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	11.30	<1.00		2.30	<1.00		7.60	<1.00		11.6	4.6	47.4	10.1	1.5	46.5
TOC	mg/L	%	N/A	N/A	N/A	3.90	5.80		4.00	5.60		4.10	7.00		<1.00	<1.00	14300	<1.00	<1.00	13600
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		<0.03	0.22	38.7	<0.03	5.87	50.4

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-98-03			FH-98-04			FH-98-05			FH-98-PA1A			FH-98-REF1		
					Date:	9/30/1997			9/30/1997			9/30/1997			9/30/1997			9/30/1997		
					Channel Station:	-50+00			-100+00			-150+00								
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						54.9			4.3			3.3			1.6			21.9
Silt		%						7.4			43.6			19.0			44.3			41.0
Clay		%						37.7			52.1			77.7			54.1			37.1
D50		mm						0.06			0.00			0.00			0.00			0.02
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<1.00	<1.00	4.28	<1.00	<1.00	6.34	<1.00	<1.00	6.13	<1.00		5.77	<1.00	<1.00	3.94
Barium	µg/L	mg/kg	N/A	N/A	N/A	28.8	57.7	100	23.6	45.1	210	22.1	52.7	187	23.7		151	22.2	57.9	122
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.35	<0.10	<0.10	0.17		0.14	<0.10	<0.10	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0	<1.0	16.4	<1.0	<1.0	22.7	<1.0	<1.0	17.8	<1.0		17.9	<1.0	<1.0	13.5
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00	<1.00	11.85	<1.00	<1.00	15.20	<1.00	<1.00	13.20	<1.00		12.10	<1.00	<1.00	9.83
Lead	µg/L	mg/kg	210	133	46.7	<1.0	<1.0	3.51	<1.0	<1.0	5.29	<1.0	<1.0	4.33	<1.0		4.58	<1.0	<1.0	3.41
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.20	0.05	<0.20	<0.20	**0.21**	<0.20	<0.20	0.07	<0.20		0.02	<0.20	<0.20	0.05
Nickel	µg/L	mg/kg	74	118	20.9	<1.00	1.05	14.4	<1.00	1.35	17.1	<1.00	2.78	14.4	<1.00		15.4	<1.00	<1.00	12.1
Selenium	µg/L	mg/kg	290	564	N/A	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20	<1.00		<0.20	<1.00	<1.00	<0.20
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0	<1.0	<0.10	<1.0	<1.0	0.19	<1.0	<1.0	<0.10	<1.0		0.23	<1.0	<1.0	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	20.3	1.7	43.0	7.0	<1.0	61.9	6.2	2.1	52.1	20.5		51.8	10.6	1.1	44.2
TOC	mg/L	%	N/A	N/A	N/A	<1.00	<1.00	6250	<1.00	<1.00	11300	<1.00	<1.00	11800	<1.00		7350	<1.00	<1.00	6880
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01		<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	<0.03	2.93	11.9	<0.03	1.67	26.6	<0.03	2.94	25.2	<0.03		11.8	<0.03	5.70	5.70

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-99-01			FH-99-01DUP			F-99-02			F-99-03			FH-H-00-01		
					Date:	7/8/1998			7/8/1998			7/8/1998			7/8/1998			5/23/2000		
					Channel Station:	50+00			50+00			112+00			125+00			75+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						12.1			10.7									
Silt		%						23.8			21.4									
Clay		%						64.1			67.9									
D50		mm						0.00			0.00									
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	2.40	4.39	7.98	1.20	8.16	7.72	1.50	7.53		1.00	9.10		<1.00	<1.00	
Barium	µg/L	mg/kg	N/A	N/A	N/A	33.5	378.0	124.0	34.1	541.0	199.0	29.6	93.0		22.8	81.3		44.3	52.5	
Cadmium	µg/L	mg/kg	40	45.4	1.20	0.3	<0.1	<0.10	0.4	<0.1	<0.10	0.5	<0.1		0.7	<0.1		0.60	<0.10	
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.00	<1.00	10.70	<1.00	<1.00	23.10	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00	<1.00	10.90	<1.00	<1.00	12.10	<1.00	<1.00		<1.00	<1.00		32.30	<1.00	
Lead	µg/L	mg/kg	210	133	46.7	1.60	<1.00	2.85	2.80	<1.00	12.50	2.10	<1.00		2.90	<1.00		<1.00	<1.00	
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.20	0.11	<0.20	<0.20	<0.02	<0.20	<0.20		<0.20	<0.20		<0.20	<0.20	
Nickel	µg/L	mg/kg	74	118	20.9	<1.00	3.30	12.7	<1.00	<1.00	16.3	2.42	4.10		<1.00	3.30		<1.00	<1.00	
Selenium	µg/L	mg/kg	290	564	N/A	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A	
Zinc	µg/L	mg/kg	90	92.7	150	73.4	3.10	47.4	3.10	1.90	55.1	2.10	68.0		8.6	1.50		13.0	4.30	
TOC	mg/L	%	N/A	N/A	N/A	<1.00	<1.00	12500	<1.00	<1.00	8820	<1.00	<1.00		<1.00	<1.00		<1.0	<1.0	
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	
Ammonia	mg/L	mg/kg	Var	N/A	N/A	0.15	14.60	2.11	0.12	14.90	2.79	0.14	10.80		0.09	6.87		<0.03	<0.03	

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-H-00-01A			FH-H-00-01B			FH-H-00-01B DUP			FH-J-00-01A			FH-OB-00-05		
					Date:	5/23/2000			5/23/2000			5/23/2000			5/23/2000			5/23/2000		
					Channel Station:	85+00			95+00			95+00			60+00			-150+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%															6.7			4.1
Silt		%															21.2			25.8
Clay		%															72.1			70.1
D50		mm															0.00			0.00
Percent Solids		%																		
Arsenic	µg/L	mg/kg	69	149	8.2	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	4.38	<1.00	<1.00	4.51
Barium	µg/L	mg/kg	N/A	N/A	N/A	41.9	58.8		50.8	60.0		46.0	55.4		51.0	58.3	104.0	28.2	52.4	55.0
Cadmium	µg/L	mg/kg	40	45.4	1.20	0.90	<0.10		0.60	0.40		0.30	0.90		0.30	<0.10	<0.10	0.70	<0.10	0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	7.66	<1.00	<1.00	7.27
Copper	µg/L	mg/kg	4.8	13.5	34.0	**5.00**	2.90		1.20	2.90		<1.00	<1.00		<1.00	<1.00	7.52	<1.00	2.40	7.86
Lead	µg/L	mg/kg	210	133	46.7	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	16.2	<1.00	<1.00	16.0
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.20		<0.20	<0.20		<0.20	<0.20		<0.20	<0.20	0.04	<0.20	<0.20	0.04
Nickel	µg/L	mg/kg	74	118	20.9	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	9.82	<1.00	<1.00	10.20
Selenium	µg/L	mg/kg	290	564	N/A	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	0.24	<1.00	<1.00	0.22
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.00	<1.00		<1.00	<1.00		<1.00	<1.00		<1.00	<1.00	<0.10	<1.00	<1.00	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A		N/A	N/A		N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	8.7	5.5		491.0	6.1		10.7	7.1		14.5	4.6	37.2	6.6	3.3	28.3
TOC	mg/L	%	N/A	N/A	N/A	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	16100	<1.0	<1.0	15100
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	0.12	<0.03		0.11	<0.03		<0.03	<0.03		0.11	<0.03	26.7	<0.03	0.75	3.17

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-OB-00-06			FH-OB-00-PA1A			FH-OB-00-REF1			FH-EC-04-01			FH-EC-04-02		
					Date:	5/23/2000			5/23/2000			5/23/2000			4/29/2004			4/29/2004		
					Channel Station:	-200+00									60+00			-45+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						1.0			28.2			6.1			7.5			10.7
Silt		%						29.4			41.6			33.4			28.0			65.5
Clay		%						69.6			30.2			60.5			64.5			23.8
D50		mm						0.00			0.05			0.00			0.00			0.01
Percent Solids		%															40.2			42.6
Arsenic	µg/L	mg/kg	69	149	8.2	<1.00	<1.00	5.77	<1.00		3.43	<1.00	<1.00	4.92	1.83	2.58	6.75	1.32	2.47	7.12
Barium	µg/L	mg/kg	N/A	N/A	N/A	25.2	40.4	106.0	31.7		76.0	26.2	47.5	81.2	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.10	0.10	<0.10	0.60		<0.10	0.90	0.40	0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.00	<1.00	9.66	<1.00		6.00	<1.00	<1.00	8.91	<1.00	<1.00	18.8	<1.00	<1.00	14.9
Copper	µg/L	mg/kg	4.8	13.5	34.0	**8.00**	<1.00	10.00	<1.00		7.53	<1.00	<1.00	9.34	<1.00	<1.00	11.3	<1.00	<1.00	8.55
Lead	µg/L	mg/kg	210	133	46.7	<1.00	<1.00	17.9	<1.00		11.1	<1.00	<1.00	16.1	<1.00	<1.00	17.9	<1.00	<1.00	17.8
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.20	0.04	<0.20		0.04	<0.20	<0.20	0.04	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nickel	µg/L	mg/kg	74	118	20.9	<1.00	<1.00	13.30	4.00		8.04	<1.00	<1.00	12.50	<1.00	<1.00	17.3	<1.00	<1.00	14.9
Selenium	µg/L	mg/kg	290	564	N/A	<1.00	<1.00	0.29	<1.00		0.20	<1.00	<1.00	0.27	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.00	<1.00	<0.10	<1.00		<0.10	<1.00	<1.00	<0.10	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	<1.00	<1.00	0.27	<1.00	<1.00	0.21
Zinc	µg/L	mg/kg	90	92.7	150	80.7	4.1	38.5	10.7		31.2	47.1	5.2	34.3	8.39	9.70	28.6	4.61	8.72	27.3
TOC	mg/L	%	N/A	N/A	N/A	<1.0	<1.0	18800	<1.0		10100	<1.0	<1.0	15500	4.32	8.34	7800	3.07	5.33	7800
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01	<0.01	<1.00	<0.01		<1.00	<0.01	<0.01	<1.00	N/A	N/A	N/A	N/A	N/A	N/A
Ammonia	mg/L	mg/kg	1.7	N/A	N/A	<0.03	0.70	12.4	<0.03		29.0	<0.03	0.36	3.05	0.05	1.17	99.9	0.03	1.25	88.6

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-EC-04-03			FH-EC-04-03 DUP			FH-EC-04-REF			FH-EC-05-01			FH-EC-05-02		
					Date:	4/29/2004			4/29/2004			4/29/2004			6/29/2005			6/29/2005		
					Channel Station:	-150+00			-150+00						60+00			-45+00		
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						1.1			0.9			12.9			4.0			16.7
Silt		%						68.0			63.6			28.2			19.1			41.5
Clay		%						30.9			35.5			58.9			76.9			41.8
D50		mm						0.01			0.01			0.00			0.00			0.01
Percent Solids		%						35.4			33.5			47.2			41.4			45.8
Arsenic	µg/L	mg/kg	69	149	8.2	1.30	1.45	**8.63**	1.80	1.07	**9.15**			6.93	2.25	3.84	7.26	2.26	4.08	6.19
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10			0.13	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.00	<1.00	19.3	<1.00	<1.00	20.5			19.6	<1.00	<1.00	23.5	<1.00	<1.00	18.7
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00	<1.00	11.2	<1.00	<1.00	11.8			12.2	<1.00	<1.00	14.0	<1.00	<1.00	10.4
Lead	µg/L	mg/kg	210	133	46.7	<1.00	<1.00	22.5	<1.00	<1.00	23.7			17.6	<1.00	<1.00	18.5	<1.00	<1.00	15.2
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<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
Nickel	µg/L	mg/kg	74	118	20.9	<1.00	<1.00	18.6	<1.00	<1.00	19.3			18.8	<1.00	6.06	19.2	<1.00	3.89	15.8
Selenium	µg/L	mg/kg	290	564	N/A	<2.00	<2.00	<0.50	<2.00	<2.00	<0.50			<0.50	2.26	<2.00	<0.50	2.24	<2.00	<0.50
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20			<0.20	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20
Thallium	µg/L	mg/kg	N/A	N/A	N/A	<1.00	<1.00	0.28	<1.00	<1.00	0.27			0.21	<1.00	<1.00	1.09	<1.00	<1.00	0.50
Zinc	µg/L	mg/kg	90	92.7	150	12.2	8.61	31.0	2.83	8.04	34.1			25.4	<1.00	5.03	19.6	<1.00	1.89	17.1
TOC	mg/L	%	N/A	N/A	N/A	3.33	3.98	11300	3.71	3.95	11500			10300	2.80	3.37	14800	3.25	4.29	15300
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ammonia	mg/L	mg/kg	1.7	N/A	N/A	0.03	0.55	83.5	0.03	0.72	82.8			71.0	0.15	0.87	17.2	0.11	0.74	7.7

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-2 (Concluded)

DETECTED PARAMETERS
FREEPORT HARBOR CHANNEL

					Station:	FH-EC-05-02 DUP			FH-EC-05-03			FH-EC-05-REF		
					Date:	6/29/2005			6/29/2005			6/29/2005		
					Channel Station:	-45+00			-150+00					
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						14.5			1.0			7.5
Silt		%						47.8			70.2			5.7
Clay		%						37.7			28.8			86.8
D50		mm						0.01			0.01			0.00
Percent Solids		%						43.1			33.7			47.4
Arsenic	µg/L	mg/kg	69	149	8.2	2.34	3.78	6.47	2.42	3.10	**8.61**			7.53
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	<1.00	<1.00	<0.10	<1.00	<1.00	<0.10			0.2
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.00	<1.00	18.7	<1.00	<1.00	23.6			23.8
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00	<1.00	10.3	<1.00	<1.00	13.9			15.4
Lead	µg/L	mg/kg	210	133	46.7	<1.00	1.27	16.1	<1.00	1.19	21.7			16.8
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			<0.20
Nickel	µg/L	mg/kg	74	118	20.9	<1.00	4.34	16.0	<1.00	4.35	19.9			20.8
Selenium	µg/L	mg/kg	290	564	N/A	2.26	<2.00	<0.50	2.21	<2.00	<0.50			<0.50
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.00	<1.00	<0.20	<1.00	<1.00	<0.20			<0.20
Thallium	µg/L	mg/kg	N/A	N/A	N/A	<1.00	<1.00	0.28	<1.00	<1.00	0.53			0.38
Zinc	µg/L	mg/kg	90	92.7	150	<1.00	2.40	17.4	<1.00	2.29	24.1			17.9
TOC	mg/L	%	N/A	N/A	N/A	1.87	5.49	12900	2.28	4.13	18900			13300
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			N/A
Ammonia	mg/L	mg/kg	2.9	N/A	N/A	0.19	1.07	21.2	0.16	0.98	20.6			12.2

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

TABLE 3.9-3
CONSTITUENTS DETECTED IN WATER AND ELUTRIATE SAMPLES BY YEAR

	Year																			
	1987		1988		1989		1993		1995		1997		1998		1999		2000		2004		2005	
Parameter	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E
Arsenic												X	X	X	X	X			X	X	X	X
Barium									X	X	X	X	X	X	X	X	X	X				
Cadmium			X	X					X	X	X		X	X	X		X	X				
Chromium								X			X		X	X								
Copper	X	X									X	X	X	X			X	X				
Lead	X	X										X			X							X
Mercury											X											
Nickel			X	X							X	X		X	X	X						X
Selenium												X									X	
Silver																						
Thallium																						
Zinc	X	X	X	X			X	X			X	X	X		X	X	X	X	X	X		X
TOC													X	X					X	X	X	X
Total PCB																						
Ammonia											X	X		X	X	X	X		X	X	X	X

* Channel Stations Only, PA and Reference samples are not included.

W = water, E = elutriate

of high cadmium concentrations was also true of the sediments: pre- and post-1995, no value was above 1.5 milligram per kilogram (mg/kg), while in 1995 the values ranged from 134.6 mg/kg to 329.1 mg/kg. Mercury, selenium, and total PCBs were also high in the sediment samples in 1995, relative to the other years but they were not detected in the water or elutriate samples. Additionally, chromium, nickel, and zinc were abnormally low in the sediments. Whatever the explanation for these data, they were not repeated in the five data sets since then.

For samples collected in January 1997, the copper WQC but not TWQS, was exceeded in one water and three elutriate samples. In September 1997 samples, copper was not detected in any elutriate samples and in only one water sample. There were no other exceedances in 1997. Analyses for ammonia were first conducted in 1997 and continue to the present. There is no TWQS for ammonia but there is a WQC. However, it is based on a combination of temperature, salinity, and pH and, thus, varies from sample to sample. For more recent data (2004 and 2005), where all of these parameters are available, the WQC was calculated and is compared to the water and elutriate concentrations. Samples were also collected at two different times in 1998. More constituents were detected in the March samples than in the September samples (see Table 3.9-3) but there were no exceedances of any WQC or TWQS.

For samples collected in 2000, the copper WQC but not TWQS, was exceeded in two water samples: one in the Brazosport Turning Basin and one in the Entrance Channel. Copper was not detected or was below the WQC and TWQS in the rest of the water samples and in all elutriate samples. There were no other exceedances in 2000. In 2004 and 2005, the latest data sets and the only ones within the last five years, there were no consistent trends when elutriate concentrations were compared to water concentrations except that elutriate ammonia values were always higher than water ammonia values. No WQC or TWQS was exceeded in 2004 or 2005 samples.

3.9.2.3 Bioassays

Two recent sets of elutriate bioassays have been conducted on samples collected from the Entrance Channel (PBS&J 1999, 2004). The results of these tests are presented in Table 3.9-4, an examination of which indicates that in all tests, survival of organisms exposed to the suspended particulate phase (SPP, unfiltered elutriate) of sediments from the Freeport Harbor Jetty and Entrance Channels was greater than 50%, and in all instances except one, above 90%. Therefore, no 96 hour LC_{50} (that concentration of a substance which is lethal to 50% of test organisms after a continuous exposure time of 96 hours) could be calculated. This indicates that no acute toxicity to water column organisms could be expected from dredging the Jetty and Entrance Channels or placement of Channel sediments.

There are no indications of water or elutriate problems in the Freeport Harbor Jetty and Entrance Channels.

TABLE 3.9-4
THE NUMBER AND PERCENTAGES OF SURVIVING ORGANISMS
SUSPENDED PARTICULATE PHASE BIOASSAYS
100% TEST SOLUTION
April 1999

		Number of Survivors							
	Replicate	True Control	Reference Control	True Control	FH-1	True Control	FH-2	True Control	FH-3
A. bahia	1	10	9	10	9	10	9	10	10
juveniles	2	10	9	10	9	10	10	10	10
10/replicate	3	10	10	10	9	10	10	10	9
	4	10	8	10	10	10	10	10	10
	5	9	10	9	9	9	9	9	10
	Average	9.8	9.2	9.8	9.2	9.8	9.6	9.8	9.8
	(%)	98.0%	92.0%	98.0%	92.0%	98.0%	96.0%	98.0%	98.0%
A. bahia	1	10	10	10	10	10	10	10	9
adults	2	10	10	10	9	10	10	10	7
10/replicate	3	10	10	10	10	10	10	10	6
	4	10	9	10	10	10	10	10	9
	5	10	10	10	10	10	9	10	7
	Average	10.0	9.8	10.0	9.8	10.0	9.8	10.0	7.6
	(%)	100.0%	98.0%	100.0%	98.0%	100.0%	98.0%	100.0%	76.0%
C. variegatus	1	10	10	10	10	10	10	10	10
10/replicate	2	10	10	10	10	10	10	10	10
	3	10	10	10	10	10	10	10	10
	4	10	10	10	10	10	10	10	10
	5	9	10	9	10	9	10	9	10
	Average	9.8	10.0	9.8	10.0	9.8	10.0	9.8	10.0
	(%)	98.0%	100.0%	98.0%	100.0%	98.0%	100.0%	98.0%	100.0%

TABLE 3.9-4 (Concluded)
THE NUMBER AND PERCENTAGES OF SURVIVING ORGANISMS
SUSPENDED PARTICULATE PHASE BIOASSAYS
100% TEST SOLUTION
May 2004

		Number of Survivors							
	Replicate	Dilution Control	Reference Control	Dilution Control	FH-EC-01 60+00	Dilution Control	FH-EC-02 -45+00	Dilution Control	FH-EC-03 -150+00
A. bahia	1	10	10	10	10	10	10	10	10
juveniles	2	10	10	10	10	10	10	10	10
10/replicate	3	10	10	10	10	10	10	9	10
	4	10	10	10	10	10	10	10	10
	5	10	10	10	10	10	10	10	10
	Average	10.0	10.0	10.0	10.0	10.0	10.0	9.8	10.0
	(%)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	98.0%	100.0%
A. bahia	1	10	10	10	10	10	10	10	10
adults	2	10	9	10	10	10	10	10	10
10/replicate	3	10	10	10	10	10	9	10	10
	4	10	10	10	10	10	10	10	10
	5	10	9	10	10	10	10	10	10
	Average	10.0	9.6	10.0	10.0	10.0	9.8	10.0	10.0
	(%)	100.0%	96.0%	100.0%	100.0%	100.0%	98.0%	100.0%	100.0%
M. beryllina	1	10	10	10	10	10	10	10	10
10/replicate	2	6	10	6	10	6	9	6	10
	3	10	10	10	10	10	10	10	10
	4	10	10	10	10	10	9	10	10
	5	10	10	10	9	10	10	10	9
	Average	9.2	10.0	9.2	9.8	9.2	9.6	9.2	9.8
	(%)	92.0%	100.0%	92.0%	98.0%	92.0%	96.0%	92.0%	98.0%

3.9.2.4 Ballast Water

Ballast water is loaded on empty ships to provide weight and stability while traveling from one port to the next. There are thousands of marine species that can be carried from port to port in ballast water which may ultimately result in the introduction of unwanted aquatic species from foreign ports of origin (Global Ballast Water Management Programme, 2006). As a consequence, invasive, exotic species have been introduced into United States waters through ballast water. Ballast water is the largest single vector for nonindigenous species transfer (EPA, 2001). The EPA has compiled a list of invasive species that have the potential to be unintentionally introduced in Texas, although not necessarily through ballast water alone (Table 3.9-5) (EPA, 2001).

The USCG, under the provisions of the National Invasive Species Act of 1996, has implemented a program that consists of a suite of mandatory ballast water management (BWM) protocols. All vessels, foreign and domestic, equipped with ballast water tanks that operate within the U.S. waters are required to comply with 33 CFR Part 151 regarding management protocol. This includes submitting a ballast water exchange report to the National Ballast Information Clearinghouse (NBIC) to ensure compliance with the management requirements (USCG, 2006a).

According to the NBIC (2006) ballast water reporting database, between 2004 and 2006, 271 ballast water exchange reports were submitted for Freeport Harbor. Of these, 14 represented treated and 8 represented untreated discharges that occurred at Freeport. Treated discharges consisted of either flow-through or empty/refill of ballast tanks.

3.9.3 Sediment Quality

3.9.3.1 Surficial Sediments

There has been only one recent study that evaluated construction material, as part of the jetty stability analysis, which is pertinent to the project (PBS&J, 2005). Soil samples were collected by Fugro (2005) to determine if the soils presented a “cause for concern”. There are no sediment or soil quality criteria with which to compare concentrations in soils; however, there are several different guidelines that are used to look for a cause for concern in sediment samples. One of these guidelines is the ERL, which has been used in the past to examine both soils and sediments destined for BU or ocean disposal in the Gulf of Mexico.

It should be noted that while ERLs are used for comparative purposes, they were developed by assembling a large group of sediment data sets, comprising samples for which there was both bulk sediment chemistry and exhibition of toxicity. For each chemical in the data set, the concentrations were ranked in ascending order and the ERL was calculated as the lower 10th percentile of the concentrations. However, this approach demonstrates no cause and effect from the chemicals in the data set, since the fact that a chemical was detected does not demonstrate that it was responsible for any of the toxicity exhibited by the sediment. Not surprisingly, when ERLs derived from sets of data from different areas are

TABLE 3.9-5
CURRENT AND POTENTIAL AQUATIC SPECIES
THAT POSE A THREAT TO TEXAS

Scientific Name	Common Name	Texas
Shrimp Viruses		
Taura Syndrome Virus	shrimp virus	√
White Spot Syndrome Virus	shrimp virus	√
Coelenterates		
Phyllorhiza punctata	spotted jellyfish	P
Roundworms (phylum Nematoda)		
Anguillicola crassus	eel parasite	P
Mollusks		
Corbicula fluminea	Asian clam	P
Crassostrea gigas	Japanese (or Pacific giant) oyster	√
Dreissena polymorpha	zebra mussel	P
Perna perna	brown mussel	P
Pomacea canalicula	channeled applesnail	√
Crustaceans		
Carcinus maenus	green crab	P
Charybdis helleri	marine swimming crab	P
Eriocheri sinensis	Chinese mittencrab	P
Fishes		
Cichlasoma cyanoguttatum	Rio Grande cichlid	√
Ctenopharyngodon idella	grass carp	√
Hypophthalmichthys molitrix	silver carp	P
Hypophthalmichthys nobilis	bighead carp	P
Mylopharyngodon piceus	black carp	P
Oreochromis aureus	blue tilapia	√
Oreochromis mossambicua	Mozambique tilapia	√
Mammals		
Myocastor coypus	nutria	√
Algae		
Aureoumbra lagunensis	brown tide algae	√ *

TABLE 3.9-5
CURRENT AND POTENTIAL AQUATIC SPECIES
THAT POSE A THREAT TO TEXAS

Scientific Name	Common Name	Texas
Vascular Plants		
Alternathera philoxeroides	alligatorweed	√
Eichhornia crassipes	water hyacinth	√
Hydrilla verticillata	hydrilla	√
Ipomoea aquatica	waterspinach	P
Lythrum salicaria	purple loosestrife	P
Panicum repens	torpedograss	√
Pistia stratiotes	waterlettuce	√
Salvinia minima	common salvinia	√
Salvinia molesta	giant salvinia	√
Semi-Aquatic Vascular Plants		
Pueraria montana	kudzu	P
Sapium sebiferum	Chinese tallow tree	√

P = Potential threat
√ = Current threat
* = Cryptogenic (a species whose status as indigenous or nonindigenous remains unresolved)

Source: EPA, 2001

compared, the results are inconsistent (USACE, 1998). For example, when the ERLs of a number of chemicals were compared using a northern California data set versus a southern California data set, the ERLs differed by a range, from only a factor of three for total polychlorinated biphenyls (PCB) to a factor of 2,689 for p,p' DDE. Since the ERLs are not based on cause and effect data, one would expect them to exhibit low predictive ability and to give a high number of false positives, both of which are true (USACE, 1998). Also used, on occasion, are the Effects Range Medium (ERM), similar to the ERLs but with higher concentrations. The ERLs (and the one ERM) used here are those presented in the National Oceanic and Atmospheric Administration (NOAA) 1999 Screening Quick Reference Tables (Buchman, 1999).

Data for detected compounds are presented in Table 3.9-6: a total of ten samples taken from six borings (Figure 3.9-1). Arsenic, beryllium, total chromium, copper, lead, manganese, mercury, nickel, and zinc were detected in all samples. Thallium was detected in 6 of 10 samples, mercury in only 2 samples. Antimony, cadmium, selenium, silver, and the nonmetal, cyanide, were not detected in any sample.

A complete suite of organic compound analyses were conducted including organic halides, VOCs, semivolatile organic compounds, pesticides, and PCBs. Of these, only fluoranthene was detected and in only one sample.

There were six exceedances of ERLs: all by nickel, ranging from 23.8 mg/kg (114% of the ERL) to 35.3 mg/kg (170% of the ERL). Nickel concentrations up to 28.6 mg/kg were found in sediments from the Sabine-Neches Entrance Channel (PBS&J, 1999), but no toxicity was exhibited by sensitive water column or benthic organisms, during bioassays conducted according to procedures provided in EPA/USACE (1991). Since (1) there is no way to determine if nickel was the causative factor in the data that led to the nickel ERL, (2) toxicity data have demonstrated that nickel concentrations in the same range as those found in these samples did not cause toxicity, (3) the concentrations are less than a factor of two of the ERL, (4) the concentrations are below the ERM concentration (51.6 mg/kg) and well below the Apparent Effects Threshold values, of which 110.0 mg/kg (for echinoderm larvae) is the lowest value (Buchman, 1999), (5) there are no-action levels established by the food and drug administration for poisonous or deleterious substances in human food and animal feed (which includes fish and shellfish) for nickel, and (6) no other ERLs were exceeded, there would appear to be no significant cause for concern relative to placing these soils in the Gulf of Mexico or using them beneficially.

3.9.3.2 Maintenance Material

3.9.3.2.1 Chemistry

The data, collected by the USACE on maintenance material and others since 1987, were analyzed to determine the sediment quality of the project area. The data presented here are from bulk sediment analyses, which tend to show considerable variation, even within duplicates. The data from areas outside the Jetty and Entrance channels are not included in this analysis because those sediments will not be part of the maintenance material from the widened channel. Like the construction material discussed above, the sediment data are compared to ERLs.

TABLE 3.9-6

CONCENTRATIONS OF DETECTED CONSTITUENTS IN SOILS (dry weight)

FREEPORT WIDENING PROJECT

Date Sampled: February 2005

Parameter	Units	NOAA ERL*	B-1,E,26' 0211038	B-2,E-1,24' 0211039	B-2,E-2,46' 0211040	B-3,E-1,26' 0211041	B-3,E-2,35' 0211042	B-4,E-1,35' 0211043	B-4,E-2,40' 0211044	B-5,E-1,34' 0211045	B-5,E-2,59' 0211046	B-6,E-2,32-34' 0211047
Antimony	mg/kg	N/A	< 0.0986	< 0.0934	< 0.0971	< 0.0948	< 0.0977	< 0.0977	< 0.0971	< 0.0878	< 0.0910	< 0.0966
Arsenic	mg/kg	8.2	2.7	2.4	1.4	0.700	8.2	2.0	4.1	0.600	2.0	1.6
Beryllium	mg/kg	N/A	1.15	1.18	1.46	0.274	1.46	0.743	1.16	0.142	0.983	0.433
Chromium, Total	mg/kg	81.0	28.1	46.0	59.9	7.8	46.8	15.3	23.2	4.1	20.2	9.9
Copper	mg/kg	34.0	25.8	19.1	19.9	3.6	26.1	10.1	19.5	1.6	12.2	4.6
Lead	mg/kg	46.7	14.9	27.6	29.9	5.1	39.9	7.0	15.6	2.8	10.7	6.8
Manganese	mg/kg	N/A	257.7	184.7	214.1	130.2	723.2	157.2	489.6	85.2	290.1	311.9
Mercury	mg/kg	0.150	< 0.00794	< 0.00664	< 0.00663	< 0.00613	< 0.00647	< 0.00597	< 0.00647	< 0.00602	0.0111	0.0129
Nickel	mg/kg	20.9	**30.2**	**26.8**	**33.3**	6.0	**35.3**	17.6	**29.8**	3.3	**23.8**	10.6
Thallium	mg/kg	N/A	0.294	0.284	0.340	< 0.190	0.324	< 0.195	0.285	< 0.176	0.214	< 0.193
Zinc	mg/kg	150	61.7	63.1	73.5	38.0	64.5	34.8	58.9	10.5	50.4	40.6
Fluoranthene	ug/kg	600	< 635	< 531	< 265	534	< 259	< 239	< 259	< 241	< 237	< 259
Percent Solids	%	N/A	63.0	75.3	75.4	81.5	77.3	83.8	77.3	83.0	84.5	77.1

ERL = Effects Range Low for Marine Sediments. There are no ERLs for soils.

PBSJ
6504 Bridge Point Pkwy, Ste. 200
Austin, Texas 78730
Phone: (512) 329-8342 Fax: (512) 327-2453

Figure 3.9-1
Fugro Boring Locations, Port Freeport

Prepared for: USACE, Galveston District	
Job No.: 441591.00	Scale: 1:30,000
Prepared by: EMonshaugen	Date: 06/07/2006
File: N:/44159100/Projects/Fig3_9_1.mxd	

Geotechnical Boring

N
W E
S

2,500 1,250 0 2,500
Feet

Source: Fugro Consultants, 2005.

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The sediment chemistry data is presented in Table 3.9-2 for the same time period and the same stations as for the water and elutriate samples, except, as noted above, channel stations outside of the project area are not included. PA stations and Reference station data are included in Table 3.9-2 for comparison purposes. Exceedances of ERLs are bolded in Table 3.9-2. Table 3.9-7 shows the years in which the various constituents in Table 3.9-2 were detected, but only in channel station sediments.

There were no exceedances of ERLs in 1987, 1988, or 1989. In 1993, the ERL for cadmium was slightly exceeded in two of seven samples. For example, the Reference concentration was 1.0 mg/kg, the ERL is 1.2 mg/kg, and the highest concentration was 1.5 mg/kg. In 1995, as noted in the discussion on water and elutriates, sediment cadmium ranged up to 244.6 mg/kg, over 200 times the ERL, and exceeded the ERL in all Jetty and Entrance Stations. The ERL was also exceeded at the PA and Reference stations. Mercury also exceeded the ERLs in 1995 at all channel stations, the PA, and the Reference station. The ERL for mercury was exceeded by more than 100 times in the PA sample, which contained the highest concentration of mercury. There are no ERLs for selenium and total PCBs but these constituents were also found in very high concentrations in all sediment samples, relative to concentrations in other years. The fact that the concentrations were high in the PA samples, where placement had not yet taken place in the 1995 dredging cycle and the Reference sample calls these data into question.

In January 1997, the nickel ERL was slightly exceeded (1.2 times maximum) in all Entrance channel sediment samples and the PA sample but not the Jetty Channel or Reference samples. The lead ERL was also slightly exceeded (1.02 times) at one station. There were no exceedances in September 1997 or in March 1998. In September 1998, the mercury ERL was slightly exceeded (0.21 mg/kg versus and ERL of 0.15 mg/kg) at one Entrance Channel station. There were no exceedances in 1999 or 2000. In 2004, the ERL for arsenic was slightly exceeded (8.63 and 9.15 mg/kg versus the ERL of 8.2 mg/kg) at one Entrance Channel station and its duplicate. There were no exceedances in 2005.

3.9.3.2.2 Bioassays

Table 3.9-8 presents the data for solid phase (SP, or whole mud) bioassays with Jetty and Entrance Channel sediments from 1999, 2004, and 2005. These bioassays were conducted according to protocols in EPA/USACE (1991) and the Regional Implementation Agreement (RIA) (EPA/USACE, 2003). In 1999, all survival was good and there were no tests in which survival in the Reference Control was greater than survival in the treatments and the difference exceeded 10%, requiring statistical analysis. Therefore, the survival data from the SP bioassay indicate no potential for environmentally unacceptable toxic impacts to benthic organisms from the placement of sediments from Freeport Harbor-Entrance Channel (FH-EC).

Survival in the SP bioassays conducted with the amphipod, *Leptocheirus plumulosus*, on samples collected in April 2004, was acceptable and survival in the Reference Control was not at least 10% greater than survival in the treatments. However, survival of the opossum shrimp, *Americamysis bahia*, was poor, especially in the Reference Control. While the tests theoretically passed the requirements of the RIA, the results were not typical and the SP bioassays with *A. bahia* was repeated in 2005. As can be seen from Table 3.9-8, survival was good for all test groups. Survival was also nearly equal in all tests, confirming

TABLE 3.9-7
CONSTITUENTS DETECTED IN SEDIMENT SAMPLES BY YEAR*

Parameter	1988	1989	1993	1995	1997	1998	1999	2000	2004	2005
Arsenic	X				X	X	X	X	X	X
Barium					X	X	X	X		
Cadmium			X	X		X		X		
Chromium	X	X	X		X	X	X	X	X	X
Copper	X	X	X	X	X	X	X	X	X	X
Lead	X	X	X	X	X	X	X	X	X	X
Mercury				X	X	X	X	X		
Nickel	X	X	X		X	X	X	X	X	X
Selenium				X				X		
Silver						X				
Thallium									X	X
Zinc	X	X	X		X	X	X	X	X	X
TOC						X	X	X	X	X
Total PCB				X						
Ammonia					X	X	X	X	X	X

* Channel Stations in the Project Area Only, PA, Reference, and interior samples are not included.

TABLE 3.9-8
THE NUMBER AND PERCENTAGES OF SURVIVING ORGANISMS
10-DAY SOLID PHASE BIOASSAYS
FREEPORT HARBOR JETTY AND ENTRANCE CHANNELS

1999

		Number of Survivors				
	Replicate (n=5)	True Control	Reference Control	FH-1	FH-2	FH-3
A. abdita 20/replicate	1	19	20	17	17	18
	2	17	19	19	17	20
	3	18	20	17	19	18
	4	18	20	19	20	18
	5	19	20	20	19	18
	Average	18.2	19.8	18.4	18.4	18.4
	(%)	91.0%	99.0%	92.0%	92.0%	92.0%
P. pugio 20/replicate	1	18	19	17	19	20
	2	20	20	19	18	18
	3	19	20	17	19	17
	4	20	18	20	20	19
	5	19	18	18	18	19
	Average	19.2	19.0	18.2	18.8	18.6
	(%)	96.0%	95.0%	91.0%	94.0%	93.0%
Total Organisms 30/replicate	1	37	39	34	36	38
	2	37	39	38	35	38
	3	37	40	34	38	35
	4	38	38	39	40	37
	5	38	38	38	37	37
	Average	37.4	38.8	36.6	37.2	37.0
	(%)	93.5%	97.0%	91.5%	93.0%	92.5%

TABLE 3.9-8 (Continued)

2004

	Replicate (n=5)	Number of Survivors True Control	Reference Control	FH-EC-01 60+00	FH-EC-02 -45+00	FH-EC-03 -150+00
10-DAY	1	20	19	19	20	20
L. plumulosis	2	20	15	18	12	19
20/replicate	3	20	19	19	20	20
	4	20	19	18	9	18
	5	20	15	15	16	8
	Average	20.0	17.4	17.8	15.4	17.0
	(%)	100.0%	87.0%	89.0%	77.0%	85.0%
A. bahia	1	20	6	19	18	20
20/replicate	2	20	16	20	15	17
	3	18	3	19	19	10
	4	19	0	18	7	17
	5	18	12	15	8	15
	Average	19.0	7.4	18.2	13.4	15.8
	(%)	95.0%	37.0%	91.0%	67.0%	79.0%
Total Organisms	1	40	25	38	38	40
30/replicate	2	40	31	38	27	36
	3	38	22	38	39	30
	4	39	19	36	16	35
	5	38	27	30	24	23
	Average	39.0	24.8	36.0	28.8	32.8
	(%)	97.5%	62.0%	90.0%	72.0%	82.0%

2005

	Replicate (n=5)	Number of Survivors True Control	Reference Control	FH-EC-05-01 60+00	FH-EC-05-02 -45+00	FH-EC-05-03 -150+00
10-DAY	1	19	15	17	18	17
A. bahia	2	19	18	17	13	20
20/replicate	3	19	18	15	17	17
	4	20	20	17	20	20
	5	19	18	20	18	19
	Average	19.2	17.8	17.2	17.2	18.6
	(%)	96.0%	89.0%	86.0%	86.0%	93.0%

TABLE 3.9-8 (Concluded)

2003

		Number of Survivors			
	Replicate (n=5)	True Control	Reference	Q1 NW Quadrant	Q2 NE Quadrant
10-DAY	A	15	17	15	17
A. abdita	B	19	17	18	13
20/replicate	C	17	18	13	18
	D	17	18	17	19
	E	18	17	14	18
	Average	17.2	17.4	15.4	17.0
	(%)	86.0%	87.0%	77.0%	85.0%

		Number of Survivors			
	Replicate (n=5)	Q3 SE Quadrant	Q4 SW Quadrant	Down Current	LA-5 Control
10-DAY	A	17	18	16	16
A. abdita	B	16	18	17	16
20/replicate	C	17	16	20	13
	D	19	18	18	18
	E	16	19	18	18
	Average	17.0	17.8	17.8	16.2
	(%)	85.0%	89.0%	89.0%	81.0%

the conclusions drawn from the SP bioassay with the April 2004 samples, that there is no indication of a cause for concern from the ocean placement of the maintenance material from FH-EC.

Solid phase bioassays, using the amphipod, *Ampelisca abdita*, were also conducted for the EPA in 2003 (Battelle, 2004). The data reported in Battelle (2004) are also included in Table 3.9-8. These bioassays were on composite sediment samples from the four quadrants of the ODMDS, from a reference area roughly 2 miles up-current from the ODMDS, from an area roughly 750 ft down current of the down-current edge of the ODMDS, and two laboratory controls. Survival ranged from 77% to 89%. There were no tests in which survival in the Reference Control was greater than survival in the treatments and the difference exceeded 10%, requiring statistical analysis.

3.9.3.2.3 Bioaccumulation Studies

Bioaccumulation studies were also conducted on samples of the maintenance material for the USACE and from the Battelle stations noted above for the SP bioassays (Table 3.9-9). In 1999, no organic chemicals were found above detection limits in test organism tissues. Of the metals, arsenic, barium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc were found in tissue samples above detection limits. Only the concentrations of nickel in tissues of *N. virens* exposed to test sediments were significantly higher than the concentrations in Reference Control organisms. However, the nickel concentration in archive polychaete tissues were more than twice that of the highest test sediment organism, so there was no bioaccumulation, just less depuration in some test polychaetes than in Reference Control polychaetes.

In 2004, no organic chemicals were found above detection limits in test organism tissues, except bis (2-ethylhexyl) phthalate. Of the metals, antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc were found in tissue samples above detection limits. The concentrations of none of the constituents in tissues of *N. virens* or *M. mercenaria* exposed to test sediments were significantly higher than the respective concentrations in Reference Control organisms.

The data reported in Battelle (2004) are also included in Table 3.9-9. These bioaccumulation studies, using *M. nasuta*, were on the composite sediment samples from the four quadrants of the ODMDS, the reference area, the down-current station, and three laboratory controls. Samples were also taken from clams that were not tested (archive samples). In general, all of the values were approximately the same for individual constituents, although the archive tissue tended to have the highest numerical values. “There were no environmentally noteworthy elevations of” metals or organic compounds “in tissues exposed to sediments from the active discharge quadrants (Q1 and Q2), the inactive quadrants (Q3 and Q4), the Down Current site, or the Reference site” (Battelle, 2004).

3.10 COMMERCIAL AND RECREATIONAL NAVIGATION

The Port of Freeport primarily handles bulk fuels and chemicals. Table 3.10-1, summarizing the USACE Waterborne Commerce data, indicates that approximately 81% of the tonnage through the Port consists of

TABLE 3.9-9
AVERAGE CONCENTRATIONS OF DETECTED COMPOUNDS
IN TISSUE SAMPLES OF
FREEPORT HARBOR JETTY AND ENTRANCE CHANNELS

N. virens 1999

Parameter	STATION					
	True Control	Reference Control	FH-1	FH-2	FH-3	Archive
Metals (mg/kg)						
Arsenic	1.17	0.64	0.74	0.76	0.85	1.03
Barium	0.59	0.53	0.69	0.52	0.63	0.49
Cadmium	0.10	0.10	0.18	0.10	0.10	0.10
Chromium	0.25	0.49	0.36	0.49	0.55	1.53
Copper	5.22	9.80	3.24	4.36	8.34	4.26
Lead	0.10	0.10	0.12	0.10	0.18	0.11
Nickel	0.67	0.54	0.67	1.01	1.22	2.44
Selenium	0.20	0.20	0.23	0.20	0.20	0.20
Silver	0.10	0.10	0.10	0.12	0.11	0.10
Zinc	23.6	18.5	27.3	26.4	26.3	21.7

M. nasuta 1999

Parameter	STATION					
	True Control	Reference Control	FH-1	FH-2	FH-3	Archive
Metals (mg/kg)						
Arsenic	1.33	1.76	2.03	1.83	1.56	0.92
Barium	0.42	3.22	2.26	2.38	4.25	0.31
Cadmium	0.10	0.10	0.10	0.11	0.10	0.10
Chromium	0.41	0.37	0.39	0.27	0.23	0.25
Copper	2.91	2.42	2.48	1.89	2.25	2.37
Lead	0.11	0.13	0.10	0.16	0.15	0.10
Nickel	0.97	0.76	0.70	0.53	0.53	0.36
Selenium	0.20	0.20	0.20	0.21	0.20	0.20
Silver	0.10	0.11	0.11	0.10	0.12	0.10
Zinc	13.4	14.2	14.3	14.4	13.3	13.2

TABLE 3.9-9 (Cont'd)

N. virens 2004

Parameter	STATION				
	True Control	Reference Control	FH-EC-01 60+00	FH-EC-02 -45+00	FH-EC-03 -150+00
Metals (mg/kg)					
Arsenic	3.41	2.39	2.39	2.38	2.50
Chromium	0.13	0.08	0.10	0.10	0.10
Copper	1.28	1.23	1.36	1.25	1.30
Lead	0.11	0.11	0.12	0.11	0.13
Nickel	0.32	0.28	0.27	0.24	0.26
Selenium	0.26	0.25	0.25	0.23	0.24
Zinc	12.8	9.13	10.4	13.0	8.90
Bis (2-ethylhexyl) phthalate	67.5	73.0	76.6	85.1	100

M. mercenaria 2004

Parameter	STATION				
	True Control	Reference Control	FH-EC-01 60+00	FH-EC-02 -45+00	FH-EC-03 -150+00
Metals (mg/kg)					
Arsenic	1.99	1.98	1.51	2.03	1.89
Chromium	0.12	0.09	0.09	0.05	0.08
Copper	1.09	0.98	1.00	1.14	1.20
Lead	0.39	0.41	0.32	0.37	0.42
Nickel	0.18	0.20	0.15	0.18	0.15
Selenium	9.19	9.05	8.51	9.27	8.79
Zinc	61.6	65.7	58.7	76.1	74.0
Bis (2-ethylhexyl) phthalate	67.5	73.0	76.6	85.1	100

TABLE 3.9-9 (Concluded)

M. nasuta 2003

Parameter	STATION				
	Control A	Control B	Control C	Reference	Archive
Metals (mg/kg)					
Arsenic	1.83	2.15	2.20	1.77	1.73
Cadmium	0.02	0.03	0.03	0.02	0.03
Chromium	0.17	0.43	0.41	0.20	0.08
Copper	0.90	1.25	1.22	0.95	1.65
Lead	0.11	0.13	0.16	0.18	0.12
Nickel	0.32	0.49	0.64	0.39	0.32
Selenium	0.15	0.12	0.17	nd	0.17
Silver	0.02	0.02	0.03	0.02	0.03
Zinc	6.07	6.95	9.02	6.73	9.60
Low Molecular Wt PAH	0.94	1.34	1.34	0.62	2.84
High Molecular Wt PAH	1.49	1.50	2.41	1.00	6.59
Total PAH	2.43	2.84	3.75	1.62	9.43
Total DDT	0.08	0.12	0.22	0.06	0.09

Parameter	STATION				
	Q1 NW Quadrant	Q2 NE Quadrant	Q3 SE Quadrant	Q4 SW Quadrant	Down Current
Metals (mg/kg)					
Arsenic	1.94	1.87	2.19	2.03	2.13
Cadmium	0.02	0.02	0.02	0.02	0.04
Chromium	0.18	0.25	0.30	0.24	0.23
Copper	1.19	1.22	1.09	1.14	1.24
Lead	0.20	0.20	0.28	0.19	0.22
Nickel	0.30	0.36	0.46	0.38	0.40
Selenium	0.17	0.24	0.14	0.17	0.14
Silver	0.03	0.02	0.03	0.02	0.03
Zinc	6.90	7.10	8.62	7.33	8.41
Low Molecular Wt PAH	2.27	0.99	0.87	0.70	0.72
High Molecular Wt PAH	2.35	1.53	1.57	1.52	1.64
Total PAH	4.62	2.52	2.44	2.22	2.36
Total DDT	0.10	0.11	0.09	0.10	0.11

foreign trade, with roughly 90% of that being imports and 10% being exports. The bulk of the imports are crude petroleum destined for the Phillips Sweeny refinery as well as to refineries in Oklahoma and Nebraska (USACE, 2002). The exports are primarily chemical exports from Dow and BASF. The remaining 20% of the tonnage is domestic. The bulk of this is from barge traffic in the GIWW but some consists of coastwise movements of chemical tankers.

TABLE 3.10-1

DEEP DRAFT TRAFFIC AT PORT FREEPORT, 2003

	Tanker		Pass and Dry Cargo	
Draft (ft)	In	Out	In	Out
42	53		1	
41	16	1	5	
40	14	5	12	
39	38	4	1	
38	50	3		
37	26	12	1	
36	35	8	1	2
35	26	7	2	1
34	16	18	1	1
33	16	15		1
32	35	18		
31	34	25		4
30	32	41	2	15
29	28	32	5	51
28	30	270	65	21
27	25	33	39	29
26	17	40	19	29
25	20	16	8	13
24	28	22	3	4
23	14	16	3	6
22	15	11	3	1
21	5	9	1	
20	19	8	4	2
19	11	2	3	5
18	25	4	75	23
Totals	628	620	254	208
Avg Draft	31.69	28.4	24.57	24.8
Median Draft	31.5	27.7	26.1	26.8

While the majority of the tonnage is crude oil, bulk fuels, and chemicals, there are other commodities moved through the Port. The Port of Freeport has facilities belonging to American Rice Inc. (ARI), Chiquita, and Dole (U.S. Federal Energy Regulatory Commission [FERC], 2004). These are used for rice exports and receipt of bananas, and other commodities.

In terms of vessel movements summarized in Table 3.10-1, the great majority of self propelled cargo vessels are tankers (73%) and the remainder are dry cargo. In terms of numbers, tow traffic is considerably larger with approximately 1,400 towboat movements and 2,300 barges in or out. The great

majority of the tow traffic is domestic; it is this that accounts for almost all of the domestic tonnage shown in Table 3.10-2. In addition to the tow traffic that calls on Port Freeport, there is a substantial amount of traffic on the GIWW passing through the Port. Based on the statistics gathered at the Brazos River locks (USACE, 2006), there are over 5,000 tows each direction passing through Port Freeport on the GIWW each year. That averages about 27 tow movements per day through the Port of Freeport.

TABLE 3.10-2

WATERBORNE COMMERCE FOR PORT FREEPORT, 1999–2003

	Total	Domestic	Foreign	Imports	Exports
2003	30,536,657	5,435,996	25,100,661	22,665,591	2,435,070
2002	27,163,872	5,079,632	22,084,240	19,778,106	2,306,134
2001	30,142,822	5,248,758	24,894,064	22,645,478	2,248,586
2000	28,966,389	5,598,981	23,367,408	20,628,455	2,738,953
1999	28,076,004	5,558,866	22,517,138	20,629,944	1,887,194
Average	28,977,149	5,384,447	23,592,702	21,269,515	2,323,187

	Percent of Total		Percent of Foreign	
	19%	81%	90%	10%

Much of the import tonnage is crude oil, with vessels entering loaded and departing with a lower draft. The average and median drafts of the tanker fleet is about 3 ft more for the inbound tankers as the outbound. In contrast, there is little difference in the average or median drafts of the dry cargo vessels.

The USACE Waterborne Commerce system does not record recreational vessel movements in Port Freeport. The number is undoubtedly substantial. The nearby Brazos River Locks tabulates this traffic. In 2001, there were 2,617 recreational vessel trips and 1,245 other noncommercial trips through the East Lock and similar numbers through the West Lock. The EIS for the LNG project (FERC, 2004) compiled data from 2002 provided by TxDOT at the Quintana Island swing bridge (since replaced by a fixed bridge). They reported 700 pleasure boats, 200 shrimp boats, and 200 work boats passing through the area in addition to the tow traffic.

3.10.1 Operating Restrictions

As summarized by the USACE (2002) and FERC (2004) the Port of Freeport imposes the following restrictions on larger vessels:

- Draft: 42 ft to maintain a 3 ft underkeel clearance
- Length: 825 ft LOA, imposed because of crab angle restrictions in the 400-ft-wide channel. This restriction is relaxed in suitable weather—see discussion below.
- Beam: 145 ft. This restriction is relaxed in suitable weather—see discussion below.

- One-way Traffic, imposed due to channel width restrictions
- Daylight Only transits for vessels > 685 ft LOA

These restrictions impose delays on traffic. The length and beam restrictions are relaxed when the wind is less than 20 knots and current across the jetty mouth is negligible (< 0.5 knots). FERC (2004) reports that this condition is not met 25–30% of the time. When those conditions are not met, larger vessels would either have to wait or divert to another port (USACE, 2002).

FERC (2004) reports that the daylight transit and one-way traffic restrictions apply to all vessels over 750 ft long. FERC (2004) also reports that the pilots are currently imposing a moving safety zone around large crude carriers of 2 miles ahead and astern. Port Freeport and pilots have estimated that the worst delays would be 30 to 60 minutes and these would be mitigated by widening of the channel (FERC, 2004). Additionally, an analysis of widening benefits was performed as part of a jetty stability analysis, which is provided in Appendix D.

3.11 VEGETATION

The proposed project is located within Upper Coast division (Hatch et al., 1999) of the Gulf Coast Prairies and Marshes Vegetational Region (Gould, 1975). This Vegetational Region is a nearly level plain less than 250 ft in elevation, covering approximately 10 million acres (Hatch et al., 1990). The Gulf Prairies include the coastal plain that extends approximately 30–80 miles inland. The Gulf Marshes are located in a narrow strip of lowlands that are adjacent to the coast and barrier islands (Hatch et al., 1999).

The project area is limited to the immediate area of the Freeport Harbor Ship Channel and Jetties. The communities of Surfside (to the northeast) and Quintana Beach (to the southwest) are adjacent to the channel. There is very little undeveloped area in the immediate vicinity other than the beach and dunes system. Because of this and because the proposed widening of the ship channel is limited to the existing open water area in the channel vicinity, no wetlands or other plant communities are located in the footprint of the proposed project. According to National Wetland Inventory (NWI) mapping (FWS, 1992a), there is no aquatic vegetation in the open waters of the ship channel and none was observed (other than algae) during field visits for this report. However, there are natural areas (vegetation communities) outside of the footprint of the proposed project that could potentially be impacted by changes in the channel and/or jetties. This includes the beaches and dunes of the Gulf shoreline and interior wetlands that are hydrologically connected to the ship channel via natural and man-made (e.g., GIWW) channels. Another possible impact is from the placement of dredged material. Therefore, baseline data are provided for the Freeport area as shown on Figure 3.11-1.

The vegetation communities, with particular attention to the wetlands have been mapped and described in several studies (McGowen et al., 1976; TPWD, 1999; FWS [NWI], 1992a; White et al., 1988, 2004, 2005; H-GAC, 2002; Bezanson, 2001). However, the Ship Channel is commonly the eastern or western boundary of these studies which focus either on the Galveston Bay System to the northeast or the

Matagorda Bay System to the southwest. So acreage values and trends for plant community types in the Freeport area tend to be swamped by the values and trends in the other estuaries. White et al. (2004 and 2005) do break down the larger areas by subarea including the delta of the diverted channel of the Brazos River and Follet's Island. Some of their findings are presented in this report. In order to provide local data on the vegetation for this report, the general area (approximately 250,000 acres) of the Freeport Ship Channel was defined as the study area (see Figure 3.11-1), and the wetland communities and upland categories were mapped and acreage values calculated.

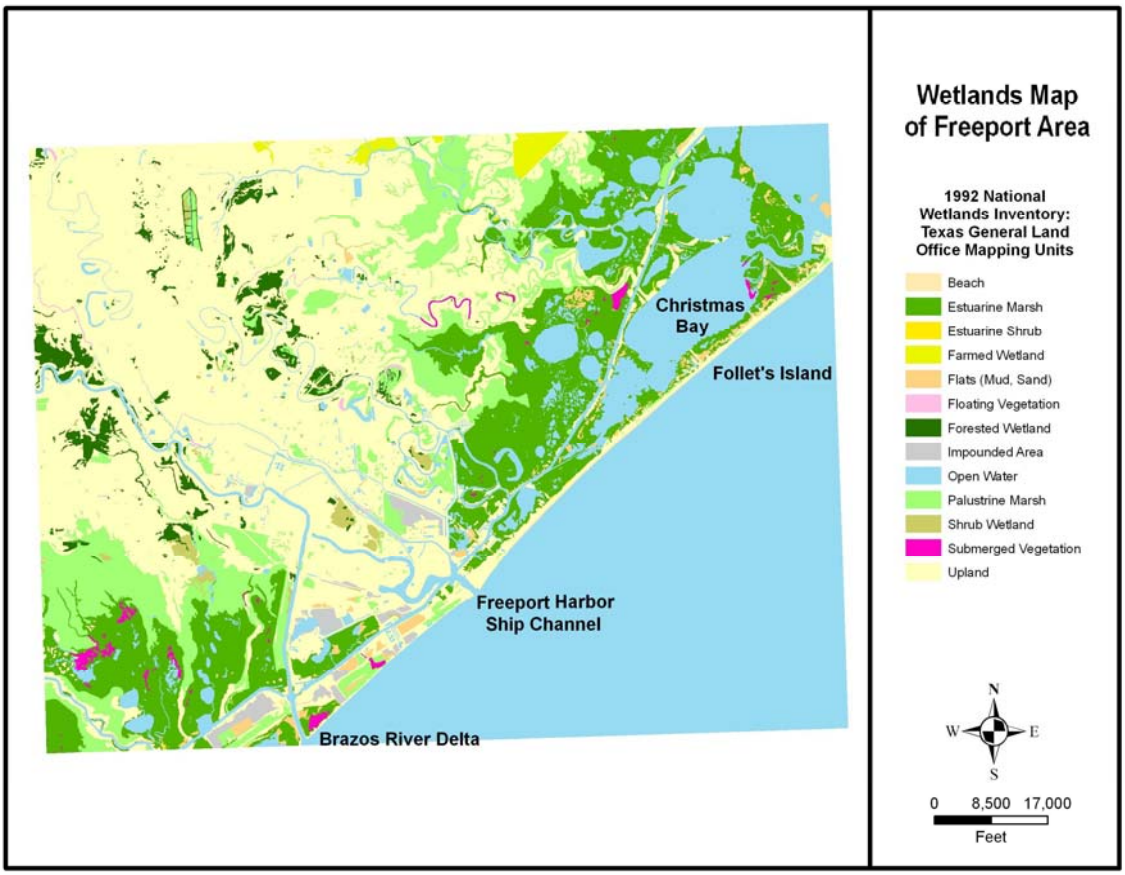

Figure 3.11-1. Freeport Study Area - Wetlands/Uplands (FWS, 1992a)

As can be seen on Figure 3.11-1, the mouth of the Freeport Harbor Ship Channel is in a fairly upland area of the Texas coast line. The wetlands are more extensive to the southwest (Brazos River Delta and the San Bernard National Wildlife Refuge [NWR]) and to the northeast behind the area known as Follet's Island, which includes Christmas Bay and parts of the Brazoria NWR. Figure 3.11-1 uses the Texas GLO mapping categories (e.g., estuarine marsh), which are clumped NWI mapping units (based on the Cowardin et al. [1979] classification system). The acreage values listed later in this report for each of the community types are based on the NWI categories, and are basically the same as the GLO categories, except that the flats and aquatic vegetation are differentiated into estuarine and freshwater.

Uplands in the City of Freeport area include developed areas as well as dunes and relic beach ridges that support grassland vegetation. The interior uplands include grasslands and pastures and woodlands, including bottomland hardwood forests.

An important ecosystem that occurs in this area is the Columbia Bottomlands, which is located in the floodplains of the Brazos, San Bernard and Colorado Rivers (Figure 3.11-2). The ecological importance of this area is described in the Strategic Conservation Plan for the Columbia Bottomlands (The Nature Conservancy [TNC], 2004), which was produced by the FWS, National Fish and Wildlife Foundation, Trust for Public Land, TPWD, Gulf Coast Bird Observatory, and TNC. The plant communities in the Columbia Bottomlands area include marshes, forested wetlands, small scattered prairies, and bottomland hardwood forests (TNC, 2004). According to the conservation plan (TNC, 2004), the majority of the forests and woodlands are one of three communities including Live Oak (*Quercus virginiana*) Forest, Coastal Live Oak – Pecan (*Q. virginiana – Carya illinoinensis*), and Columbia Bottomlands Ash (*Fraxinus pennsylvanica*) Flats. The Live Oak Forest species include Texas yaupon (*Ilex vomitoria*), dwarf palmetto (*Sabal minor*), Cherokee sedge (*Carex cherokeensis*), and Drummond's wax-mallow (*Malvaviscus arboreus* var. *drummondii*). Columbia Bottomlands Ash Flats species include water hickory (*Carya aquatica*), eastern swamp privet (*Forestiera acuminata*), and swamp panic grass (*Panicum gymnocarpon*). White et al. (1988) described some of this area as "abundant fluvial woodlands that that have been cleared along straight lines to produce rangeland and cropland."

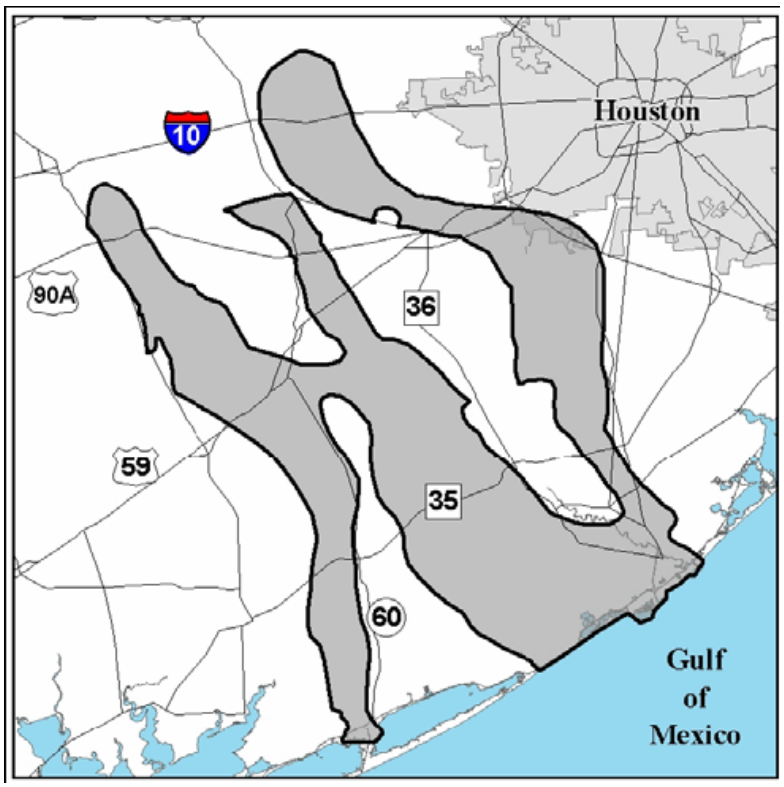

Figure 3.11-2. Columbia Bottomlands Conservation Area *(from TNC, 2004)*

Diamond and Smeins (1987) describe additional forest and woodlands that occur in the Upper Coastal Prairie including Coastal Live Oak/Post Oak (*Quercus stellata*) Forest, Water oak (*Quercus nigra*)/ Coastal Live Oaks Forest, and Mesquite-Huisache (*Prosopis glandulosa-Acacia farnesiana*) Shrublands.

The upland grasslands within the study area include:

- pasture lands, dominated by introduced species including bermudagrass (*Cynodon dactylon*) and bahaigrass (*Paspalum notatum*);

- remnants of the original coastal prairie, with common species including little bluestem (*Schizachyrium scoparium*), brownseed paspalum (*Paspalum plicatulum*), indiangrass (*Sorghastrum nutans*), rosettegrass (*Panicum oligosanthes*), and thin paspalum (*Paspalum setaceum*); and

- beach and dune communities. Typical plant species of the primary dunes include sea oats (*Uniola paniculata*), bitter panicum (*Panicum amarum*), Gulf croton (*Croton punctatus*), beach morning glory (*Ipomea pes-caprae*), and fiddleleaf morning glory (*Ipomea stolonifera*). Secondary dune species include marshhay cordgrass (*Spartina patens*), seashore dropseed (*Sporobolus virginicus*), seacoast bluestem (*Schizachyrium littorale*), seashore saltgrass, pennywort (*Hydrocotyle bonariensis*), and partridge pea (*Chamaecrista fasciculata*). The secondary dune community, which is located in the hummocky area leeward of the higher and drier primary dunes, is often a wetland community or considered a transitional community between upland and wetland.

Beaches along the south Texas coastline are dynamic habitats subject to a variety of environmental influences such as wind and wave action, salt spray, high temperature, and moisture stress. White et al. (2005) reports that erosion rates locally exceed 39 ft/year. The harsh conditions associated with the beach/ dune system support a relatively small number of adapted animals and plants. Sand dunes help absorb the impacts of storm surges and high waves and also serve to slow the intrusion of water inland. In addition, dunes store sand that helps deter shoreline erosion and replenish eroded beaches after storms. The dune complexes are of two types, primary and secondary, each of which supports a unique plant community. The primary dunes are taller and offer more protection from wind and hurricane storm surge. The coastal shore areas serve as buffers protecting upland habitats from erosion and storm damage, and adjacent marshes and waterways from water-quality problems.

3.12 WETLANDS

Unlike most of the major river systems in Texas, there is no bay associated with the Freeport area (McGowen et al. [1976] present a detailed on the history of the geological development of the area which caused this condition). Also, there is no active delta or direct inflow from the river into the Port of Freeport Ship Channel area because the river was diverted approximately 7 miles to the southwest in 1929. These two factors, in addition to construction associated with the GIWW, the ship channel, and the

towns of Surfside and Quintana, explain why there are no wetlands in the immediate area of the historic mouth of the Brazos River.

Coastal wetlands (saline to freshwater) are distinct areas between terrestrial and aquatic systems where the water table is at or near the surface or the land is covered by shallow water with emergent vegetation. They are important natural resources that provide essential habitat for fish, shellfish, and other wildlife. Coastal wetlands also serve to filter and process agricultural and urban runoff and buffer coastal areas against storm and wave damage.

The condition and distribution of wetland types can be affected by changes in depth and frequency of inundation as well as salinity. White et al. (2005) reports that relative sea-level rise in the Freeport area exceeded 0.43 inch/year from 1959 through 1971. They stress that these are short-term rates which can be affected by variations caused by climatic factors (e.g., droughts and high rainfall periods). The overall relative sea level is also affected by subsidence, which may be as high as 5 ft in the Freeport area according to their report.

Descriptions of the wetland plant communities (including aquatic vegetation) that occur in the study area appear in the following paragraphs.

3.12.1 Estuarine Submerged Aquatic Vegetation

Seagrasses, which are submerged aquatic vegetation (SAV), are considered to be critical coastal nursery habitat for estuarine fisheries and wildlife. They also serve as a food source for fish, waterfowl, and turtles. They contribute organic matter to the nutrient cycle and stabilize coastal sedimentation and erosion processes (TPWD, 1999).

The 1992 FWS NWI data map saline-brackish (estuarine) and freshwater (palustrine and lacustrine) aquatic vegetation in the study area. There is no aquatic vegetation mapped (FWS, 1992b) within 1 mile of the proposed project. There are 630 acres of estuarine SAV within the study area. The estuarine SAV species probably include true seagrasses, primarily shoalgrass (*Halodule wrightii*), and widgeongrass (*Ruppia maritima*). The 1992 FWS NWI map of SAV does not show a significant amount of estuarine SAV (approximately 70 acres) in Christmas Bay (on western edge of the Galveston Bay estuary). White et al. (2004) report approximately 170 acres of SAV in the Follet's Island area (including Christmas Bay) in 2001. Both the 1992 (FWS) and 2001 (White et al., 2004) maps show estuarine SAV in the inter-ridge swales of the Brazos River delta. These deltaic SAV and estuarine marshes are separated by a leveed DMPA from lacustrine (freshwater) SAV and marsh to the northeast.

3.12.2 Estuarine Marshes – Salt/Brackish

The low estuarine marshes (i.e., frequently inundated) are generally at lower elevations than the high marshes. The dominant species in the low salt marshes are smooth cordgrass (*Spartina alterniflora*) and secondarily, seashore saltgrass (*Distichlis spicata*). These are often interspersed with low brackish

marshes, dominated by saltmarsh bulrush (*Bolboschoenus robustus*) and glasswort (*Salicornia virginicus*). Commonly, the low salt marsh is adjacent to open water areas with the low brackish marsh adjacent to the low salt marsh. At slightly higher elevations (and less frequently inundated) are the high salt/brackish marshes. Common species in the high marshes include sea ox-eye daisy (*Borrichia frutescens*), saltwort (*Batis maritima*), and shoregrass (*Monanthochloe littoralis*).

White et al. (1988) described some of these communities in the active Brazos River delta, where they occur in the swales between upland ridges (relic beach ridges). Smooth cordgrass is abundant in the proximal saltwater marshes and intergrades with saltgrass at higher elevations. There are brackish marshes in the delta which support cattails (*Typha* sp.), saltmarsh bulrush, American bulrush (*Schoenoplectus pungens* var. *longispicatus*), jointed flatsedge (*Cyperus articulatus*), black rush (*Juncus roemerianus*), and saltgrass. They also report extensive stands of black rush and cattails in the swales near Quintana. White et al. (2004) found that the most significant trend in the Brazos Delta and surrounding area was the 30% overall loss of estuarine marsh from the 1950s to 2002. Some of this loss was due to the erosion of marshes that had developed at the mouth of the diverted Brazos River. Some of that was offset by delta progradation (and marsh creation) on the southwestern side (down drift) of the mouth of the river. There was also marsh loss along the GIWW due to the placement of dredged material, which converted marshes to uplands. They estimate that 50% of the marsh loss in the Brazos delta area was the result of conversion to upland habitat.

There are approximately 31,400 acres of estuarine wetlands (not including flats) in the study area. Most of this (approximately 70%) is mapped as high marsh.

3.12.3 Estuarine Shrub-Scrub Wetlands – Salt/Brackish

The estuarine intertidal scrub-shrub category describes coastal wetlands dominated by woody vegetation and periodically flooded by tidal waters. Examples of estuarine intertidal scrub-shrub species in the study area include big leaf sumpweed (*Iva frutescens*), the exotic invasive tamarisk (*Tamarix* spp.), and bushy sea-ox-eye (*Borrichia frutescens*). There are approximately 38 acres of estuarine shrubland in the study area.

3.12.4 Estuarine Tidal Flats

This community type includes coastal wetlands periodically flooded by tidal waters and with less than 30% areal coverage by vegetation. This category includes sandbars, mud flats, and other nonvegetated or sparsely vegetated habitats called salt flats. Sparse vegetation of salt flats may include glasswort, saltwort, and shoregrass. These tidal flats serve as valuable feeding grounds for coastal shorebirds, including the threatened piping plover; fish; and invertebrates. There are approximately 1,530 acres of this category within the study area.

3.12.5 Freshwater Aquatic Vegetation – Submerged and Floating

The NWI map which maps farther inland than the White et al. Status and Trends studies (2004, 2005) shows approximately 250 acres of freshwater floating vegetation within the study area, generally located in ditches and abandoned channels. Species may include the invasive exotic species, water hyacinth (*Eichornia crassipes*), water lettuce (*Pistia stratiotes*) or frogbit (*Linobium spongia*). There are also approximately 280 acres of fresh SAV. Species may include widgeongrass, as well as other strictly fresh-intermediate species like Sago pondweed (*Potamogeton pectinatus*), cabomba (*Cabomba caroliniana*), and mermaid weed (*Proserpinica palustris*).

3.12.6 Freshwater Marshes

The estuarine system extends landward to the point where ocean-derived salts are less than 0.5 ppt (during average annual low flow) (Cowardin et al., 1979). Freshwater marshes include those categories mapped by NWI as palustrine, riverine and lacustrine. Common species include spikerush (*Eleocharis* sp.), flat-sedge (*Cyperus* spp.), rushes (*Juncus* spp.), smartweed (*Polygonum* sp.), coastal water-hyssop (*Bacopa monnieri*), seashore paspalum (*Paspalum vaginatum*), California bulrush (*Schoenoplectus californicus*), coastal cattails (*Typha domingensis*), jointed flatsedge, and American bulrush (*Schoenoplectus pungens*).

Most of the freshwater marshes are located at more inland locations, but some occur in swales near the Gulf shoreline, as noted in the previous section on estuarine marshes. There are approximately 24,000 acres of freshwater marsh (including wet meadows which are at the drier end of the spectrum) in the study area. This number does not include the agricultural wetlands (rice farms) that cover approximately 1,150 acres.

3.12.7 Freshwater Shrub-Scrub Wetlands

Freshwater shrub-scrub wetlands in the coastal zone may include the woody species such as buttonbush (*Cephalanthus occidentalis*), baccharis shrub (*Baccharis* sp.), big leaf sumpweed, and tamarisk. There are approximately 1,218 acres of freshwater shrub-scrub wetland in the study area.

3.12.8 Freshwater Forested Wetlands

The forested wetlands are located more inland, upstream along the river, creeks, and sloughs of the Columbia Bottomland, as described earlier. These wetlands are primarily associated with active and abandoned channels. This pattern can be seen in Figure 3.11-1. There are approximately 4,697 acres of forested wetlands in the study area. The plant communities include the Columbia Bottomlands Ash Flats (dominated by green ash and include water hickory, eastern swamp privet, and swamp panic grass) and Water Oak Flats. Bald cypress (*Taxodium distichum*) also occurs along some of the waterways.

3.12.9 Freshwater Flats

Freshwater flats are unvegetated to sparsely vegetated areas with sand or mud substrate. Common species are the same as freshwater marshes. There are approximately 244 acres of freshwater flats in the study area.

3.13 TERRESTRIAL WILDLIFE

The study area is within the Texan Biotic Province, as described by Blair (1950). The climate of the region is moist subhumid, with some excess rainfall. The vertebrate fauna of the province includes considerable elements of Austroriparian as well as grassland species. Wildlife habitats within the study area include beach, shell ramp-barrier flats, dredged material, salt-water marsh, brackish- to fresh-water marsh, fresh- to brackish-water bodies (i.e., ponds and lakes), grassland, and fluvial woodland (McGowen et al., 1976).

The Texan Biotic Province supports a diverse fauna composed of a mixture of species common to neighboring provinces. Austroriparian species from the east are generally restricted to forests, bogs, and marshes. Grassland species, entering the area from the west, are generally restricted to the prairies (Blair, 1950). No vertebrate species are endemic to the Texan Biotic Province (Blair, 1950).

At least 49 mammal species occur or have occurred in the Texan Biotic Province (Blair, 1950). Although terrestrial habitat is of limited extent in the study area, common terrestrial mammals of potential occurrence include Virginia opossum (*Didelphis virginiana*), swamp rabbit (*Sylvilagus aquaticus*), black-tailed jackrabbit (*Lepus californicus*), marsh rice rat (*Oryzomys palustris*), fulvous harvest mouse (*Reithrodontomys fulvescens*), hispid cotton rat (*Sigmodon hispidus*), nutria (*Myocastor coypus*), coyote (*Canis latrans*), northern raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*) (Schmidly, 2004). Marine mammals of potential occurrence in the study area include the bottlenose dolphin (*Tursiops truncatus*).

At least 16 species of lizards and 39 species of snakes occur or have occurred in the Texan Biotic Province (Blair, 1950). In addition, at least five urodeles (newts and salamanders) and 18 anurans (frogs and toads) have occurred in the Texan Biotic Province (Blair, 1950). Terrestrial amphibian and reptile species of potential occurrence in the study area include Blanchard's cricket frog (*Acris crepitans blanchardi*), Gulf Coast toad (*Bufo nebulifer*), green treefrog (*Hyla cinerea*), squirrel treefrog (*Hyla squirella*), American bullfrog (*Rana catesbeiana*), green anole (*Anolis carolinensis*), eastern six-lined racerunner (*Aspidoscelis sexlineata sexlineata*), Mediterranean house gecko (*Hemidactylus turcicus*), western cottonmouth (*Agkistrodon piscivorus leucostoma*), western diamond-backed rattlesnake (*Crotalus atrox*), several species of watersnake (*Nerodia* spp.), Gulf saltmarsh snake (*Nerodia clarkii clarkii*), and Gulf Coast ribbonsnake (*Thamnophis proximus orarius*) (Dixon, 2000). Aquatic reptile species of potential occurrence in the study area include American alligator (*Alligator mississippiensis*) and Texas diamond-backed terrapin (*Malaclemys terrapin littoralis*) (Dixon, 2000).

The study area supports an abundant and diverse avifauna. Tidal flats, bay margins, and beaches provide excellent habitat for numerous species of herons and egrets, shorebirds, wading birds, gulls, and terns. According to the FWS Texas Colonial Waterbird Census (TCWC) (FWS, 2005), several rookeries occur within the study area (Figure 3.13-1). Table 3.13-1 provides information on nesting activities at these rookeries. Common species of potential occurrence in the study area include great blue heron (*Ardea herodias*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), white ibis (*Eudocimus albus*), roseate spoonbill (*Platalea ajaja*), clapper rail (*Rallus longirostris*), common moorhen (*Gallinula chloropus*), killdeer (*Charadrius vociferus*), black-necked stilt (*Himantopus mexicanus*), yellowlegs (*Tringa* spp.), willet (*Catoptrophorus semipalmatus*), long-billed curlew (*Numenius americanus*), sanderling (*Calidris alba*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), dowitchers (*Limnodromus* spp.), Wilson's snipe (*Gallinago delicata*), laughing gull (*Larus atricilla*), ring-billed gull (*Larus delawarensis*), herring gull (*Larus argentatus*), Forster's tern (*Sterna forsteri*), and least tern (*Sterna antillarum*) (FWS, n.d.; Richardson et al., 1998). In addition, prairies and marshes provide habitat for numerous waterfowl, several species of raptors, and a variety of songbirds. Texas is one of the most significant waterfowl wintering regions in North America with three to five million waterfowl annually wintering in the State (Texas Coastal Management Program [TCMP], 1996). In addition, the mainland and barrier islands of the Texas Gulf coast provide critical stopover habitat for numerous species of neotropical songbirds during migration.

3.14 AQUATIC ECOLOGY

3.14.1 Aquatic Communities

The study area includes a small portion of the old Brazos River Channel and the Gulf nearshore waters at the Freeport Harbor Channel. Within the study area, environmental fluctuations are extreme and the inhabitant biota reflect and are adapted to this lack of stability in the environment (Warshaw, 1975). Large changes in habitat can occur on a daily basis with respect to wind, tidal action, salinity regimes, and freshwater inflow. These ongoing natural processes are coupled with other natural events such as freezes, droughts, hurricanes, and anthropogenic pressures (i.e., management practices and coastal projects) in the study area. Nevertheless, the biological community present in the study area remains diverse and abundant. The Gulf nearshore community includes many species found in both estuarine and offshore oceanic habitats (Tunnell et al., 1996). Most of the species in the Gulf nearshore waters are temperate in biogeographic distribution with a few tropical species (Tunnell et al., 1996).

Many aquatic communities are present in the study area that serve to support the ecological diversity and abundance. These include commercial and recreational species, oyster reef habitat, offshore sands, and artificial reefs. Commercial and recreational species are discussed in detail below. Other fish species found mainly in shallow areas include Gulf killifish (*Fundulus grandis*), sheepshead minnow (*Cyprinodon variegates*), and silversides (*Menidia* sp.) (Pattillo et al., 1997). Inhabitants of marsh areas include the pinfish (*Lagodon rhomboids*), silver perch (*Bairdiella chrysoura*), and gizzard shad (*Dorosoma cepedianum*) (Pattillo et al., 1997). Species often found in deeper areas include the Atlantic

Rookery

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6,250 0 6,250
Feet

PBSJ
6504 Bridge Point Pkwy, Ste. 200
Austin, Texas 78730
Phone: (512) 329-8342 Fax: (512) 327-2453

Figure 3.13-1

Project Area Rookeries

Prepared for: Erik Huebner	
Job No.: 441591.00	Scale: 1:75,000
Prepared by: RF Cooper	Date: July 18, 2006
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TABLE 3.13-1

NUMBER OF NESTS OF COLONIAL WATERBIRDS
AT SELECTED ROOKERIES IN THE STUDY AREA

Rookery/ID	Common Name	Scientific Name	2000	2001	2002	2003	2004	2005
Freeport Dow/ 610-100	Black skimmer	*Rynchops niger*	500	725	1,600		380	320
	Gull-billed tern	*Sterna nilotica*	60	72	60		25	
	Least tern	*Sterna antillarum*	17	50	40		30	40
Bryan Beach SP/ 610-101	Black skimmer	*Rynchops niger*						
	Least tern	*Sterna antillarum*						
Bryan Beach Spoil/610-102	Tricolored heron	*Egretta tricolor*						
	Little blue heron	*Egretta caerulea*						
	Least tern	*Sterna antillarum*						
	Great egret	*Ardea alba*						
	Great blue heron	*Ardea herodias*						
	Cattle egret	*Bubulcus ibis*						
	Black skimmer	*Rynchops niger*						
Bryan Mound/ 610-103	Roseate spoonbill	*Ajaia ajaja*	30	8				
	Neotropic cormorant	*Phalacrocorax brasilianus*	60	20				
	Least tern	*Sterna antillarum*	15	5				
	Gull-billed tern	*Sterna nilotica*						
	Great egret	*Ardea alba*	5	4				
	Great blue heron	*Ardea herodias*	4	3				
	Cattle egret	*Bubulcus ibis*	200					
	White ibis	*Eudocimus albus*						
	White-faced ibis	*Plegadis chihi*						
	Tricolored heron	*Egretta tricolor*						
	Snowy egret	*Egretta thula*		1				
	Black-crowned night-heron	*Nycticorax nycticorax*	2					
Dow Gate A-40/ 610-104	Least tern	*Sterna antillarum*	2	6				
Dow Tern/610-105	Least tern	*Sterna antillarum*						
Bryan Beach Diked Spoil/610-106	N/A							

Source: TCWC Database (FWS, 2006b)

croaker (*Micropogonias undulatus*), Gulf menhaden (*Brevoortia patronus*), and hardhead catfish (*Arius felis*), while a number of fish occur in abundance in both marsh and deeper areas, including bay anchovy (*Anchoa mitchilli*), spot (*Leiostomus xanthurus*), and striped mullet (*Mugil cephalus*) (Pattillo et al., 1997). These species are ubiquitous along the Texas coast and are unaffected by changes in salinity. Seasonal differences occur in abundance with the fall usually being the smallest in biomass and number. Newly spawned fish and shellfish begin migrating into the estuary in winter and early spring with the maximum biomass observed during the summer months (Parker, 1965). A list of fish species found in the study area is presented in Table 3.14-1.

The entire food chain is dependent on the microscopic plankton which utilize nutrients and provide an abundant food source. The plankton community consists of small plants (phytoplankton) and animals (zooplankton) that are suspended in the water column. Diverse and abundant plankton communities exist throughout the study area. The dominant phytoplankton assemblages include diatoms, green algae, and blue-green algae, while the dominant zooplankton include the barnacle nauplii, the copepod *Acartia tonsa*, and the dinoflagellate *Noctiluca scintillans* (Armstrong et al., 1987).

The open-water/open-bay bottom includes all areas of the study area not covered with oyster reefs (Lester and Gonzales, 2001). Benthic organisms are divided into two groups: epifauna, such as crabs and smaller crustaceans, which live on the surface of the bottom substrate, and infauna, such as mollusks and polychaetes, which burrow into the bottom substrate (Green et al., 1992). Mollusks and some other infaunal organisms are filter feeders which strain suspended particles from the water column. Others, such as polychaetes, feed by ingesting sediments and extracting nutrients. Many of the epifauna and infauna feed on plankton, and are then fed upon by numerous fish and birds (Armstrong et al., 1987; Lester and Gonzales, 2001). The open-water/open-bay bottom includes flat areas consisting of mud and sand that contribute large quantities of nutrients and food, making them one of the most important components of this habitat type. The distribution of the benthic macroinvertebrates is primarily influenced by bathymetry and sediment type (Calnan et al., 1988). Benthic macroinvertebrates found in the sediments of the Bay City-Freeport area are primarily polychaetes, bivalves, gastropods, and crustaceans (Calnan et al., 1988). The dominant bivalves include the dwarf surf clam (*Mulinia lateralis*) and the concentric nut clam (*Nuculana concentrica*); the dominant gastropods are the Eastern white slipper shell (*Crepidula plana*) and the vitrinella (*Vitrinella floridana*); the dominant polychaetes are *Mediomastus californiensis* and *Paraprionospio pinnata*; and the dominant crustaceans are *Ampelisca abdita* and *Ampelisca agassizi*.

3.14.1.1 Recreational and Commercial Species

Over the years many commercially important fish have been subject to overfishing and subsequent decline in the Gulf of Mexico. In recent years, however, certain fish stocks in the Gulf of Mexico are no longer overfished and are beginning to show signs of rebuilding (NOAA, 2004). TPWD does not collect commercial or recreational fishery statistics for the Brazos River estuary. The most important commercially harvestable species that utilize the Brazos River estuary include brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), pink shrimp (*Farfantepenaeus*

TABLE 3.14-1
FISH SPECIES FOUND WITHIN THE STUDY AREA

Common Name	Scientific Name	Relative Abundance
Bay squid	*Lolliguncula brevis*	common
Brown shrimp	*Farfantepenaeus aztecus*	abundant
Pink shrimp	*Penaeus duorarum*	common
White shrimp	*Litopenaeus setiferus*	abundant
Grass shrimp	*Palaemonetes pugio*	highly abundant
Blue crab	*Callinectes sapidus*	common
Gulf menhaden	*Brevoortia patronus*	abundant
Gizzard shad	*Dorosoma cepedianum*	common
Bay anchovy	*Anchoa mitchilli*	highly abundant
Hardhead catfish	*Arius felis*	common
Sheepshead minnow	*Cyprinodon variegatus*	abundant
Gulf killifish	*Fundulus grandis*	abundant
Silversides	*Menidia* sp.	abundant
Bluefish	*Pomatomus saltatrix*	common
Crevalle jack	*Caranx hippos*	common
Gray snapper	*Lutjanus griseus*	common
Pinfish	*Lagodon rhomboides*	abundant
Silver perch	*Bairdiella chrysoura*	common
Sand trout	*Cynoscion arenarius*	common
Spotted trout	*Cynoscion nebulosus*	common
Spot	*Leiostomus xanthurus*	abundant
Atlantic croaker	*Micropogonias undulatus*	highly abundant
Black drum	*Pogonias cromis*	common
Red drum	*Sciaenops ocellatus*	common
Striped mullet	*Mugil cephalus*	common
Spanish mackerel	*Scomberomorous maculatus*	rare
Southern flounder	*Paralichthys lethostigma*	common
Gag grouper	*Mycteroperca microlepis*	occurrence
Scamp	*Mycteroperca phenax*	occurrence
Red snapper	*Lutjanus campechanus*	common
Lane snapper	*Lutjanus synagris*	common
Greater amberjack	*Seriola dumerilli*	common
King mackerel	*Scomberomorus cavalla*	common
Cobia	*Rachycentron canadum*	common

Source: Pattilo et al., 1997, GMFMC, 1998

duorarum), blue crab (*Callinectes sapidus*), and southern flounder (*Paralichthys lethostigma*). Important recreational species include red drum (*Sciaenops ocellatus*), red snapper (*Lutjanus campechanus*), speckled trout (*Cynoscion nebulosus*), black drum (*Pogonias cromis*), southern flounder, greater amberjack (*Seriola dumerili*), Spanish mackerel (*Scomberomorus maculatus*), and king mackerel (*Scomberomorus cavalla*). No oysters are commercially harvested within the study area.

3.14.1.2 Oyster Reef Habitat

Many organisms, including mollusks, polychaetes, barnacles, crabs, gastropods, amphipods, polychaetes, and isopods can be found living on oyster reefs, forming a very diverse community (Sheridan et al., 1989). Oyster reef communities are dependent upon food resources from the open bay and marshes. Many organisms feed on oysters including fish, such as black drum, crabs (*Callinectes* spp.), and gastropods such as the oyster drill (*Thais haemastoma*) (Sheridan et al., 1989; Lester and Gonzales, 2001). When oyster reefs are exposed during low tides, shore birds will use the reef areas as resting places (Armstrong et al., 1987).

Scattered reefs of Eastern oyster (*Crassostrea virginica*) are present in areas surrounding Oyster Creek and scattered oyster are found in many of the nearby open-water areas (Swan Lake, Bryan Lake); however, no oysters are found within the immediate project area. Oysters are not commercially harvested from the Brazos River estuary. The Freeport area has been classified as restricted by the Texas Department of Health (TDH) and is closed to the harvesting of molluscan shellfish from this system (TDH, 2006). In addition, TDH does not have any bay water sampling stations for monitoring oysters within the Brazos River estuary (Heideman, 2006).

3.14.1.3 Offshore Sands

There are few seagrasses or attached algae found in the offshore sands due to the strong currents and unstable sediments. Most of the bottom surface is populated with macroinfauna, with the exception of an occasional hermit crab, portunid crab, or ray. Even though there is little life on the sand surface itself, the overlying waters are highly productive. Phytoplankton are abundant, including microscopic diatoms, dinoflagellates, and other algae (Britton and Morton, 1989).

Much of the faunal diversity lies buried in the sand and relies on the phytoplankton for food. Bivalves found in offshore sands include the blood ark (*Anadara ovalis*), incongruous ark (*Anadara brasiliana*), southern quahog (*Mercenaria campechiensis*), giant cockle (*Dinocardium robustum*), disk dosinia (*Dosinia discus*), pen shells (*Atrina serrata*), common egg cockle (*Laevicardium laevigatum*), cross-barred venus (*Chione cancellata*), tellins (*Tellina* spp.), and the tusk shell (*Dentalium texasianum*). One of the most common species occurring in the shallow offshore sands is the sand dollar (*Mellita quinquiesperforata*) as well as several species of brittle stars (*Hemipholis elongata*, *Ophiolepis elegans*, and *Ophiothrix angulata*). Many gastropods are common, including the moon snail (*Polinices duplicatus*), ear snail (*Sinum perspectivum*), Texas olive (*Oliva sayana*), Atlantic auger (*Terebra dislocata*), Salle's ager (*Terebra salleano*), scotch bonnet (*Phalium granulatum*), distroted triton

(*Distrosio clathrata*), wentletraps (*Epitonium* sp.), and whelks (*Busycon* spp.). Crustaceans inhabiting these waters include white and brown shrimp (both commercially caught species), rock shrimp (*Sicyonia brevirostris*), blue crabs, mole crabs (*Albunea* spp.), speckled crab (*Arenaeus cribrarius*), box crab (*Calappa sulcata*), calico crab (*Hepatus epheliticus*), and pea crab (*Pinotheres maculatus*). The most abundant infaunal organism, with respect to the number of individuals, are the polychaetes (Capitellidae, Orbiniidae, Magelonidae, and Paraonidae) (Britton and Morton, 1989).

3.14.1.4 Artificial Reefs

In the Gulf, two types of artificial reefs exist, those structures placed to serve as oil and gas production platforms and those intentionally placed to serve as artificial reefs (Gulf of Mexico Fisheries Management Council [GMFMC], 2004). The more than 4,500 oil and gas structures in the Gulf form unique reef ecosystems that extend throughout the water column providing a large volume and surface area, dynamic water flow characteristics, and a strong profile (Ditton and Falk, 1981; Dokken, 1997; Stanley and Wilson, 1990; Vitale and Dokken, 2000). Fish are attracted to oil platforms because these structures provide food, shelter from predators and ocean currents, and a visual reference which aids in navigation for migrating fishes (Bohnsack, 1989; Duedall and Champ, 1991; Meier, 1989; Vitale and Dokken, 2000). The size and shape of the structure affect community characteristics of pelagic, demersal, and benthic fishes (Stanley and Wilson, 1990). Many scientists feel that the presence of oil platform structures allows fish populations to grow, which increases fishery potential (Scarborough-Bull and Kendall, 1992).

Artificial reefs are colonized by a diverse array of microorganisms, algae, and sessile invertebrates including shelled forms (barnacles, oysters, and mussels), as well as soft corals (bryozoans, hydroids, sponges, and octocorals) and hard corals (encrusting, colonial forms). These organisms (referred to as the biofouling community) provide habitat and food for many motile invertebrates and fishes (GMFMC, 2004).

Species associated with the platforms that are not dependent on the biofouling community for food or cover include the Atlantic spadefish (*Chaetodipterus faber*), lookdown (*Selene vomer*), Atlantic moonfish (*Selene setapinnis*), creole-fish (*Paranthias furcifer*), whitespotted soapfish (*Rypticus maculatus*), gray triggerfish (*Balistes capriscus*), and lane snapper (*Lutjanus synagris*), all transients (move from platform to platform), and resident species (always found on the platforms) including red snapper, large tomate (*Haemulon aurolineatum*), and some large groupers. Other resident species that are dependent upon the biofouling community for food or cover include numerous species of blennies, sheepshead, and small grazers (butterflyfishes, Chaetodontidae). Highly transient, large predators associated with these structures include barracuda (*Sphyraena barracuda*), almaco jack (*Seriola rivoliana*), hammerhead sharks (*Sphyrna* spp.), cobia (*Rachycentron canadum*), mackerels (Scombridae), other jacks (*Caranx* sp.), and the little tunny (*Euthynnus alletteratus*) (GMFMC, 2004).

There appear to be no platforms within 5 miles of the end of the jetties and only 9 within 10 miles of the end of jetties (NOAA Coast Survey Nautical Chart 11321, 30th Ed., July 2004). The *George Vancouver*, a

Liberty Ship, which is part of the TPWD artificial reef program, is located about 10½ miles southwest of Freeport.

3.14.2 Essential Fish Habitat

Congress enacted amendments to the Magnuson-Stevens Fishery Conservation and Management Act (PL 94-265) in 1996 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. A letter (Appendix E) was submitted to NMFS requesting a list of EFHs in the study area.

EFH is defined 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 GMFMC has identified the study area as EFH for adult and juvenile brown, white, and pink shrimp, red drum, gag grouper (*Mycteroperca microlepis*), scamp (*Mycteroperca phenax*), red snapper, gray snapper (*Lutjanus griseus*), lane snapper (*Lutjanus synagris*), greater amberjack, king mackerel, Spanish mackerel, and cobia (*Rachycentron canadum*).

The following describes the preferred habitat, life history stages, and relative abundance of each EFH managed species based on information provided by GMFMC (2004). Table 3.14-2 describes EFH for each of these species.

Brown Shrimp: Brown shrimp eggs are demersal and are deposited offshore. The larvae begin to migrate through passes with flood tides into estuaries as postlarvae. Migrating occurs at night mainly from February to April, with a minor peak in the fall. Brown shrimp postlarvae and juveniles are associated with shallow vegetated habitats in estuaries, but are also found over silty sand and nonvegetated mud bottoms. Postlarvae and juveniles occur in salinity ranging from zero to 70 ppt. The density of late postlarvae and juvenile brown shrimp are highest in marsh edge habitat and submerged vegetation, followed by tidal creeks, inner marsh, shallow, open water and oyster reefs. Muddy substrates seem to be preferred in unvegetated areas. Juvenile and subadult brown shrimp can be found from secondary estuarine channels out to the continental shelf, but prefer shallow estuarine habitats, such as soft, muddy areas associated with plant-water interfaces. Subadult brown shrimp migrate from estuaries, at night, on ebb tides during new and full moon phases in the Gulf. Their abundance offshore correlates positively with turbidity and negatively with hypoxia (low levels of oxygen in the water). Adult brown shrimp inhabit neritic Gulf waters (marine waters extending from MLT to the edge of the continental shelf) and

TABLE 3.14-2
ESSENTIAL FISH HABITAT - ADULT AND JUVENILE PRESENCE
IN THE PORT OF FREEPORT STUDY AREA

	ESTUARINE		MARINE	
Common Name/Scientific Name	Adults	Juvenile	Adults	Juvenile
Brown shrimp (*Penaeus aztecus*)	*not present*	*abundant* year-round	major adult area spring, summer, fall spawn year-round at depths greater than 13 m	spawning area
White shrimp (*Penaeus setiferus*)	*common* April-June	*abundant* November-June *highly abundant* July-October	adult area year-round	not present in study area
Pink shrimp (*Penaeus duroarum*)	*not present*	*common* November-March	adult area year-round summer spawning	not present in study area
Red drum (*Sciaenops ocellatus*)	*no data*	*common* year-round	adult area year-round	spawning area fall and winter - spawn in shallow coastal waters
Gag grouper (*Mycteroperca microlepis*)	*not present*	*not present*	adult occurrence	not present
Scamp (*Mycteroperca phenax*)	*not present*	*not present*	adult occurrence	no present in study area
Red snapper (*Lutjanus campechanus*)	*not present*	*not present*	not present in study area	nursery area year-round
Gray snapper (*Lutjanus griseus*)	*not present*	*not present*	major adult area year-round spawn June to August	nursery area
Lane snapper (*Lutjanus synagris*)	*not present*	*not present*	not present in study area	nursery area
Greater amberjack (*Seriola dumerilli*)	*not present*	*not present*	adult area year-round year-round spawning	nursery area year-round
King mackerel (*Scomberomorus cavalla*)	*not present*	*not present*	adult area year-round spawn May to November	nursery area year-round
Spanish mackerel (*Scomberomorus maculatus*)	*common* April-October *rare* November-March	*rare* July-October	adult area year-round	spawning area summer and fall nursery area year-round
Cobia (*Rachycentron canadum*)	*not present*	*not present*	adult area summer spawn in spring and summer	nursery area year-round

are associated with silt, muddy sand, and sandy substrates (GMFMC, 2004). Juvenile brown shrimp are common within the Brazos River estuary year-round.

Larval brown shrimp feed on phytoplankton and zooplankton. Postlarvae brown shrimp feed on phytoplankton, epiphytes, and detritus. Juvenile and adult brown shrimp prey on amphipods, polychaetes, and chironomid larvae, but graze on algae and detritus (Pattillo et al., 1997).

White Shrimp: White shrimp inhabit Gulf and estuarine waters and are pelagic or demersal, depending on their life stage. Their eggs are demersal and larval stages are planktonic and both occur in nearshore Gulf waters. Postlarvae migrate into estuaries through passes from May to November with most migration occurring in June and September. Migration is in the upper 6.5 ft of the water column at night and at mid-depths during the day. Postlarval white shrimp become benthic once they reach the estuary. Here they seek shallow water with mud or sand bottoms high in organic detritus or rich marsh where they develop into juvenile white shrimp. Postlarvae and juveniles prefer mud or peat bottoms with large quantities of decaying organic matter or SAV. Densities are usually highest along marsh edge and in SAV, followed by marsh ponds and channels, inner marsh, and oyster reefs. White shrimp juveniles prefer salinities of less than 10 ppt and occur in tidal rivers and tributaries. As white shrimp juveniles mature, they migrate to coastal areas where they mature and spawn. Adult white shrimp are demersal and inhabit soft mud or silt bottoms (GMFMC, 2004). Adult and juvenile white shrimp are common to highly abundant in the Brazos River estuary throughout the year. Adult white shrimp also occur throughout the Gulf to depths of about 131 ft.

White shrimp larvae feed on phytoplankton and zooplankton. White shrimp postlarvae feed on phytoplankton, epiphytes, and detritus. Juvenile and adult white shrimp prey on amphipods, polychaetes, and chironomid larvae, but also graze on algae and detritus (Pattillo et al., 1997).

Pink Shrimp: Pink shrimp inhabit Gulf and estuarine waters and are pelagic or demersal, depending on their life stage. After spawning offshore, postlarval pink shrimp recruitment into the estuaries occurs in the spring and fall through passes. Juveniles can be found in SAV meadows where they burrow into the substrate; however, postlarvae, juvenile, and adults may prefer a mixture of course sand/shell/mud. Densities of pink shrimp are lowest or absent in marshes, low in mangroves, and greatest near or in SAV. Adults occur offshore in depths of 30 to 145 ft and prefer substrates of coarse sand and shell (GMFMC, 2004). Juvenile pink shrimp are common from November through March in the Brazos River estuary.

Pink shrimp feed on phytoplankton and zooplankton. Postlarvae feed on phytoplankton, epiphytes, and detritus. Juveniles and adults prey on amphipods, polychaetes, and chironomid larvae but also on algae and detritus (Patillo et al., 1997). The habitat of these prey is essentially the same as that required by shrimp, estuarine, and marine.

Red Drum: Red drum occupy a variety of habitats, ranging from offshore depths of 131 ft to very shallow estuarine waters. Spawning occurs in the Gulf near the mouths of bays and inlets during the fall and early winter. Eggs usually hatch in the Gulf and larvae are transported with tidal currents into the

estuaries where they mature. Adult red drum use estuaries, but tend to migrate offshore where they spend most of their adult life. Red drum occur over a variety of substrates including sand, mud, and oyster reefs and can tolerate a wide range of salinities (GMFMC, 2004).

Estuaries are especially important to larval, juvenile, and subadult red drum. Juvenile red drum are most abundant around marshes, preferring quiet, shallow, protected waters over mud substrate or among SAV. Subadult and adult red drum prefer shallow bay bottoms and oyster reefs (GMFMC, 2004). Adult red drum that migrate into the Gulf are pelagic.

Estuaries are also important for the prey of larval, juvenile, and subadult red drum. Red drum larva feed primarily on shrimp, mysids, and amphipods, while juvenile red drum prefer fish and crabs. Adult red drum feed primarily on shrimp, blue crab, striped mullet, and pinfish (GMFMC, 2004). Within the Brazos River estuary, juvenile red drum are common year-round.

Gag Grouper: Gag grouper are demersal and are most common in the eastern Gulf. Eggs are pelagic, and are spawned from December through April. Larvae are pelagic and most abundant in the early spring. Postlarvae and pelagic juveniles move through inlets into high salinity estuaries from April through May, where they become benthic and settle into grass flats and oyster beds. Older juveniles move offshore in the fall to shallow reef habitat in depths of 3 to 165 ft. Adults prefer depths of 33 to 328 ft, and utilize hard bottoms, oil platforms, and artificial reefs. Spawning occurs on the west Florida shelf from December through April (GMFMC, 2004).

Gag grouper feed on estuarine-dependent organisms such as shrimp, small fish, and crabs during their juvenile stages. As they mature and move offshore, they become opportunistic predators, feeding on a variety of fish and crustaceans (GMFMC, 2004). Adult gag grouper occur in Gulf waters within the study area.

Scamp: Scamp are demersal and widely distributed on shelf areas of the Gulf. Scamp eggs and larvae are pelagic and are spawned offshore in the spring. Juvenile scamp occur on shallow, nearshore hard bottoms and reefs in depths of 40 to 620 ft. Scamp spawn in aggregations from late February to early June.

Juvenile scamp feed on estuarine-dependent organisms such as shrimp, small fish, and crabs. As they mature and move offshore, they become opportunistic predators, feeding on a variety of fish and crustaceans (GMFMC, 2004). Adult scamp occur in Gulf waters within the study area.

Red Snapper: Red snapper are demersal and found over sand and rock substrates around reefs, and underwater objects to depths of 656 ft. However, adult red snapper prefer depths ranging from 131 to 360 ft (GMFMC, 2004). Spawning occurs in the Gulf from May to October, at depths of 60 to 122 ft over fine sand substrate. Larvae, postlarvae and early juveniles occur from July through November in shelf waters. Early and late juveniles are often associated with underwater structures or small burrows, but are also abundant over barren sand and mud bottoms.

Juvenile red snapper feed on shrimp, but after age one, prey primarily on fish and squid. Of the vertebrates consumed, most are not obligate reef dwellers, indicating that red snapper feed away from reefs (GMFMC, 2004). Juvenile red snapper occur in the Gulf waters within the study area.

Gray Snapper: Gray snapper can be demersal, structure, or mid-water dwellers inhabiting marine, estuarine, and riverine habitats. They inhabit depths to about 550 ft in the Gulf. Juvenile gray snapper are common in shallow water around SAV while adult gray snapper tend to congregate in deeper Gulf waters around natural and artificial reefs. Spawning occurs in the Gulf from June to August around structures and shoals. Their eggs are pelagic and the larvae are planktonic, both occurring in Gulf shelf waters and near coral reefs. Postlarvae migrate into the estuaries and are most abundant over *Halodule* and *Syringodium* grassbeds. Juveniles seem to prefer *Thalassia* grassbeds, seagrass meadows, marl bottoms, and mangrove roots, and are found in estuaries, bayous, channels, grassbeds, marshes, mangrove swamps, ponds and freshwater creeks (GMFMC, 2004).

Juvenile gray snapper feed on estuarine-dependent organisms such as shrimp, small fish, and crabs. Gray snapper are classified as opportunistic carnivores at all life stages (Pattillo et al., 1997). In estuaries, juvenile gray snapper feed on shrimp, larval fish, amphipods, and copepods. Adult gray snapper feed primarily on fish, but smaller individuals will prey on crustaceans (GMFMC, 2004). Adult and juvenile gray snapper are found in the Gulf waters of the study area.

Lane Snapper: Lane snapper are demersal, occurring over all substrate types, but are most commonly found near coral reefs and sandy bottoms. Spawning occurs in Gulf waters from March through September. Nursery areas include mangrove and grassy estuarine habitats in southern Texas and Florida and shallow waters with sand and mud bottoms along all Gulf states. Juvenile lane snapper appear to favor grass flats, reefs, and soft bottoms to depths of 66 ft. Adult lane snapper occur offshore in depths ranging from 13 to 433 ft near sand bottoms, natural channels, banks, and artificial and natural structures (GMFMC, 2004).

Juvenile lane snapper feed on estuarine-dependent organisms such as shrimp, small fish, and crabs. Lane snapper are considered to be unspecialized, opportunistic predators, feeding on a variety of crustaceans and fish. However, adult lane snapper tend to prefer fish (GMFMC, 2004). Juvenile lane snapper are found in estuaries and Gulf waters within the study area.

Greater Amberjack: Greater amberjack occur throughout the Gulf to depths of 1,300 ft. Adults are pelagic and epibenthic, occurring near reefs and artificial structures. Spawning occurs offshore, and juvenile greater amberjack are associated with floating Sargassum and debris (GMFMC, 2004). Adult and juvenile greater amberjack are found in the Gulf within the study area.

King Mackerel: King mackerel are pelagic and found in Gulf waters from nearshore to 655 ft. Spawning occurs in the Gulf from May to October. Eggs are pelagic occurring over depths of 98 to 590 ft. Nursery areas are located in marine waters with juveniles only occasionally entering estuaries (GMFMC, 2004).

While estuaries are important for most king mackerel prey, they feed on a variety of fishes, extensively utilizing herrings. Squid, shrimp, and other crustaceans are also prey for by king mackerel. Adult and juvenile king mackerel are found in the Gulf within the study area.

Spanish Mackerel: Spanish mackerel are pelagic, inhabiting depths to 245 ft throughout the coastal zone of the Gulf. Adult Spanish mackerel are usually found from nearshore to the edge of the continental shelf. However, they may also migrate seasonally into estuaries with high salinity, but this migration is infrequent and rare. Spawning occurs in the Gulf from May through October. Larvae typically occur in the Gulf in depths ranging from 30 to 275 ft. Juveniles inhabit the Gulf surf and sometimes estuarine habitats. However, juvenile Spanish mackerel prefer marine salinities and are not considered estuarine-dependent. Adult and juvenile Spanish mackerel are found in the Gulf year-round within the study area. Juvenile Spanish mackerel prefer clean sand bottoms, but the substrate preferences of the other life stages are unknown (GMFMC, 2004).

While Spanish mackerel rarely use estuarine environments, estuaries are important for most of their prey. They feed on a variety of fishes, extensively herrings. Squid, shrimp, and other crustaceans are also fed upon by Spanish mackerel.

Cobia: Cobia are large, pelagic fish, occurring from nearshore to depths of 131 ft near artificial and natural structures, including floating objects. In the study area, cobia occur only in the Gulf and do not use estuarine waters (GMFMC, 2004).

However, estuaries are important for most cobia prey. They feed on a variety of fishes, extensively herrings. Squid, shrimp, and other crustaceans are also prey for cobia (GMFMC, 2004).

3.15 ENDANGERED AND THREATENED SPECIES

Congress enacted the Endangered Species Act (ESA) [16 U.S.C. 1531 et. Seq.] of 1973, as amended, to provide a program for the preservation of endangered and threatened species and to provide protection for the ecosystems upon which these species depend for their survival. All Federal agencies are required to implement protection programs for these designated species and to use their authorities to further the purposes of the act. The FWS and the NMFS are the primary agencies responsible for implementing the ESA. The FWS is responsible for birds and terrestrial and freshwater species, while the NMFS is responsible for nonbird marine species.

An endangered species is one that is in danger of extinction throughout all or a significant portion of its range in the U.S. A threatened species is one likely to become endangered within the foreseeable future throughout all or a significant portion of its range. This assessment addresses State-listed threatened and endangered species; however, the ESA does not protect these species. Only those species that FWS or NMFS lists as endangered or threatened have complete Federal protection under the ESA. Inclusion on the following lists does not imply that a species occurs in the study area, but only acknowledges the potential for occurrence. The FWS (2006a) and TPWD Natural Diversity Database (NDD, 2005)

provided county-level lists of endangered and threatened species of potential occurrence in Brazoria County. In addition, NDD (2006) provided digital map data presenting specific locations of listed species within the study area.

3.15.1 Flora

TPWD's official state list of endangered and threatened species includes the same species that FWS lists as endangered or threatened. FWS (2006a) currently identifies 30 plant species as endangered or threatened in Texas; however, no Federally or State-listed plant species are of potential occurrence in Brazoria County (NDD, 2005; FWS, 2006a).

3.15.2 Wildlife

Table 3.15-1 lists wildlife taxa that FWS and TPWD consider as endangered or threatened and that have a geographic range that may include Brazoria County. As noted above, inclusion on the following list does not imply that a species occurs in the study area, but only acknowledges the potential for occurrence. The following paragraphs present distributional data concerning each Federally or State-listed species, along with a brief evaluation of the potential for the species to occur within the study area.

3.15.2.1 Birds

FWS and/or TPWD identify 12 Federally and/or State-listed endangered and threatened bird species as occurring or potentially occurring in the study area. Some of these are inland species that are not likely to occur in the study area, while others are migrants that pass though the region seasonally. Others may occur as breeding birds, permanent residents, or post-nesting visitors. The following paragraphs present descriptions of Federally listed species, followed by descriptions of State-listed species.

The Federally and State-listed endangered Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*), a subspecies of the greater prairie-chicken (*T. cupido*), was formerly abundant on the coastal prairies of Texas, but fewer than 50 individuals remain and it is arguably the most endangered species in Texas (Schroeder and Robb, 1993; Lockwood and Freeman, 2004). The greater prairie-chicken historically inhabited native prairie and oak savannahs throughout central North America, as well as the coastal plain from Massachusetts to Virginia. Current populations are restricted to native prairie intermixed with cropland, mainly in mid-western states. The Attwater's subspecies was once a common resident of the Gulf coastal prairies of Texas and Louisiana, but currently only two wild populations remain at refuges in Colorado and Galveston counties (FWS, 1992b; Lockwood and Freeman, 2004). A third wild population in Refugio County was recently extirpated (Lockwood and Freeman, 2004). This species would not occur within the study area because of the lack of prairie habitat and its extremely limited range.

The Federally and State-listed endangered brown pelican (*Pelecanus occidentalis*) is an uncommon to common resident along the Texas Gulf Coast, occasionally wandering inland during post-breeding in late

TABLE 3.15-1

ENDANGERED AND THREATENED WILDLIFE SPECIES OF POSSIBLE OCCURRENCE IN BRAZORIA COUNTY, TEXAS[1]

Common Name[2]	Scientific Name[2]	Status[3]	
		FWS	TPWD
BIRDS			
Attwater's greater prairie-chicken	*Tympanuchus cupido attwateri*	E	E
Brown pelican	*Pelecanus occidentalis*	E	E
Whooping crane	*Grus americana*	E	E
Bald eagle	*Haliaeetus leucocephalus*	T-PDL	T
Piping plover	*Charadrius melodus*	T	T
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T
Reddish egret	*Egretta rufescens*	NL	T
White-faced ibis	*Plegadis chihi*	NL	T
Wood stork	*Mycteria americana*	NL	T
Swallow-tailed kite	*Elanoides forficatus*	NL	T
White-tailed hawk	*Buteo albicaudatus*	NL	T
Sooty tern	*Sterna fuscata*	NL	T
MAMMALS			
Ocelot[4]	*Leopardus pardalis*	E	E
Jaguarundi[4]	*Herpailurus yaguarondi*	E	E
West Indian manatee[4]	*Trichechus manatus*	E	E
Louisiana black bear	*Ursus americanus luteolus*	T	T
Black bear	*Ursus americanus*	T/SA; NL	T
Blue Whale	*Balaenoptera musculus*	E	
Finback Whale	*Physeter macrocephalus*	E	
Right Whale	*Eubalaena glacialis*	E	
Sei Whale	*Balaenoptera borealis*	E	
REPTILES			
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
Green sea turtle	*Chelonia mydas*	T	T
Texas horned lizard	*Phrynosoma cornutum*	NL	T
Timber rattlesnake	*Crotalus horridus*	NL	T
Smooth greensnake	*Opheodrys vernalis*	NL	T

[1]According to NDD (2005) and FWS (2006).

[2]Nomenclature and taxonomic orders follow AOU (1998, 2000, 2002, 2003, 2004, and 2005), Crother et al. (2000, 2001, and 2003), Baker et al. (2003), NDD (2005), and FWS (2006a).

[3]E – Endangered; T – Threatened; T/SA – Threatened because of similarity of appearance to another listed species; DL – Federally delisted; PDL – Proposed for delisting; NL – Not listed.

[4]Listed as present in Brazoria County by TPWD but not by FWS/NMFS. Not included in BA.

summer and fall (Lockwood and Freeman, 2004). Brown pelicans breed on barrier, natural estuarine, or dredge-spoil islands (Shields, 2002). The species is an uncommon resident in the general area (FWS, n.d.), but likely occurs in the open water and barrier island habitats in the study area.

The Federally and State-listed endangered whooping crane (*Grus americana*) is a large wading bird that in the last 50 years has returned from the brink of extinction. Only three wild populations of whooping crane exist, the largest of which is the Aransas/Wood Buffalo population, which breeds in Wood Buffalo National Park in northern Canada and migrates annually to Aransas NWR and adjacent areas of thecentral Texas coast in Aransas, Calhoun, and Refugio counties where it winters (FWS, 1995; Lewis, 1995). Other smaller wild populations include the experimental Rocky Mountain population and the nonmigratory Florida population (Lewis, 1995). In Texas, the whooping crane's wintering habitat includes estuarine marshes, shallow bays, and tidal flats, and occasionally nearby rangelands or farmlands. According to FWS (1995), Brazoria County is within the species' migration corridor; however, the species is unlikely to occur in the study area because of the absence of suitable wintering habitat. NDD (2006) indicates documented records of whooping cranes from marshes west of the Brazos River; however, these likely represent vagrant birds and no wintering populations are present in the study area.

The Federally and State-listed threatened bald eagle (*Haliaeetus leucocephalus*) is present year-round in Texas, including breeding, wintering, and migrating birds. In Texas, bald eagles breed along the Gulf Coast and on major inland lakes and reservoirs in the eastern two-thirds of the state. Additional numbers of bald eagles winter in these habitats, as far west as the Trans-Pecos. Bald eagles prefer large bodies of water surrounded by tall trees or cliffs, which they use as nesting sites. In 1999, the FWS proposed to remove the bald eagle from the list of endangered and threatened wildlife (64 FR 128; 36453–36464; 6 July 1999); however, the FWS has yet to make a final decision on the delisting. If delisted, the bald eagle would still receive Federal protection under provisions of the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Ortego (2002) identified 155 nesting territories statewide, of which at least four currently exist in Brazoria County. Ortego (2002) does not disclose the locations of bald eagle nests; therefore, the exact locations of the nests are unknown. NDD (2006) indicates an active bald eagle territory north of Freeport, between Clute and Oyster Creek (TPWD nest #020-8A). The species is likely present in the general area at some time during the year; however, no suitable nesting habitat is present in the study area.

The Federally and State-listed threatened piping plover (*Charadrius melodus*) is a small shorebird that inhabits coastal beaches and tidal flats. Approximately 35% of the known global population of piping plovers winters along the Texas Gulf Coast, where they spend 60 to 70% of the year (Campbell, 1995; Haig and Elliott-Smith, 2004). The piping plover population that winters in Texas breeds on the northern Great Plains and around the Great Lakes. The species is a common migrant and rare to uncommon winter resident on the upper Texas coast (Richardson et al., 1998; Lockwood and Freeman, 2004). FWS (n.d.) indicates that the piping plover is an uncommon migrant and winter resident in Brazoria County. Because of a lawsuit, FWS has designated critical habitat for the species in its nesting and wintering range (65 FR 41781–41812, 6 July 2000). Designation of critical habitat became final on 10 July 2001 (66 FR 17;

36038–36143). Critical Habitat Unit TX-36 encompasses approximately 388 acres between the mouth of the Brazos River and Farm-to-Market Road (FM) 1495 and includes Bryan Beach and adjacent beach habitat (66 FR 17; 36142, 10 July 2001). NDD (2006) maps show no documented records within the study area.

The FWS recently removed the peregrine falcon (*Falco peregrinus*) from the Federal list of endangered and threatened species, but the Arctic subspecies (*Falco peregrinus tundrius*) retains its State-listed status of threatened in Texas. The Arctic subspecies of peregrine falcon is an uncommon migrant statewide and an uncommon winter resident along the Texas Gulf Coast, where it typically occurs near bays and estuaries (Lockwood and Freeman, 2004). Peregrine falcons may occur within the study area during migration; however, no suitable nesting or wintering habitat is present in the study area. NDD mapping indicates no documented records from the study area; however, the species may occur in winter or as a transient during migration.

The State-listed threatened reddish egret (*Egretta rufescens*) is a resident of brackish marshes, tidal flats, and shallow salt lakes along the Texas Gulf Coast, where they nest in brushy yucca and prickly pear thickets on dry coastal islands (Oberholser, 1974; Lowther and Paul, 2002; Lockwood and Freeman, 2004). Reddish egrets are uncommon year-round residents on the upper Texas coast, including Brazoria County (FWS, n.d.; Richardson et al., 1998). Reddish egrets are likely present in the general area.

The State-listed threatened white-faced ibis (*Plegadis chihi*) is a medium-sized wading bird that inhabits freshwater marshes, sloughs, and irrigated rice fields, but also frequents brackish and saltwater habitats. White-faced ibis are permanent residents along the Texas Gulf Coast; however, nesting records exist for many scattered inland localities (Ryder and Manry, 1994; Lockwood and Freeman, 2004). The species is a common migrant/summer resident and uncommon winter resident on the upper Texas coast (Richardson et al., 1998). NDD (2006) indicates no documented records within the study area; however, the species is likely present year-round in the general area.

The State-listed threatened wood stork (*Mycteria americana*) is an uncommon to locally common post-breeding visitor to coastal Texas and inland waters in east and central Texas (Lockwood and Freeman, 2004). Wood storks historically bred in North America along the Gulf Coast from east Texas to Florida, but their range has significantly declined since the 1960s and their North American breeding range is now restricted to Florida, Georgia, and South Carolina (Oberholser, 1974; Coulter et al., 1999). In Texas, wood storks typically occur near freshwater or saltwater wetlands, lakes, or along rivers and streams. The FWS lists the wood stork as Federally endangered in Florida, Alabama, Georgia, North Carolina, and South Carolina, but not in Texas. Wood storks are uncommon to common in summer and fall along the upper Texas coast (FWS, n.d.; Richardson et al., 1998). The species likely occurs in the study area during summer and fall.

The State-listed threatened swallow-tailed kite (*Elanoides forficatus*) is a medium-sized raptor that historically occurred along the coastal plains, interior lowlands, and riparian areas throughout the

southeastern U.S. and Mississippi River Valley, west to central Texas (Meyer, 1995). Beginning in the late 1800s and early 1900s, this species' U.S. range dramatically decreased, likely because of forestry practices, which resulted in the loss of tall trees used for nesting. Today, swallow-tailed kites breed primarily in Florida, with scattered breeding populations in South Carolina, Georgia, Alabama, Mississippi, Louisiana, and southeastern Texas (Meyer, 1995). In Texas, the species is a rare to uncommon migrant throughout the eastern third of the state, with occasional migration records west to the eastern Edwards Plateau (Lockwood and Freeman, 2004). The species is a rare migrant in Brazoria County, with the majority of records occurring between April and June (Richardson et al., 1998; Shackelford and Simons, 2000). NDD (2006) indicates no records within the study area; however, Shackelford and Simons (2000) indicate recent records of migrating birds, therefore, the species may occur in the study area as a migrant.

The State-listed threatened white-tailed hawk (*Buteo albicaudatus*) is an uncommon local resident on the Gulf coastal plain, from Harris County south to the Rio Grande (Lockwood and Freeman, 2004). White-tailed hawks inhabit coastal prairies and brushlands, as well as inland mesquite and oak savannahs (Farquhar, 1992; NDD, 2005). This species likely occurs in the general vicinity of the study area, particularly in inland areas with appropriate habitat.

The State-listed threatened sooty tern (*Sterna fuscata*) is a largely pelagic (open ocean) species that nests on isolated tropical and subtropical islands (Schreiber et al., 2002). The species is a rare and local summer resident along the middle and lower Texas Gulf Coast from Matagorda County to Cameron County, where they nest in small numbers on natural and dredged material islands, particularly in the Laguna Madre (Oberholser, 1974; Lockwood and Freeman, 2004). Sooty terns are rare in summer along the upper Texas Coast (Richardson et al., 1998). It is unlikely that this oceanic species would regularly occur in the study area; however, their occurrence is possible.

3.15.2.2 Mammals

The ocelot is a medium-sized spotted cat that historically inhabited dense thornscrub and thickets in southwest Texas, along the Texas Gulf Coast, and in the Big Thicket of east Texas, but currently occurs only in small, remnant patches of dense thornscrub in the Lower Rio Grande Valley (Schmidly, 2004). The current Texas ocelot population likely consists of 80 to 120 individuals, which occur in two isolated populations in several south Texas counties (Schmidly, 2004). At least one historic record of an ocelot exists from Brazoria County (Schmidly, 2004); however, because of the limited terrestrial habitat and the fact that much of the area is developed, it is highly unlikely that ocelots would occur in the study area.

The jaguarundi is a secretive, small slender-bodied cat that inhabits dense thornscrub and brushland in Cameron, Hidalgo, Starr and Willacy counties (Schmidly, 2004). The jaguarundi is the least common felid in Texas and the current Texas population likely consists of no more than 15 individuals (Schmidly, 2004). NDD (2006) indicates a 1991 class II record (reliable observation) from Brazoria NWR. Schmidly

(2004) indicates no recent documented records of jaguarundis exist from Brazoria County and it is highly unlikely that this extremely rare species would occur in the study area.

The Federally listed endangered West Indian manatee (*Trichechus manatus*) is an aquatic mammal which inhabits brackish water bays, large rivers, and salt water (Davis and Schmidly, 1994), and feeds upon submergent, emergent, and floating vegetation with the diet varying according to plant availability (O'Shea and Ludlow, 1992). Historically the manatee inhabited the Laguna Madre, Gulf of Mexico, and tidally influenced portions of rivers. It is currently, however, extremely rare in Texas waters and the most recent sightings are likely individuals migrating or wandering from Mexican waters. Historical records from Texas waters include Cow Bayou, Sabine Lake, Copano Bay, the Bolivar Peninsula, and the mouth of the Rio Grande (Schmidly, 2004). In May 2005, a live manatee was photographed in the Laguna Madre near Port Mansfield (Blankinship, 2005). Although the West Indian manatee is chiefly a marine species, its occurrence in the study area is unlikely.

TPWD lists the Louisiana black bear as a potentially occurring species in Nacogdoches and San Augustine counties, along with the nominate American black bear, because of its similarity in appearance to the Louisiana subspecies. The Louisiana black bear historically inhabited east Texas, Louisiana, and southern Mississippi, but now occurs only in small numbers in Mississippi and Louisiana (FWS, 1992c). The last Texas Pineywoods record of native black bear is from the late 1950s, near the town of Livingston in Polk County (Fleming, 1980). There are periodic reports of black bears from various counties of east Texas; however, these bears most likely represent individuals dispersing from neighboring areas in Louisiana (Taylor, 2000). According to Garner (1995), Louisiana black bears historically ranged as far east as Aransas and Refugio counties, which suggests they may have occurred in Brazoria County; however, no recent documented sightings of black bears exist from the Texas Gulf Coast. It is unlikely that either subspecies of black bear would occur in the study area.

The blue whale (*Balaenoptera musculus*) is listed as endangered under the ESA. This species inhabits and feeds in both coastal and pelagic environments. The distribution of blue whales is presumably governed largely by food requirements. Populations move toward the poles in the spring to take advantage of high zooplankton production during summer months. Blue whales move toward the subtropics in the fall to reduce energy expenditure while fasting and engage in reproductive activities in warmer waters. The blue whale is considered only an occasional visitor in the U.S. Atlantic waters. This may represent the southern limit of the western North Atlantic blue whales feeding range, although the actual southern limit of its range is unknown. Some records have suggested an occurrence of this species in waters near Florida and in the Gulf of Mexico (NMFS, 2006a). The blue whale is not expected to occur in the study area.

The finback or fin whale (*Balaenoptera physalus*) is listed as endangered under the ESA. Finback whales are found offshore and tend to be nomadic. The high food availability in high latitudes and cold currents make it a desired habitat for the finback whale. In the fall these whales migrate several thousand miles to equatorial waters. Fin whales fast almost completely in the winter, living off fat reserves. Mating occurs throughout the winter and young are born a year later between December and April (New York State

Department of Environmental Conservation [NYSDEC], 2006). The finback whale is not expected to occur in the study area.

The sperm whale (*Physeter macrocephalus*) is endangered throughout its range due mostly to overexploitation from commercial whaling during the past two centuries. This species is found throughout the world's oceans in deep waters between about 60° N and 60° S latitudes. Sperm whales tend to inhabit areas with water depths of 1,970 ft or more, and are uncommon in waters less than 985 ft deep. Their distribution is dependent on their food source and suitable conditions for breeding, and varies with the sex and age composition of the group. Sperm whale migrations are not as predictable or well understood. In some mid-latitudes, there seems to be a general trend to migrate north and south depending on the seasons (whales move poleward in the summer). However, in tropical and temperate areas, there appears to be no obvious seasonal migration (NMFS, 2006a). The sperm whale is not expected to occur in the study area.

The right whale (*Eubalaena glacialis*) has been listed as endangered under the ESA since its passage in 1973. This species is among the rarest of all marine mammal species. Historically, right whales probably occurred in coastal and continental shelf waters of all the world's oceans from temperate to subpolar latitudes. Right whales were hunted to near extinction by the nineteenth century. The distribution of right whales in the northern hemisphere is strongly correlated to the distribution of calanoid copepods, their primary food source (NMFS, 2006a). North Atlantic right whale sightings have been reported as far south as the Gulf of Mexico. A female and calf were recently (on 16 January 2006) observed in Corpus Christi Bay, Texas (personal communication with K. Baker, NOAA Fisheries-Protected Resources Division).

The main factor limiting right whales is their critically low population size, the result of extensive exploitation since the beginning of commercial whaling. Other principal threats include incidental collisions with vessels and entanglement in fishing gear. The right whale is not expected to occur in the study area (NMFS, 2006a).

The Sei whale (*Balaenoptera borealis*) is currently designated as an endangered species under the ESA. The Sei whale inhabits, breeds, and feeds in open oceans, and is usually restricted to more temperate waters. These whales migrate several thousand miles to the equator in the fall. The mating season lies between April to December, during which they fast or forage minimally, living off their fat reserves. Sei whales are found in the North Atlantic Ocean ranging from the south of Iceland to the northeastern Venezuelan coast, and northwest to the Gulf. Sei whales are also known to occur near Cuba, the Virgin Islands and infrequently in U.S. waters (NYSDEC, 2006). Sei whales of the U.S. waters are grouped into four stocks: East North Pacific, Hawaii, Nova Scotia (formerly part of Western North Atlantic), and Western North Atlantic stocks. Due to lack of data there are currently no trends on the Sei whale population of most of the stocks or on their recovery rate. The protection status accorded to the Sei whale since 1976 might have increased the population; however, unauthorized hunting, incidental ship strikes and gillnet mortality (NMFS, 2006a) make this uncertain. The Sei whale is not expected to occur in the study area.

3.15.2.3 Reptiles

Five species of sea turtle occur in Texas waters: Kemp's ridley sea turtle (*Lepidochelys kempii*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and green sea turtle (*Chelonia mydas*). Kemps' ridley, the hawksbill, and the leatherback are Federally and State-listed as endangered, while the loggerhead and green sea turtle are Federally and State-listed as threatened. The loggerhead and Kemps' ridley are the two most common species in Texas waters and the leatherback sea turtle is the rarest. All except the leatherback turtle have nested on Texas beaches, with the vast majority of nests belonging to the Kemp's ridley (NMFS, 2006b; National Park Service [NPS], 2006; Shaver, 2006).

The Kemp's ridley sea turtle inhabits shallow coastal and estuarine waters, usually over sand or mud bottoms. Adults are primarily restricted to the Gulf of Mexico, although juveniles may range throughout the Atlantic Ocean since they have been observed as far north as Nova Scotia (Musick, 1979) and in coastal waters of Europe (Brongersma, 1972). Almost the entire population of Kemp's ridleys nests on an 11-mile stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, approximately 190 miles south of the Rio Grande. Sporadic nesting has been reported from Mustang Island, Texas, southward to Isla Aquada, Campeche. Kemp's ridley occurs in Texas in small numbers and in many cases may well be in transit between crustacean-rich feeding areas in the northern Gulf of Mexico and breeding grounds in Mexico. It has nested sporadically in Texas in the last 50 years. The number of nestings in Texas, however, has increased over the last decade from 4 nests in 1995 to 51 nests in 2005, 28 of which were from the Padre Island National Seashore (Shaver, 2006; NPS, 2006). Several of the ridley nests were from headstarted individuals. Such nestings, together with the proximity of the Rancho Nuevo rookery, probably account for the occurrence of hatchlings and subadults in Texas. Kemp's ridley has been recorded from the study area. In 1994, a headstarted ridley was accidentally caught by a fisherman on a rod and reel in the GIWW and released alive (NDD, 2006). This species has also nested in the study area. One nest was found on Quintana Beach in 2002 and another was found near Surfside Beach in 2003 (Yeargan, 2006).

The loggerhead sea turtle is widely distributed in tropical and subtropical seas, being found in the Atlantic Ocean from Nova Scotia to Argentina, Gulf of Mexico, Indian and Pacific oceans (although it is rare in the eastern and central Pacific) and the Mediterranean Sea (Rebel, 1974; Ross, 1982; Iverson, 1986). In the continental U.S., loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey (Musick, 1979) and sporadically along the Gulf coast, including Texas. Like the worldwide population, the population of loggerheads in Texas has declined. The loggerhead is the most abundant turtle in Texas marine waters, preferring shallow inner continental shelf waters and occurring only very infrequently in the bays. It is often seen around offshore oil rig platforms, reefs, and jetties. Loggerheads are probably present year-round but are most noticeable in the spring when one of their food items, the Portuguese man-o-war, is abundant. Loggerheads constitute a major portion of the dead or moribund turtles washed ashore (stranded) on the Texas coast each year. A large proportion of these deaths is the result of accidental capture by shrimp trawlers, where caught turtles drown and their bodies are dumped overboard.

In 1999, two loggerhead nests were confirmed in Texas, while in 2000, five loggerhead nests were confirmed (Shaver, 2000). For the last five years, up to five loggerhead nests per year have been recorded from the Texas coast (Shaver, 2006). This species has been recorded from the study area. Between 1995 and 2000, eight loggerheads were caught in Freeport Harbor, and during the Freeport Harbor Project (July 13 to September 24, 2002), one loggerhead was captured by a relocation trawler (NMFS, 2003).

The green sea turtle is a circumglobal species in tropical and subtropical waters. In U.S. Atlantic waters, it occurs around the U.S. Virgin Islands, Puerto Rico, and continental U.S. from Massachusetts to Texas. Major nesting activity occurs on Ascension Island, Aves Island (Venezuela), Costa Rica, and in Surinam. Relatively small numbers nest in Florida, with even smaller numbers in Georgia, North Carolina, and Texas (NMFS and FWS, 1991; Hirth, 1997). The green turtle in Texas inhabits shallow bays and estuaries where its principal foods, the various marine grasses, grow (Bartlett and Bartlett, 1999). While green turtles prefer to inhabit bays with seagrass meadows, they may also be found in bays that are devoid of seagrasses. The green turtles in these Texas bays are mainly small juveniles. Adults, juveniles, and even hatchlings are occasionally caught on trotlines or by offshore shrimpers or are washed ashore in a moribund condition.

Green turtle nests are rare in Texas. Five nests were recorded at the Padre Island National Seashore in 1998, none in 1999, and one in 2000 (Shaver, 2000). For the last five years, up to five nests per year have been recorded from the Texas coast (Shaver, 2006). Since long migrations of green turtles from their nesting beaches to distant feedings grounds are well documented (Meylan, 1982; Green, 1984), the adult green turtles occurring in Texas may be either at their feeding grounds or in the process of migrating to or from their nesting beaches. The juveniles frequenting the seagrass meadows of the bay areas may remain there until they move to other feeding grounds or, perhaps, once having attained sexual maturity, return to their natal beaches outside of Texas to nest. This species is of potential occurrence in the study area.

The hawksbill sea turtle is circumtropical, occurring in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans (Witzell, 1983). This species is probably the most tropical of all marine turtles, although it does occur in many temperate regions. The hawksbill sea turtle is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas), south to Brazil (NMFS, 2006b). The hawksbill generally inhabits coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where it occurs at depths of less than 70 ft. Like some other sea turtle species, hatchlings are sometimes found floating in masses of marine plants (e.g., sargassum rafts) in the open ocean (National Fish and Wildlife Laboratory [NFWL], 1980). In the continental U.S., the hawksbill largely occurs in Florida where it is sporadic at best. In 1998 the first hawksbill nest recorded on the Texas coast was found at Padre Island National Seashore. This nest remains the only documented hawksbill nest on the Texas coast (NPS, 2006; Shaver 2006). Elsewhere in the western Atlantic, hawksbills nest in small numbers along the Gulf Coast of Mexico, the West Indies, and along the Caribbean coasts of Central and South America (Musick, 1979). Texas is the only state outside of Florida where hawksbills are encountered with any regularity. Most of these sightings involve posthatchlings and

juveniles, and are primarily associated with stone jetties. These small turtles are believed to originate from nesting beaches in Mexico (NMFS, 2006b). This species is of potential occurrence in the study area.

The leatherback sea turtle is probably the most wide-ranging of all sea turtle species. It occurs in the Atlantic, Pacific and Indian oceans; as far north as British Columbia, Newfoundland, Great Britain and Norway; as far south as Australia, Cape of Good Hope, and Argentina; and in other water bodies such as the Mediterranean Sea (NFWL, 1980). The leatherback is mainly pelagic, inhabiting the open ocean, and seldom approaches land except for nesting (Eckert, 1992) or when following concentrations of jellyfish (TPWD, 2006), when it can be found in inshore waters, bays, and estuaries. It dives almost continuously, often to great depths. Leatherbacks nest primarily in tropical regions and only sporadically in some of the Atlantic and Gulf states of the continental U.S., with one nesting reported as far north as North Carolina (Schwartz, 1976). In the Atlantic and Caribbean, the largest nesting assemblages occur in the U.S. Virgin Islands, Puerto Rico, and Florida (NMFS, 2006b). No nests of this species have been recorded in Texas for at least 70 years (NPS, 2006); the last two, one from the late 1920s and one from the mid-1930s, were both from Padre Island (Hildebrand, 1982, 1986). Apart from occasional feeding aggregations such as the large one of 100 animals reported by Leary (1957) off Port Aransas in December 1956, or possible concentrations in the Brownsville Eddy in winter (Hildebrand, 1983), leatherbacks are rare along the Texas coast, tending to keep to deeper offshore waters where their primary food source, jellyfish, occurs (NMFS and FWS, 1992). A leatherback, however, was caught by a relocation trawler in a shipping channel approximately 1.5 miles north of Aransas Pass in 2003 (NMFS, 2003). This species is unlikely to occur in the study area.

The State-listed threatened Texas horned lizard (*Phrynosoma cornutum*) occurs throughout the western two-thirds of the state in a variety of habitats, but prefers arid to semi-arid habitats in sandy loam or loamy sand soils that support patchy bunch-grasses, cacti, yucca, and various shrubs (Henke and Fair, 1998; Dixon, 2000). Dixon (2000) shows historic records from Brazoria County; however, because of the limited terrestrial habitat it is unlikely they would occur in the study area.

The State-listed threatened timber rattlesnake (*Crotalus horridus*) typically inhabits dense thickets and brushy areas along the floodplains of major creeks and rivers throughout the eastern third of Texas. It occurs in a variety of habitats including floodplains and riparian areas, swamps, upland pine and deciduous woodlands, abandoned farmland, and limestone bluffs (Werler and Dixon, 2000). This rattlesnake is most active during the summer and fall, with some activity noted in spring and as late as December (Werler and Dixon, 2000). Documented records exist from Brazoria County (Dixon, 2000); however, it is unlikely the species would occur in the study area because of the lack of suitable habitat.

The State-listed threatened smooth greensnake (*Opheodrys vernalis*) is a rare, slender, nonvenomous snake that inhabits open short-grass prairies and meadows in the coastal plains of Austin, Chambers, Harris, and Matagorda counties (Tennant, 1985; Werler and Dixon, 2000). The smooth greensnake is one of the rarest serpents in Texas, known from less than 10 specimens in the aforementioned counties (Werler and Dixon, 2000). The Texas population of the species represents a relict population that is over

500 miles from the closest population in the northern U.S. (Werler and Dixon, 2000). Although Brazoria County is within the general distribution of the species (Dixon, 2000), the species is very rare and is unlikely to occur within the study area in considerable numbers.

3.15.2.4 Fish

The following fish species are not included in Table 3.15-1 because they are considered species of concern or candidate species (those species of concern that are actively being considered for listing as endangered or threatened) and are not currently offered formal protection under the ESA. However, they are included in the discussion below to address fish species considered as potentially in need of protection by the NMFS (2006c).

While the American eel (*Anguilla rostrata*) is not formally listed as threatened or endangered in Texas, it has been identified as a candidate species. This concern stems from general declines in the apparent numbers, which are believed to be largely due to main-stem impoundments on rivers (Haro et al., 2000). The American eel occurs primarily in the Great Lakes and rivers with open access to the Atlantic Ocean and Gulf of Mexico. The American eel is catadromous, spending most of its life in rivers while migrating to the sea to spawn. Spawning occurs in the Sargasso Sea and after spawning, it is thought that the adults die. The young develop while drifting as plankton in the open sea; when they become juveniles (often referred to as "glass eels") they migrate into estuaries to mature. American eels are opportunistic carnivores, feeding on a vast array of animal life depending on the size of the eel and the availability of prey within a given habitat (Van Den Avyle, 1984). In Texas, records include American eels from the Red River to the Rio Grande in most large river systems, however it is unlikely this species will occur in the study area (Hubbs et al., 1991).

The dusky shark (*Carcharhinus obscurus*), also known as the bronze whaler or black whaler, was added to the NMFS species of concern list in 1997. It has a wide-ranging (but patchy) distribution in warm-temperate and tropical continental waters (NMFS, 2006c). It is coastal and pelagic in its distribution where it occurs from the surf zone to well offshore and from surface depths to 400 meters (Compagno, 1984). Because it apparently avoids areas of lower salinities, it is not commonly found in estuaries (Compagno, 1984; Musick et al., 1993). The dusky shark is not likely to occur in the study area.

The largetooth sawfish (*Pristis pristis*) is a sluggish demersal (bottom-dwelling) fish inhabiting near-shore marine, coastal, estuarine, and tidal freshwater habitats. It is listed as a species of concern due to declining stocks in recent decades, thought to be caused by incidental commercial catch and (mainly in inshore areas) habitat degradation (NMFS, 2006c). In the U.S., largetooth sawfish have most commonly been reported in the northern Gulf of Mexico, although records are sporadic. The species is somewhat more common in tropical areas. Since most of the records in the northern Gulf of Mexico are of adults, it is believed that spawning may be confined to more southern waters (McEachran and de Carvalho, 2002). The largetooth sawfish has been rarely reported in the Gulf and is not likely to occur in the study area (Hoese and Moore, 1998).

NMFS designated the night shark (*Carcharhinus signatus*) a species of concern in 1997. Data on this species are minimal because the shark is a deepwater species, exceeding 525 ft in depth. The shark has been reported in waters from Delaware south to Brazil, including the Gulf of Mexico. It has also been reported from West Africa. It was formerly abundant in deep waters off the northern coast of Cuba and the Straits of Florida (NMFS, 2006c). The night shark is not likely to occur in the study area.

NMFS designated the saltmarsh topminnow (*Fundulus jenkinsi*) as a species of concern in 1997. This rare species is restricted to coastal streams and adjacent bay shores on the western side of Galveston Bay and from Vermilion Bay to the Florida Panhandle. Usually found in low salinities, it has been taken from the Chandeleur Islands (Hoese and Moore, 1998). This species tends to live in salt marshes and brackish water, although it has been known to survive in freshwater. This species can also be found in shallow tidal meanders of Spartina marshes (NMFS, 2006c). In Texas, the saltmarsh topminnow is known only from Dickinsons Bayou near Galveston Bay and is not likely to occur in the study area (Hubbs et al., 1991).

The Atlantic and Gulf of Mexico populations of the sand tiger shark (*Odontspis taurus*) were added to the species of concern list in 1997. Sand tiger sharks have a broad inshore distribution. In the western Atlantic, this shark occurs from the Gulf of Maine to Florida, in the northern Gulf of Mexico, in the Bahamas and in Bermuda. Although first reported in Texas in the 1960s, this species does not seem to be uncommon. A cool temperate species, it is more common north of Cape Hatteras (Hoese and Moore, 1998). They are generally coastal, usually found from the surf zone down to depths around 75 ft. However, they may also be found in shallow bays, around coral reefs and to depths of 600 ft on the continental shelf. They usually live near the bottom, but may also be found throughout the water column (NMFS, 2006c). The sand tiger shark is uncommon in the Gulf of Mexico and is not likely to occur in the study area (Hoese and Moore, 1998).

The speckled hind (*Epinephelus drummondhayi*) inhabits warm, moderately deep waters from North Carolina to Cuba, including Bermuda, the Bahamas and the Gulf of Mexico. The preferred habitat is hard bottom reefs in depths ranging from 150 to 300 ft, where the temperatures are from 60 to 85°F. The speckled hind was listed as a species of concern 1997 (NMFS, 2006c). This species is rare in the northwestern Gulf of Mexico and is not likely to occur in the study area (Hoese and Moore, 1998).

The Warsaw grouper (*Epinephelus nigritus*) was listed as a species of concern in 1997. It is a very large fish found on the deepwater reefs of the southeastern United States. Warsaw grouper range from North Carolina to the Florida Keys and throughout much of the Caribbean and Gulf of Mexico to the northern coast of South America. The species inhabits deepwater reefs on the continental shelf break in waters 350 to 650 ft deep. As for all of the candidate species above, the main threat to them has been mortality associated with fishing (NMFS, 2006c). Although Warsaw grouper are not likely to occur in the study area, they have been found near jetties and offshore oil platforms (Hoese and Moore, 1998).

FWS and NMFS listed the Gulf sturgeon (*Acipenser oxyrhinchus desotoi*), a subspecies of the Atlantic sturgeon (*A. oxyrhinchus*), as endangered on 30 September 1991 (56 FR 49653 49658). As with other

sturgeon species, the damming of rivers has been the most significant threat to the Gulf sturgeon (NMFS, 2006b). Dams are now present on all of the major rivers within the gulf sturgeon's range (Pearl, Mississippi, and Alabama rivers), which prevents upstream migration for spawning. Other threats to the species include over-exploitation, incidental catch, dredging activities, the removal of snags, and dredged material placement associated with channel improvements and maintenance (FWS and Gulf States Marine Fisheries Commission [GSMFC], 1995; NMFS, 2006b).

The Gulf sturgeon is anadromous, which means the species breeds in freshwater environments (i.e., river systems), but spends the remainder of the year in marine and estuarine environments. Spawning occurs in the deeper portions of rivers on clean rock or rubble bottoms. Mud and sand bottoms and seagrass communities are likely important marine habitats (FWS and GSMFC, 1995).

The Gulf sturgeon historically ranged along the northeastern Gulf, in major rivers from the Mississippi delta in Louisiana, east to Charlotte Harbor, Florida and in marine waters of the central and eastern Gulf (FWS and GSMFC, 1995; NMFS, 2006b). Its current range extends from Lake Pontchartrain and the Pearl River in Louisiana and Mississippi east to the Suwannee River in Florida. Sporadic records exist from as far west as the Rio Grande River between Texas and Mexico, and as far east and south as Florida Bay. Viable populations exist in the Mississippi, Pearl, Escambia, Yellow, Choctawhatchee, Appachicola, and Suwannee rivers (NMFS, 2006b).

The NMFS has designated critical habitat for the Gulf sturgeon in Gulf rivers and tributaries (68 FR 13370, 19 March 2003). Although 14 critical habitat units have been identified in Florida, Alabama, Mississippi, and Louisiana, no critical habitat has been designated in Texas and, in fact, none is farther west than Lake Pontchartrain near New Orleans. The study area is not within the known historic range of the Gulf sturgeon. Fish are mobile species and frequently occur outside of their normal ranges, but it is unlikely that the species is present in the study area.

3.16 CULTURAL RESOURCES

3.16.1 Cultural Overview

The project area is located in Brazoria County, Texas which is part of the Southeast Texas Archeological Region of the Eastern Planning Region of Texas (Kenmotsu and Perttula, 1993). The cultural history of the project study area has been assigned to four primary developmental stages: Paleoindian, Archaic, Late Prehistoric, and Historic. These divisions generally are believed to reflect changes in subsistence as reflected by the material remains and settlement patterns of the people occupying this portion of Texas in prehistoric and early historic times.

The earliest generally accepted culture of the Americas, the Paleoindian (10,000–6,500 B.C.) appears to have extended over most if not all, of North America by the end of the Pleistocene epoch. It has been hypothesized that in Texas the Pleistocene coastline extended as much as 25 miles into the present Gulf of Mexico, and that rivers cut deep canyons into sediments deposited during previous periods of glaciation

(Aten, 1983). With the close of the Pleistocene came a period of climatic warming and a consequent rise in sea level as surface water was released from glaciers and polar ice. Paleoindian cultural developments in the Gulf Coastal Plain region, as in most areas of North America, appear to have been intimately related to these gradual but vast changes in the world climate and local environmental conditions.

Occupation of the Texas Gulf Coast during the terminal Pleistocene is evidenced by the recovery of several types of well-made, lanceolate, parallel-flaked projectile points such as Scottsbluff, Clovis, Plainview, Angostura, and possibly San Patrice types. The presence of these distinctive projectile point types along the coastal plain appears to reflect activities that would typically have occurred in areas further inland where the environment is characterized by a mixture of deciduous and pine woodlands (Aten, 1983). According to Aten (1983), this type of habitat typically supports low-density human populations. Archaeological evidence synthesized by Story et al. (1990) from numerous counties comprising the greater Gulf Coastal Plain in Texas, Louisiana, Arkansas and Oklahoma supports the suggestion that the Paleoindian groups probably existed in small nuclear families or bands which migrated widely in pursuit of seasonal subsistence resources.

Cultural developments appear to have progressed somewhat beyond those of the Paleoindian period with the onset of the Holocene epoch. Changes in the world climate caused sea levels to rise, inland prairies to expand and regional weather patterns to become more variable (Aten, 1983). Generally, termed the Archaic (7,000 B.C.–A.D. 700) this next period of cultural development in the New World has been further sub-divided into Early, Middle, and Late stages based on changes observed in the archaeological record that appear to coincide with episodic shifts in the Holocene climate and environment. It is commonly thought that human lifestyles and subsistence strategies maintained patterns developed during the previous Paleoindian period, but with some notable differences.

Aten (1983) suggests that Early Archaic groups, like their Paleoindian predecessors, probably continued to migrate seasonally in small bands and relied on a generalized projectile point technology to facilitate their hunting and gathering of a variety of faunal and vegetal foodstuffs. Despite a paucity of intact Archaic components at sites in the upper Texas Gulf Coast region, it has been observed that Archaic lithic technologies appear to show an increased diversity of functional types and styles over those associated with the Paleoindian period. However, the level of craftsmanship and the use of fine exotic materials appear to have declined. In addition, the greater array of Archaic projectile point styles appears to reflect a greater degree of regional cultures. Story et al. (1990) surmise that Archaic period human populations may have become more dense with individual bands covering less overall territory on their seasonal rounds.

Differentiation between Early, Middle, and Late Archaic culture sites in the upper Texas Gulf Coastal region, without the benefit of sufficient associated cultural features and artifacts from which strong chronological dates and sequences can be derived, has been based largely on observation and comparison of projectile point styles associated with more intact archaeological contexts elsewhere in Texas and North America. The assumption has been that similar point styles are probably related chronologically

despite sometimes, vast geographical distances. According to these lines of reasoning, Early Archaic point types are usually considered to include Baird, Bell, Andice, and Wells, whereas Bulverde, Carrollton, and Trinity points are usually attributed to the Middle Archaic stage. Based on a relatively greater database for defining the Late Archaic, point types considered diagnostic of this cultural stage typically include Gary, Kent, Yarbrough, Ellis, Palmillas, and Refugio (Patterson, 1979).

The Late Pre-Ceramic, which coincides, in part, with Late Archaic elsewhere in Texas, extends from the approximate period in which the sea level attained its present state until the advent of ceramic service and storage vessels, ca. A.D. 100 (Aten, 1983). During this period, population increased significantly, marked by an increase in the number of sites as well as intra-site artifact frequencies (Aten, 1983). Hall (1981) has also noted an increase in traumatic death and the development of trade relations with Woodland cultures to the east during the Late Archaic. A settlement system, which may have included a seasonal round with group dispersal in coastal areas during the summer and consolidation in inland areas during the winter months, may have begun during the Late Archaic (Aten, 1983). However, the occurrence of shell middens at Late Archaic sites is not as common as at later sites (Patterson, 1979). Projectile points diagnostic of Late Archaic occupations include Gary, Kent, Yarbrough, Ellis, Palmillas, and Refugio (Patterson, 1979).

The Late Prehistoric, or Ceramic period (700–1519 A.D.) cultures experienced a relatively static environment. This stage lasted from the time when ceramics were adopted until European interaction with the aboriginal populations became firmly established.

The addition of Perdiz and Scallorn arrow points to the inventory marks the beginning of the Late Ceramic period. Ceramics of the earlier period may include Goose Creek Plain, variety Anahuac, O'Neal Plain variety Conway, Mandeville Plain, Tchefuncte Plain, Goose Creek variety unspecified, and Tchefuncte Stamped. In the Late Ceramic period, the ceramic inventory may include San Jacinto Incised and Baytown Plain varieties Phoenix Lake and San Jacinto (Aten, 1983). It should be noted, however, that several varieties of Goose Creek Plain, as well as Goose Creek Incised (and Red-Filmed), and the occurrence of bone tempering, span much of the Ceramic period.

Population during the Late Prehistoric tended to increase until European-introduced disease helped to decimate the aboriginal inhabitants. Patterson (1979) observed an increase in numbers of Late Prehistoric sites, while individual sites exhibit fewer cultural remains. He interprets this as evidence of a more mobile lifestyle.

3.16.2 Native Inhabitants

When Europeans arrived on the northern Texas coast, they encountered two major native groups, the Atakapa and the Karankawa Indians, who occupied separate territories divided approximately at the western shore of Galveston Bay. The Atakapan, speaking a language of the Tunican family, displayed traits closely related to the natives of southwestern Louisiana. The Karankawan groups spoke a language

of the Coahuiltecan family and were more closely related to the Indians further south in Texas and Mexico.

In spite of differences in language and apparent cultural derivation the Atakapa and Karankawa maintained similar cultural patterns (Ricklis, 1996). Both groups were nomadic, although the Atakapa maintained semi-permanent winter villages in the interior. The Atakapa subsisted on shellfish, fish, birds' eggs, wild plants, deer and bear while the Karankawa ate shellfish, turtles, marine and land plants, alligator, deer, bison, bear, and peccary. Conical huts and skin tents served as shelter for the Atakapa while the Karankawa lived in portable windbreak style huts. Atakapan technology included pottery, bows and arrows, dugout canoes, basketry, traps, manos and metates, drums and flutes, wooden bowls and utensils, and grass fiber textiles. The Karankawa also used pottery, basketry, cane weirs, milling stones, drums and whistles, tambourines, lances, clubs, axes, bone tools, and bow and arrows along with dugout canoes propelled by poles. Both groups buried their dead in burial mounds and left refuse middens, primarily shell. Both wore breechcloths and skirts and decorated themselves with tattoos. Both groups were equally unprepared to defend themselves and their cultural traditions from the newly arrived Europeans. By the late eighteenth century, both the Atakapa and Karankawa peoples were in serious decline (Ricklis, 1996).

3.16.3 European Exploration and Colonization

European exploration of the Texas coast began, albeit by accident, in November 1528. Álvar Núñez Cabeza de Vaca was a member of the Narváez expedition that was destined for Pánuco (Tampico), Mexico. Cabeza de Vaca and his men were plagued with misfortune when the expedition departed from Florida in April (Creighton, 1975). While adrift and seeking fresh water, de Vaca's group discovered the mouth of the Brazos River, naming it Los Brazos de Dios, the Arms of God.

French exploration of Texas in the seventeenth century was focused primarily in the Matagorda Bay area. René Robert Cavelier, Sieur de La Salle traversed the Brazos River in 1686, though his journey did not take him to the river's mouth. An unfortunate malady that occurred at this time inspired La Salle to name the river the Rivière Maligne. While crossing the river on a raft, La Salle's servant Dumesnil was pulled into the water by an alligator and killed (Weddle, 1991).

The Spanish conducted preliminary exploration and mapping of the Freeport area in the early eighteenth century. In 1724 Brigadier Pedro de Rivera y Villalón began a three-year-long inspection tour of the 23 military outposts in northern New Spain (Chipman 1992; Weddle 1991). A series of six maps of northern New Spain created by Francisco Alvarez Barriero during the expedition is considered the first attempt at a systematic mapping of Texas (Weddle, 1991). Following this study, the Texas governor was required to conduct an annual surveillance of the coast from Matagorda Bay to the Sabine River (Weddle, 1991).

Captain Carlos Luis Cazorla conducted a survey in 1772 to identify the level of trade between the local tribes and newly established English trading posts. On his return trip he traveled down the Brazos to its entry into the Gulf, near present-day Freeport. He discovered that the stream divided into two channels

with a maze of lagoons. This was the first exploration of the mouth of the Brazos (Weddle, 1992). Ineffectual organization and motivation prevented additional substantial exploration of the Texas coast east of Matagorda Bay. It would not be until the early nineteenth century that successful immigration to the Brazos would be realized.

3.16.4 Early Settlements (1800–1835)

In 1821 the governor of Texas, Antonio Martínez, granted permission to Moses Austin for the creation of Mexican colonies in Texas. After Moses' death later that year his son, Stephen F. Austin, selected the lands for colonization. Austin organized a group of 18 immigrants that landed at the mouth of the Brazos River in late December 1821 (Bugbee, 1899). Though they mistakenly landed at the Brazos River instead of the intended destination of the Colorado River, the group labored for several weeks exploring the immediate area and building seven boats for carrying their supplies upriver. In February, the party journeyed up the Brazos until the first "high land" was sighted. At this site (Velasco), a large log house was erected and preparations were made for planting a corn crop (Bugbee, 1899). Asa Mitchell arrived at the mouth of the Brazos in January 1822 and opened a salt-manufacturing business (Creighton, 1975). He received the title to this land in 1824 and lived in the Velasco area until moving to Washington-on-the-Brazos in 1835, thus becoming possibly the first colonist to settle permanently at the site (Earls et al., 1996).

The advantageous location of Mitchell's land grant, at the juncture of the Brazos River and the Gulf of Mexico, persuaded Austin in 1823 to propose the location as a port. Austin acknowledged, in December of 1835, that Velasco was without a natural harbor and also had a treacherous sand bar at the mouth of the river (Earls et al., 1996). Despite these drawbacks, entrepreneurs encouraged steamboat navigation on the Brazos to cater to the cotton plantations along the river. The establishment of a trading post at Bell's Landing (now East Columbia) by John Richardson Harris in the 1820s encouraged the use of the river for the trade and transportation of commodities. Harris's small schooner, The Rights of Man, may have been the first vessel specially designated for trade between the Brazos River, Galveston Bay, and New Orleans (Earls et al., 1996). The popularity of Velasco as a commercial trade center was superceded by Brazoria, 15 miles upriver, which had been established about five years earlier. In 1833, Mitchell formed a land association with his neighbors William H. Wharton and Branch T. Archer. This collaboration would develop Mitchell's property into a thriving river and seaport (Earls et al., 1996).

Increased immigration into Texas in the 1820s possibly encouraged Mexico to create several military outposts, one of which was established at Velasco in 1831 (Rowe, 1903). Asa Mitchell was commissioned to serve as a boarding officer at Velasco by the fall of that year (Earls et al., 1996). With the establishment of the fort and customshouse at Velasco, the Mexican government attempted to forcibly regulate Brazos River traffic and exert tax and customs control. The conflicts created by these new restrictions culminated at Velasco in 1832. In response to friction between Mexican authority and the colonists, 150 men gathered to attack General Ugartechea at Velasco. The Mexican force commanded by Ugartechea was composed of 91 men. On June 26, three divisions of colonists attacked the fort until

sunrise the following morning (Rowe, 1903). The fort's cannon fired upon the town's structures, destroying all but the customshouse and a small office (Smith, 1910). Surrender was negotiated on June 29th, in which Ugartechea's troops were ordered to withdraw (Rowe, 1903).

Following the battle, Mitchell began to sell portions of his property, possibly to facilitate town rebuilding. In addition to the public sale of lots, the Velasco Association also announced construction of a major hotel to accommodate its many anticipated visitors (Earls et al., 1996). A nationwide cholera epidemic finally touched Velasco in the spring of 1833; only 12 of the 20 townspeople survived (Earls et al., 1996). This tragedy, and a diversion of town resources towards Texas's quest for independence, would quell the building initiative envisioned by the Velasco Association. Their grand designs would not again be revisited until after the conclusion of the Texas Revolution in 1836 (Earls et al., 1996).

3.16.5 Texas War for Independence (1835–1836)

Though Velasco was not a location of direct military engagements after 1832, it was used as a training post for Texas militia. John Sowers Brooks began drilling 250 men in late December 1835 (Roller, 1906). Anticipating a military conflict with Mexico, the abandoned fort at Velasco was refortified with a long 18-pound cannon and several smaller artillery pieces (Earls et al., 1996). Though humble in appearance, the fort was described as the best coastal defense work in Texas in May of 1836 (Pierce, 1969).

Velasco itself did not witness growth during the years of conflict (Earls et al., 1996); however, its location at the mouth of the Brazos River was strategically important to the movement of troops and supplies throughout Texas. The region experienced a marked increase in maritime activity during the Texas Revolution. Quintana, Velasco's competitor on the river's east bank, was also the location for the mercantile house of Thomas McKinney and Samuel Williams. This commercial house is accredited with establishing the first regular steam commerce on the Brazos and served plantation owners such as William Wharton (Puryear and Winfield, 1976). It was also instrumental in providing funds and military supplies for the Texas cause (Miller, 2004). Military supplies for the Texas volunteers were stored in warehouses in Velasco and Quintana (Miller, 2004). Vessels transported supplies and volunteers from New York and New Orleans to both Quintana and Velasco (Brinkley, 1937). These materials were then transshipped to locations such as Galveston, Matagorda, Columbia, and Copano Bay (Brinkley, 1936).

Velasco was homeport to the vessels Invincible, Yellow Stone, and Independence. The schooners Invincible and Independence were both purchased as vessels of the 'privateer' Texas navy organized in 1836 (Barker, 1927; General Council, 1839). The steamboat Yellow Stone was used by Sam Houston to transport troops and supplies across the Brazos River in April 1836 (Hardin, 1992).

The surrender of the Mexican army at San Jacinto was negotiated in the Treaty of Velasco, signed at Velasco on May 14, 1836, by Antonio López de Santa Anna and David G. Burnet, ad interim president of Texas. Santa Anna was forced to stay on the schooner Invincible when Texas troops under Thomas Jefferson Green refused to allow his departure to Veracruz. Santa Anna spent the next several months as a prisoner at Velasco until he was moved to Columbia towards the end of the year (Miller, 2004).

3.16.6 Texas Republic (1836–1845) and Early Statehood (1845–1862)

Following the battle of San Jacinto, ad interim president David G. Burnet selected Velasco as the location for his government offices (Winkler, 1906). Velasco was never able to earn the distinction of being Texas's "first capital," as the seat of government was transferred to Columbia in October 1836 (Pierce, 1969). Brazoria County was subsequently created on December 20, 1836. Velasco, Columbia, and Brazoria were incorporated in June 1837. These first few years of the Texas Republic, from 1836 to 1840, was the greatest period of development for Velasco (Earls et al., 1996).

At the close of the war, and with the resumption of port and customs activities, Velasco received renewed commercial interest. The Velasco Association reorganized and expanded its membership to include such key individuals as Jeremiah Brown and Isaac Hoskins (Earls et al., 1996). The year 1837 was both the height of land sales/building activity in Velasco and the beginning of a boom in port activity. An average of 425 persons arrived annually at Velasco in 1837, 1838, and 1839 (Earls et al., 1996). Velasco additionally had an average of 36 vessels visiting its port annually during the Republic years. The largest number of vessels to anchor at Velasco was 85 in 1838 (Earls et al., 1996).

Velasco's growth and importance as a commercial entity declined with the emergence of Galveston as one of Texas's principal ports. An analysis of commercial activity in 1839 demonstrated that even with Galveston's more-abundant maritime traffic, its export value was nearly matched by Velasco (Earls et al., 1996). Additionally, delayed effects of an economic depression in 1837 would impact the value of property lots, causing them to crash near the end of 1839 (Earls et al., 1996). The economic crash and the effects of reoccurring storms would quash Velasco's continued growth and development as a commercial center.

In an attempt to sustain Velasco's role in trade, a steam vessel, Lafitte, was built in 1840 to run on the Brazos between Velasco, Galveston, and the Sabine River (Earls et al., 1996). The use of the Lafitte for Brazos River shipping was fleeting. In 1842, with renewed hostilities with Mexico, the Lafitte was pressed into Texas government service as she lay at anchor in Galveston Bay (Haviland, 1852). In this same year, Sam Houston spent $9,000–10,000 fortifying the 370-mile Texas coastline at three places: Galveston, Velasco, and Matagorda (Wells, 1960). The effort to reinforce and protect Texas's coast, however, did not prevent the economic demise of Velasco.

The decline in shipping at Velasco, combined with the associated hazards of its riverine access, initiated the overland transportation of goods in this area. In the waning years of the Republic period, Velasco continued to depreciate in both real estate and shipping. A major tropical storm in 1842 dropped Velasco's sea trade to only five vessels in that year (Earls et al., 1996). By the mid-1840s Velasco had digressed from its reputation as "coming city of the Gulf" to a seaside resort and mail stop (Earls et al., 1996).

In spite of the difficulties at Velasco, the Brazos area prospered in cotton and sugar. Planters transported their goods overland and shipped them from Galveston. In the 1850s a proposed intracoastal waterway

between Velasco and Galveston promised to bring more commercial activity to the mouth of the Brazos. With completion of the canal in 1856, sternwheel steamers transported cargoes from Galveston up the Brazos River (Dorchester, 1936). Rather than revitalize maritime commerce in this area, the waterway circumvented trade from Velasco to Galveston (Dorchester, 1936). Planters continued to ship goods down the waterway to Galveston, which as a consequence bolstered the city's now undeniable reputation as a maritime trade center.

3.16.7 American Civil War (1861–1865)

In antebellum Texas, in the region of Houston and Galveston, the farming of cotton and sugarcane was highly profitable (Buenger, 1984). Planters along the Brazos River were increasingly dependent on slave labor. In 1860, 18 of the state's 44 slaveholders resided in Brazoria, Wharton, and Fort Bend Counties (Buenger, 1984). Many of the planters who lived in this region were very wealthy; one-fifth of all Texans with estates valued at over $100,000 were from these three counties. These slaveholders collectively owned more than 100 slaves (Buenger, 1984). The dependence on slave labor created unyielding support for secession, and an overwhelming majority of residents voted in favor of withdrawal from the Union on February 23, 1861 (Buenger, 1984).

Texas itself became important as a source of military supplies for the Trans-Mississippi region of the Confederacy (Barr, 1961). Federal gunboats patrolled the Texas coastline in an effort to blockade strategic waterways such as Galveston Bay and the Sabine River. Forts were erected at Quintana and Velasco (Looscan, 1898). At the outbreak of the Civil War there were only four Federal blockaders operating off the Texas coast (Barr, 1961). In January 1862, the ships Midnight, Arthur, and Rachel Seaman shelled the coastal fortifications at both Aransas Pass and Velasco (Barr, 1961). The fort at Velasco fired upon the vessels with such accuracy that the captain of the Midnight thought the fort was defended by heavy (possibly rifled) guns. The fort had only a single piece of artillery, an 18-pounder (Creighton, 1975).

Following Confederate victories at Galveston and Sabine Pass in 1863 and with Union possession of the southern half of Texas's coast, Confederate forces concentrated on holding Sabine Pass, Galveston, and Velasco at all costs. Velasco itself was so heavily reinforced, with a battery of six 32-pounders, that Federal blockaders never engaged the fort for any great length of time (Barr, 1961). By late 1864 the number of cannon at Velasco had increased to 8, with Galveston having a total of 41 cannons. Blockade-running in Texas had grown to such an extent that by 1865 the blockade squadron off the Texas coast had no fewer than 20 ships (Barr, 1961).

3.16.8 Post-Civil War and Early Industrial Revolution (1865–1910)

With the close of the Civil War and the abolition of slavery, the commercial viability of Velasco and Quintana became greatly depressed. At the end of the nineteenth century Velasco had only a general store and boat-builder's shop. Only 2 of the 20 plantations in Brazoria County were still held by their prewar owners, the rest having been sold or lost to taxes (Earls et al., 1996).

Storms in the late 1860s and early 1870s forced many families to move inland or leave the area altogether. The remaining Velasco lands were sold in 1872 and transferred to the Texas Land Company. With the acquisition of these properties, Velasco ceased to be a municipal entity. The great storm of 1886 and the hurricane that followed in 1887 destroyed any remaining town structures (Earls et al., 1996).

At the urging of W. M. D. Lee, Velasco was redeveloped in order to facilitate the building of a deep-water port at the mouth of the Brazos River. Lee was a Texas cattle baron and oilman. He believed a deep-water port at the mouth of the Brazos was the best way to move his cattle to market (Earls et al., 1996). In February 1888, Lee filed his charter for the Brazos River Channel and Dock Company. When construction began in April 1889, the influx of workers increased the population of Velasco from 50 residents to 700 by the end of the year (Earls et al., 1996). A new location for Velasco was surveyed and laid out in 1891, with the old site becoming the town of Surfside. Surfside was platted as a resort town, and a large beachfront hotel was built to help raise funds for the construction project (Earls et al., 1996). The Galveston hurricane of 1900 destroyed much of the Brazoria County coastline, including the hotel. A second hotel, built on its original site, was destroyed by fire in 1904 (Earls et al., 1996). These successive events destroyed any remaining impetus for the development of commercial enterprise at this location until the founding of Freeport in 1912.

The city of Freeport, Texas, was founded on November 20, 1912, on the west bank of the Brazos River and adjacent to the historic site of Velasco (Freeport Townsite Company, 1912). The Brazos River itself was strategically important for the transportation of needed goods and supplies inland. The importance of this riverine passage to mercantile trade preempted the founding of Freeport, as well as Velasco and historic Quintana.

3.16.9 File and Literature Review

A site file and records review was conducted for the Port Freeport Ship Channel Widening project in Brazoria County. The files at the Texas Archeological Research Laboratory (TARL) and at the Texas Historical Commission (THC) were both examined for the location of recorded terrestrial archaeological sites, listed National Register of Historic Places (NRHP) properties, State Archeological Landmark (SAL) sites, and Texas Historic Markers (THM). The ship wreck files at the THC's State Marine Archeologist Office were also examined for the location of plotted shipwrecks. The results of the file and literature review are presented in the following section.

3.16.10 Previous Investigations

Several previous terrestrial and nautical archaeological investigations have been completed in the area near Freeport, Texas. Those reports that are pertinent to the current project include terrestrial surveys and data recovery, marine magnetometer surveys and diver investigations, and archival research.

Since the 1970s, professional and avocational archaeologists have conducted investigations into the old Velasco (41BO125) and Quintana (41BO135) townsites in southern Brazoria County, Texas, on either

side of the original mouth of the Brazos River. In 1975, Ippolito and Baxter (1976), working for the Texas A&M Research Foundation, conducted an intensive archaeological survey of an area between the Brazos River Diversion Channel and the Freeport Harbor navigation channel for the USACE. One prehistoric site (41BO117) and three historic sites (41BO116, 41BO123, and 41BO125) were recorded. Excavations at site 41BO125, on the east bank of the Old Brazos River channel, revealed a large portion of a circular brick foundation and some smaller rectangular foundations which Ippolito and Baxter (1976) attributed to Fort Velasco. However, additional field work and historic research conducted in 1980 by the Center for Archaeological Research (CAR), at the University of Texas at San Antonio, indicated that these brick foundations were not part of the original Fort Velasco (Fox et al., 1981). CAR's work placed the general site of Fort Velasco within Monument Square, between the USCG Station and Surfside City Hall (Fox et al., 1981).

Since 1981, the Brazosport Archaeological Society has been acquiring surface collections from the old Velasco townsite for the Brazosport Museum of Science (Earls et al., 1996). During the latter part of 1992 and early 1993, Prewitt and Associates, Inc., conducted site testing and data recovery at the old Velasco townsite (41BO125) for the USACE (Earls et al., 1996). Over 400 features were documented, ranging from postholes to structures. The majority of a large artifact assemblage recovered from the site supports an 1830–1840s habitation date. The final report on this work contributes greatly to knowledge of the early habitation period in this area.

The USACE conducted a study in 1975 to identify historical and archaeological sites within Freeport Harbor (USACE, 1975). They found two sites of historical interest, including the Quintana Cemetery, which dates to 1822 and is located on Quintana Point, on the southern side of the mouth of the Brazos; and the site of the battle of Velasco in 1832, located near present-day Surfside. Neither of these sites was considered to be in danger of being affected by maintenance to the navigation channel. They also found no previously recorded archaeological sites in the project area (USACE, 1975).

Following the USACE's 1975 report, a survey to locate magnetic anomalies in Freeport Harbor was conducted. Offshore investigations of the area were initially reconnoitered by Odom Offshore Surveys, Inc. in 1978 (Odom, 1978) and completed by Fairfield Industries in 1979 (Fairfield, 1978). Based on the magnetic data Odom and Fairfield collected, the NPS conducted a two-day submerged cultural resources assessment, which revealed the wreck of a modern vessel north of the jetties (Murphy and Lenihan, 1980). Following this initial submerged investigation, the Texas A&M Cultural Resources Laboratory conducted additional submerged cultural resources evaluations, investigating six magnetic anomaly clusters, which revealed only modern cultural debris (Bond, 1980). An additional underwater investigation of five anomaly clusters was completed by the Archaeology Program of the Institute of Applied Sciences, North Texas State University and Texas A&M University's (TAMU) Department of Nautical Archaeology in 1981. The resulting report (Hays, 1981) indicates that none of the anomaly clusters represented sites of potential cultural significance.

In the mid-1980s, Espey, Huston & Associates, Inc. (EH&A, now PBS&J) conducted a cultural resources records search for potentially significant offshore resources adjacent to Freeport, Texas. This study was conducted under contract with the USACE to locate any previously documented cultural resources potentially impacted by the designation of a proposed site for the disposal of material associated with the construction and maintenance of the Freeport Harbor and Jetty Channels. They searched the records held by the Texas Antiquities Committee (now the THC), finding 22 historically significant sites near the proposed disposal area (EH&A, 1987). According to the EH&A (1987) EIS, the areas near the historically significant sites were excluded from the potential selection area for the ODMDS.

During the construction of a rock jetty, as part of the Freeport Harbor Project, the remains of a shipwreck were discovered. This shipwreck was initially investigated by Floyd in August 1988, and again more extensively later that same year. The wreck was identified as the General C.B. Comstock, and was documented and removed in order for the construction of the jetty to be complete (James et al., 1991).

Between 1996 and 1997 EH&A conducted a reconnaissance-level archival study to locate sites of potential historical significance along the GIWW between High Island, Texas, and the Brazos River Floodgate. They identified 194 properties of potential significance, 50 of which are within the vicinity of the current project area. These properties range from graveyards to historic buildings, forts, bridges, and shipwrecks (Hoyt et al., 1999).

Also in 1999 PBS&J evaluated historical sites, both terrestrial and nautical, in relation to proposed channel modifications along the GIWW (Hoyt et al., 1999). Thirteen shipwrecks were identified in the report, lying between Oyster Creek and the Brazos River. Eight of these shipwrecks are located in or near the survey area. The locations for all the shipwrecks in this study were drawn from historical and archival sources.

3.17 LAND USE/RECREATION/AESTHETICS

3.17.1 Land Use

Brazoria County lies in the Coastal Bend region of Texas. Land use within the area consists of agricultural land, industrial land, urban-residential and urban-commercial land, recreational land and facilities, and marshlands. Water use includes mineral production, commercial and sport fishing, recreation, and transportation.

In Brazoria County, agriculture has historically been, and continues to be, an important part of the economy. Approximately 61% of the land is used for agriculture, with 41% used for range and pastureland and the remaining 20% cultivated (NRCS, 2000). Within Brazoria County, only about 14% of land use is considered urban. According to the U.S. Department of Agriculture (USDA) 2002 Census of Agriculture, Brazoria County had 2,455 farms in 2002, up 8% from 1997, and had approximately 614,000 acres of land in farms. In 2002, the market value of production for Brazoria County was

$47,422,000 with crop sales accounting for 52% and livestock sales accounting for the remaining 48% (USDA, 2002).

The study area (Brazoria County) encompasses Freeport Harbor Channel, the GIWW to the north, Surfside Beach to the east (including Jetty Park and public beaches), open lands (including extensive nonforested wetlands) to the northwest, wetlands and open lands to the southwest, and the Village of Quintana, which includes a scattering of residential properties, Quintana Beach County Park, bird sanctuaries and open lands to the south and east on Quintana Island. Along the southeastern portion of the study area is the Gulf of Mexico (Figure 3.17-1).

The Port of Freeport is located northwest of Quintana and Surfside Beach and currently comprises 186 acres of developed land and 7,723 acres of undeveloped land (Port Freeport, 2006). There are various facilities along the channel including the Exxon Quintana Station and PF&T Quintana Terminal to the west, and Dow Chemical Plant to the north. All parcels are accessible by water, highway and rail.

Included in the project area are residences, parks, civic buildings, and other businesses such as restaurants and night clubs. To the south of the GIWW (which parallels the Gulf of Mexico), land uses consist primarily of single-family homes, condos, and a few businesses. The Quintana Beach Park is located southwest of the channel with access to the Gulf of Mexico. A USCG station is located along the channel in the northeast portion of the project area.

3.17.2 Transportation

There is direct access to the GIWW and the Freeport Harbor utilizing FM 523, State Highway (SH) 36, SH 288, and SH 332 with rail service provided by the Union Pacific Railroad (UPRR). Surface transportation in the vicinity of Freeport is provided by a network of primary, secondary, and local roads. SH 288 is the primary land route connecting the Freeport area with the Houston metropolitan area, approximately 50 miles to the north. Primary access to the Village of Quintana from Freeport is via SH 288 and FM 523 from Oyster Creek to the northeast. Once across the GIWW, service to the Village of Quintana is provided by various local streets including Quintana Road and 2nd Street with access to the Freeport Harbor Channel. Access to Surfside Beach from Freeport is via SH 332 and FM 523 from Oyster Creek to the north. Once across the GIWW, service to Surfside Beach is provided by various local streets, including Fort Velasco Drive and Parkview Road, which provide access to the channel.

Rail transportation is integral to the operations of Port Freeport and numerous industrial sites located along the Freeport Harbor Channel. The UPRR provides direct service to facilities located along Brazos Harbor. There are approximately 50,000 railcar transits per year at Port Freeport (Port Freeport, 2006).

3.17.3 Community Services

Brazoria County has a well developed infrastructure to provide health, police, fire, emergency, and social services within the study area. A wide range of public services and facilities are offered at different

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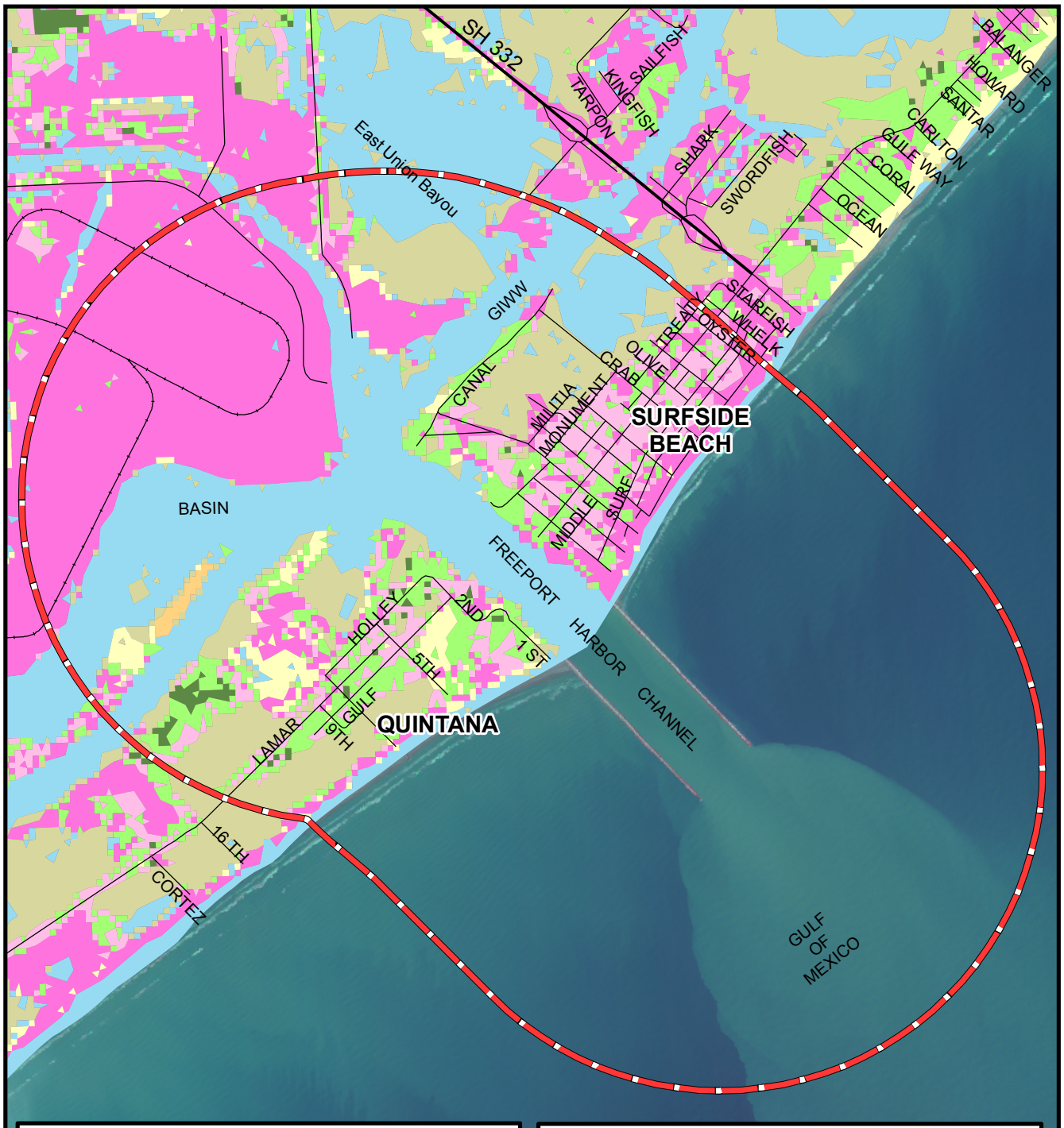

PBSJ
6504 Bridge Point Pkwy, Ste. 200
Austin, Texas 78730
Phone: (512) 329-8342 Fax: (512) 327-2453

Figure 3.17-1
Land Use - Freeport Channel

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Job No.: 441591.00	Scale: 1:30,000
Prepared by: EMons/APugh	Date: 08/30/2006
File: N:/44159100/Projects/3_17_1_LandUse.mxd	

Legend

- Land Use Study Area
- Agricultural
- Bare or Transitional
- Grassland
- High Intensity Developed
- Low Intensity Developed
- Non-Woody Wetland
- Open Water
- Woody Land
- Woody Wetland

N W E S

2,500 1,250 0 2,500
Feet

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locations from the local communities of Surfside Beach, the City of Freeport, Quintana Beach, and the Lake Jackson/Clute area. The regional provider of hospital and healthcare services is the Brazosport Memorial Hospital. Professional services are found in the larger communities of Freeport and Lake Jackson. All areas of the county are served by the Brazoria County Sheriff's Department and the Texas Department of Safety. Individual communities are served by police or marshals. All departments have regular 24-hour patrols.

Fire protection within the study area is provided by the Freeport Fire Department. The Freeport Fire Department is a "Combination Department" in that it has ten full-time employees and 19 reserve members (Stanford, 2006). The assigned service area for fire protection includes the Village of Quintana, by an annual contract, and coverage for Surfside Beach. The service area includes approximately 175 square miles, of which 20 square miles is located within the city limits of the City of Freeport. The department operates out of two stations with one station on each side of the city and an additional station utilized primarily for storage of excess equipment. The department has three class "A" pumpers; two command vehicles; one beach rescue vehicle; one water tanker truck; one crew cab flat-bed utility truck; one 5-ton crew cab utility truck with one 36-ft enclosed fifth wheel trailer, which contains a high-pressure breathing air system and hazardous material equipment; three ambulance units; one 55-ft snorkel elevated water fire truck; two fire boats, with an additional class "A" pumper, and an ambulance to be added in 2006.

The Freeport Fire & Emergency Medical Service (EMS) Department currently provides EMS service to City of Freeport, Village of Quintana, and Surfside Beach. In 2006, Surfside Beach will provide emergency services through the Surfside Beach Police Department with one full-time employee, one part-time employee and volunteers (*The Alliance*, 2006a). Surfside will be capable of providing their own EMS; however, the Freeport Fire & EMS Department will continue to provide backup for Surfside Beach (Stanford, 2006).

Law enforcement within the study area is served by both state and local departments. The Texas Highway Patrol, a service of the Texas Department of Public Safety's Traffic Law Enforcement Division, maintains an office in Angleton. The Brazoria County Sheriff's office and the Texas Highway Patrol serve the highways in unincorporated areas of Brazoria County. Within the incorporated area of Brazoria County, the cities of Freeport, Quintana, Oyster Creek, and Surfside Beach all provide police protection.

The Brazosport Independent School District has schools within the communities of Freeport, Oyster Creek, Quintana, and Surfside Beach. The District includes 19 campuses, encompassing 11 elementary schools, 2 middle schools, 3 intermediate schools, 2 high schools, and an alternative placement center (Brazosport ISD, 2006). Higher education is available through the Brazosport College campus located in Lake Jackson. It is convenient to all towns and cities in South Brazoria County and offers a broad range of courses and classes to address diverse educational goals. Students planning to pursue a bachelor's degree can enroll in introductory academic classes, as well as courses in sixteen majors, which transfer to four-year schools (Brazosport College, 2006).

Within Brazoria County, a variety of entities provide electric utility, natural gas, water, wastewater, and solid waste disposal services. These services are summarized in Table 3.17-1.

TABLE 3.17-1

PUBLIC SERVICES AND UTILITIES FOR STUDY AREA, 2005

	Electric Utility Service	Natural Gas Service	Water	Wastewater	Solid Waste Disposal Service
City of Freeport	Reliant	Center Point Energy	City of Freeport	City of Freeport	City of Freeport
Village of Quintana	Reliant	Center Point Energy	Village of Quintana	Individual Septic System	IESI Solid Waste Management
Surfside Beach	TXU	none	Surfside Beach	Surfside Beach	Surfside Beach
Oyster Creek	TXU	none	Oyster Creek	Oyster Creek	Oyster Creek

Source: City of Freeport, 2006; Reliant Energy, 2006; Center Point Energy, 2006; IESI, 2006.

3.17.4 Aesthetics

The term aesthetics deals with the subjective perception of natural beauty in a landscape by attempting to define and measure an area's scenic qualities. Consideration of the visual environment includes a determination of aesthetic values (where the major potential effect of a project on the resource is considered visual) and recreational values (where the location of a proposed project could potentially affect the scenic enjoyment of the area). Aesthetic values considered in this study, which combine to give an area its aesthetic identity, include:

- topographical variation (hills, valleys, etc.)
- prominence of water in the landscape (rivers, lakes, etc.)
- vegetation variety (woodlands, meadows, etc.)
- diversity of scenic elements
- degree of human development or alteration
- overall uniqueness of the scenic environment compared to the larger region

The study area consists of a variety of terrain characterized by varying levels of aesthetic quality. The topography of the area is mostly flat to gently rolling, with very few outstanding elevational changes. However, the study area consists mostly of open-water areas. Landscapes with water as a major element are generally considered visually pleasing, and this is the case for recreational land adjacent to these water features. However, the study area has also seen widespread urban development which can detract or add, depending on the type and scale, to the overall aesthetic quality. The study area includes a variety of land uses, including shoreline residential development, commercial development, public and private marinas, parkland, relatively undisturbed natural areas, fishing and tourism related businesses, civic uses, transportation systems (highways and railways), port facilities, and heavy industry areas.

Generally, these areas are considered to be visually pleasing, with the exception of industrial and port facilities located along the Freeport Harbor. However, generally speaking, the area is distinguished in aesthetic quality from other adjacent areas within the region that lack the vast water bodies of the study area and many of the outdoor recreational amenities. The landscape exhibits a generally moderate to high level of impact from human activities. No designated scenic views or scenic roadways were identified from the literature review or from field reconnaissance of the study area.

3.17.5 Future Development and Development Restrictions

There are approximately 8,000 acres of land adjacent to the Gulf of Mexico available for future development of the Port of Freeport. Future expansion of the Port of Freeport includes a LNG facility (under construction), construction of new berths, and the building of a transit shed. A significant development known to the BRHND is the construction of a $750 million facility to receive and store LNG, convert the product back to a gas and transport it to commercial and industrial users via pipeline. The project is expected to be completed in three years and is expected to generate increased funding for the Port and provide facilities for the local petrochemical industry. The District also plans to construct three 1,200 ft berths; which would begin with the construction of one 800-ft section in 2006. In addition, the District has begun engineering design for Transit Shed 6 adjacent to Dock 5. The 125,000-square ft facility would include rail service and may attract new business to the Port (Port Freeport, 2006).

Throughout Brazoria County, future projects include expansion of highways, new schools, new businesses, and improvements to water and sewer projects in communities such as Surfside Beach. Big industrial employers, including Freeport LNG, BASF, Dow Chemical, and Conoco Phillips will expand with major projects. Freeport will become BASF's Corporation's manufacturing base for nylon intermediates and polymers in North America with a new plant to be constructed on-site in 2007 (*The Alliance*, 2005a). Food companies such as GrupoSOS will begin construction of the first phase of their $200 million expansion (*The Alliance*, 2006b).

Future development in Surfside includes a proposed 9-acre, 400-slip, dry dock marina that would be located off of SH 332. The marina would cater to the sport fishing and yacht community and would include a restaurant, retail shops, showers, and a laundry facility. In addition, the Surfside marina would have 17-ft deep water and two helipads (*The Alliance*, 2006c). In addition to the proposed marina in Surfside, Freeport has plans for a marina to be built on the Old Brazos River which would potentially attract restaurants and hotels around the site.

Enhancements to highway and rail capabilities in the area will include widening SH 36 from two lanes to four lanes to facilitate hurricane evacuations, passenger, and freight movement. There will also be improvements made to SH 288, the main direct north-south route between Freeport and Houston. Enhancements to rail capabilities will include replacement of a rail bridge over the old Brazos River channel in downtown Freeport to serve increasing cargo volumes from Port Freeport (*The Alliance*, 2006d).

3.18 SOCIOECONOMIC RESOURCES

This section presents a summary of economic and demographic characteristics of the study area. The scope of this review includes both county level research and census tract level research (Figure 3.18-1). Population, employment, the area economy, a historical perspective of economic development, and Environmental Justice (EJ) are key areas of discussion.

3.18.1 Population

The proposed project involves improvements to the existing Freeport Harbor Channel. The study area includes Brazoria County as well as City of Freeport, Oyster Creek City, Town of Quintana, and Surfside Beach. Vessels enter the Freeport Harbor Channel southeast of Freeport, immediately passing southeast of Quintana, northwest of Surfside Beach continuing along the Freeport Harbor Channel eastward towards Brazos Harbor. The channel extends north into the Freeport Harbor where it parallels the City of Freeport shoreline.

The proposed project is located in Brazoria County with a 2000 population of 241,767 persons. Brazoria County maintained steady growth, increasing by 13% between 1980 and 1990 and by 26% between 1990 and 2000 (Table 3.18-1). The City of Freeport, population 12,717, is located on the north side of Freeport Bay and Oyster Creek (population 1,200), borders the northeastern part of the project area, while Quintana (population 44) and Surfside Beach (population 764) comprise the southern portion of the project area.

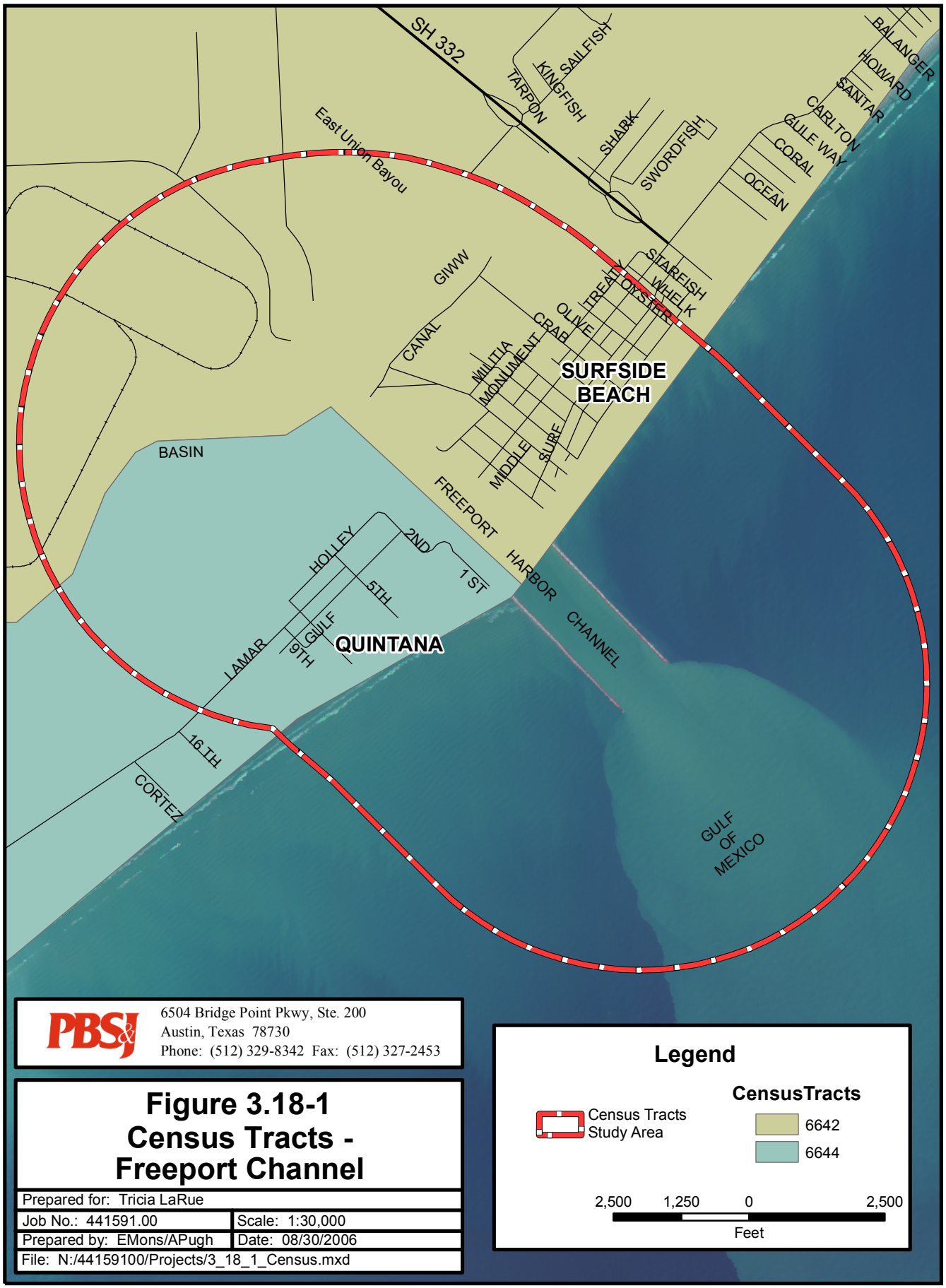
TABLE 3.18.1

POPULATION TRENDS 1980–2000

	Population			Percent Change		
Place	1980	1990	2000	1980–1990	1990–2000	1980–2000
Brazoria County	169,587	191,707	241,767	13%	26%	43%
State of Texas	14,225,513	16,986,510	20,851,820	19%	23%	47%

Source: U.S. Census Bureau, 1990, 2000a.

As shown in Table 3.18-2, population projections provided by the Texas State Data Center (TSDC) indicate that growth in Brazoria County is expected to grow at a faster rate as compared to state growth rates through 2040. Brazoria County is projected to grow 78% from 2000 to 2040 while the State of Texas is projected to grow 72% during the same time.



PBSJ
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Figure 3.18-1
Census Tracts - Freeport Channel

Prepared for: Tricia LaRue	
Job No.: 441591.00	Scale: 1:30,000
Prepared by: EMons/APugh	Date: 08/30/2006
File: N:/44159100/Projects/3_18_1_Census.mxd	

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TABLE 3.18.2

POPULATION PROJECTIONS 2000–2030

Place	Population					Percent Change			
	2000	2010	2020	2030	2040	2000–2010	2020–2030	2030–2040	2000–2040
Brazoria County	241,767	287,859	336,321	384,104	430,456	19%	17%	12%	78%
State of Texas	20,851,820	24,330,643	28,005,792	31,830,579	35,761,159	17%	14%	12%	72%

Source: TSDC, 2004.

3.18.2 Population Demographics

This section provides an assessment of various population demographics. Provided below is information collected for the following categories: family households, household tenure, average per capita income, average median household incomes, and poverty levels.

The U.S. Census Bureau classification of "family households" (homes that are occupied by a family) is the dominant form of household composition in the study area (Table 3.18-3). Households categorized as married-couple family households in the City of Freeport represent 74%, followed by 69% for Oyster Creek. The communities of Quintana and Surfside are similar with 55% and 56%, respectively.

TABLE 3.18.3

HOUSEHOLD COMPOSITION, 2000

Area	Number of Households	Family Households	% Family Households	Nonfamily Households	% Nonfamily Households	Average Household Size	Average Family Size
CT 6642	966	603	62	363	38	2.34	2.84
CT 6644	2,320	1.766	76	554	24	3.06	3.57
Freeport	4,163	3,099	74%	1,064	26%	3.05	3.59
Oyster Creek	440	304	69%	136	31%	2.64	3.14
Quintana	20	11	55%	9	45%	1.90	2.18
Surfside Beach	352	197	56%	155	44%	2.15	2.68
Brazoria County	81,954	63,128	77%	18,826	23%	2.82	3.23
State of Texas	7,393,354	5,247,794	71%	2,145,560	29%	2.74	3.28

Source: U.S. Census Bureau, 2000b.

As reported in the Texas Housing Affordability Index (TAMU, 2005a), defined as the ratio of median family income to the income required to qualify for an 80%, fixed-rate mortgage to purchase the median-priced home, the affordability index in Brazoria County has increased from 2.63 in 1999 to 3.55 in 2004. The average price from January 1990 to January 2005 has increased from $61,400 to $125,200 with the median price increasing from $56,200 to $98,000 during the same time (TAMU, 2005b).

"Household tenure" is a category that distinguishes between owner-occupied housing units and renter-occupied housing units. The 2000 census data within the study area shows that owner-occupied housing units are more abundant in Brazoria County and the State of Texas with 26% and 36%, respectively than renter occupied units in the study area, except for Quintana (Table 3.18-4).

TABLE 3.18.4

STUDY AREA HOUSEHOLD TENURE, 2000

Area	# Occupied Housing Units	Owner Occupied Units	% Owner Occupied Units	Renter Occupied Units	% Renter Occupied Units
CT 6642	960	639	67	321	33
CT 6664	2,317	1,415	61	902	39
Oyster Creek	440	300	68%	140	32%
Quintana	20	10	50%	10	50%
Surfside Beach	352	207	59%	145	41%
Brazoria County	81,954	60,674	74%	21,280	26%
State of Texas	7,393,354	4,716,959	64%	2,676,395	36%

Source: U.S. Census Bureau, 2000b.

Table 3.18-5 shows the age characteristics for the study area. Relative to the state, the study area population generally had higher percentages of the population within the following age cohorts: 5 and under (9.6%), 5 to 14 (19.2%), and 15 to 19 (8.7%). The study area population generally had lower proportions than the state for the following age cohorts: 20 to 34 (21.4%), 35 to 49 (21%), 50 to 64 (11.5%), and 65 and over with 8.5%.

TABLE 3.18-5

AGE CHARACTERISTICS OF THE STUDY AREA, 2000 (YEARS OF AGE)

Place	Under 5	5 to 14	15 to 19	20 to 34	35 to 49	50 to 64	65 and over	Total Persons
CT 6642 BG 3	40	94	40	141	263	195	99	872
CT 6644 BG 6	115	219	128	268	268	171	162	1,331
Freeport	1,274	2,552	1,143	2,791	2,572	1,346	1,030	12,708
Oyster Creek	103	189	95	227	268	182	128	1,192
Quintana	0	3	2	4	14	9	6	38
Surfside Beach	35	83	37	127	237	160	84	763
Brazoria County	18,708	38,625	18,592	48,856	62,009	33,647	21,330	241,767
State of Texas	1,624,628	3,285,376	1,636,232	4,701,487	4,738,416	2,579,338	2,286,343	20,851,820

Source: U.S. Census Bureau, 2000b.
BG = Block Group; CT = Census Tract.

The study area median household incomes in 1999 ranged from the lowest ($25,500) in Quintana to the highest ($37,778) in Surfside Beach (Table 3.18-6). Poverty levels were also examined in the study area. The percentage of persons living below the poverty line in 1999 ranged from 12.6% of the population in Surfside Beach to 22.9% of the population in Freeport.

TABLE 3.18-6

INCOME CHARACTERISTICS OF THE STUDY AREA, 2000

Place	Number of Persons	Per Capita Income	Median Household Income	Number Below Poverty	Percent Below Poverty
CT 6642 BG 3	872	$26,362	$42,308	97	11.3
CT 6644 BG 6	1,267	$18,205	$22,425	323	25.5
Freeport	12,717	$12,426	$30,245	2,896	22.9
Oyster Creek	1,200	$15,000	$35,144	225	19.2
Quintana	44	$15,900	$25,500	8	18.2
Surfside Beach	764	$24,081	$37,778	94	12.6
Brazoria County	241,767	$20,021	$48,632	23,465	10.2
State of Texas	20,851,820	$19,617	$39,927	3,117,609	15.4

Source: U.S. Census Bureau, 2000b.

As shown in Table 3.18-6, poverty levels for the study area, with the exception of Surfside Beach, were relatively high in comparison to the State of Texas (15.4%).

Table 3.18-7 shows the educational attainment of persons within the study area and the State of Texas. Generally speaking, the study area has a higher percentage of persons that attended high school but did not receive a diploma than the state. The study area has a lower percentage of persons with an Associates Degree, Bachelor's Degree or graduate or professional degree than the state with the exception of Surfside Beach for persons with an Associates Degree (5.4%).

TABLE 3.18-7

EDUCATIONAL ATTAINMENT OF THE STUDY AREA, 2000

Place	Less than 9th Grade	9th to 12th Grade, no Diploma	High School Graduate	Some College	Associates Degree	Bachelor's Degree	Graduate or Professional Degree
Freeport	22.6 %	22.3 %	28.0 %	18.3 %	3.4 %	3.3 %	2.1 %
Oyster Creek	8.9 %	24.8 %	35.2 %	21.5 %	4.5 %	3.1 %	1.9 %
Quintana	18.2 %	27.3 %	15.9 %	38.6 %	0.0 %	0.0 %	0.0 %
Surfside Beach	2.3 %	17.0 %	27.7 %	32.3 %	5.4 %	8.4 %	6.8 %
Brazoria County	7.8 %	12.6 %	27.2 %	25.8%	6.9 %	13.8 %	5.9 %
State of Texas	11.5 %	12.9 %	24.8 %	22.4 %	5.2 %	15.6 %	7.6 %

Source: U.S. Census Bureau, 2000b.

3.18.3 Employment

According to the Texas Workforce Commission (TWC), the largest percentages of jobs in Brazoria County are within Manufacturing, Trade, Transportation and Utilities, and Leisure and Hospitality service sectors. First quarter employment in 2001 had a total of 59,998 persons employed in Brazoria County, of

which, 29% were employed in manufacturing, 22% in trade, transportation and utilities, followed by 18% in construction. The workforce increased 0.4% from 2001 to 2003 with a total of 60,225 persons employed in Brazoria County. The top three employment sectors for the first quarter were trade, transportation and utilities (23%), manufacturing (21%) and construction, with 17%. The workforce grew 1.6% from 2003 to 2005 with 61,159 employed in the first quarter of 2005. The top three employment sectors were trade, transportation and utilities, with 23%, followed by manufacturing and construction with 18%. During the same period, the unemployment rate increased from 5.1% in 2001 to 7.3% in 2003 (TWC, 2005).

Table 3.18-8 shows the class of worker within the study area. According to the U.S. Census Bureau 2000 data, the study area is similar to the State of Texas when looking at the percentage of private wage and salary workers and has a slightly lower percentage of government workers. Quintana has a much higher percentage of self-employed workers while Freeport has a lower percentage of self-employed workers when compared to the county and state.

TABLE 3.18-8

CLASS OF WORKER IN THE STUDY AREA, 2000

Place	Private Wage and Salary Workers	Government Workers	Self-employed Workers (not incorporated business)	Unpaid Family Workers
Freeport	83.7 %	10.5 %	4.7 %	1.0 %
Oyster Creek	79.7 %	12.2 %	8.1 %	0.0 %
Quintana	76.9 %	0.0 %	23.1 %	0.0 %
Surfside Beach	77.1 %	10.9 %	10.9 %	1.2 %
Brazoria County	79.0 %	14.6 %	6.0 %	0.3 %
State of Texas	78.0 %	14.6 %	7.1 %	0.3 %

Source: U.S. Census Bureau, 2000b.

Approximately 26,000 Texas jobs are related to the activity within the BRHND. Approximately 8,100 jobs are directly generated by cargo and vessel activity in the Port, with Brazoria County residents holding 77% of those jobs. Table 3.18-9 provides a list of the top 20 major employers within the Freeport area. The top employers are primarily oil industry/port-related enterprises, healthcare, government, and retail industries.

TABLE 3.18-9

STUDY AREA MAJOR EMPLOYERS, 2004

Top 20 Study Area Employers	Number of Employees
Dow Chemical USA (TX Operations)	5,000
U.S. Contractors	2,000 – 4,000
Tx. Dept. of Criminal Justice	2,575
Brazosport ISD	1,800
Phillips 66 Company	1,356
Brazoria County Government	1,156

TABLE 3.18-9 (Cont'd)

Top 20 Study Area Employers	Number of Employees
Gulf States	838
BASF	800
Amoco Chemical	750
Monsanto	630
Benchmark Electronic	575
Wal-Mart	510
Brazosport Memorial Hospital	486
Oxy-Chem, Inc.	464
Kroger	350
Mallinckrodt Medical	165
Shintech	158
American Rice, Inc.	150
Rhone-Poulenc	150
U.S. Postal Service	140

Source: City of Freeport, 2004.

Table 3.18-10 shows the place of work for workers in the study area. The study area percentages are similar to the State of Texas when comparing working within the state of residence; however, the block groups and cities within the study area had a much higher percentages of persons that work within the county of residence when compared to the county or state. Only the City of Freeport is similar to the state when comparing working within the place of residence. Generally speaking, the block groups and cities within the study area has a higher percentage of persons working outside their place of residence while working within their county of residence.

TABLE 3.18-10

PLACE OF WORK FOR WORKERS IN THE STUDY AREA, 2000

Place	Work in State of Residence	Work Outside State of Residence	Work in County of Residence	Work Outside County of Residence	Work in Place of Residence	Work Outside Place of Residence
Freeport	96.8 %	3.2 %	89.7 %	7.1 %	40.2 %	59.8 %
CT 6642 BG 3	99.2%	0.8%	99.2%	20.0%	16%	84.0
CT 6644 BG 6	100%	0%	97.9%	2.1%	39.3%	60.7%
Oyster Creek	99.4 %	0.6 %	90.3 %	9.2 %	9.9 %	90.1 %
Quintana	100.0 %	0.0 %	100.0 %	0.0 %	23.0 %	76.9 %
Surfside Beach	99.0 %	1.0 %	78.5 %	20.6 %	16.0 %	84.0 %
Brazoria County	99.1 %	0.9 %	59.7 %	39.4 %	16.2 %	50.2 %
State of Texas	99.0 %	1.0 %	78.6 %	20.4 %	44.3 %	35.6%

Source: U.S. Census Bureau, 2000b.

As shown in Table 3.18-11, workers that live in Quintana have a longer travel time to work with more than 77% traveling 15 minutes or more. Workers in the City of Freeport have the least amount of travel time to work within the study area and when compared to the State of Texas.

TABLE 3.18-11

TRAVEL TIME TO WORK IN THE STUDY AREA, 2000

Place	Worked at Home	Less than 5 Minutes	5 to 15 Minutes	15 to 25 Minutes	25 to 45 Minutes	45 Minutes or More
CT 6642 BG 3	3.5%	7.5%	17.1%	31.8%	18.1%	25.5%
CT 6644 BG 6	0%	0%	56.1%	33.5%	7.4%	2.9%
Freeport	0.7 %	4.7 %	42.3 %	28.0 %	13.6 %	10.7 %
Oyster Creek	4.5 %	1.9 %	33.1 %	33.0 %	17.0 %	10.5 %
Quintana	0.0 %	0.0 %	23.1 %	53.8 %	0.0 %	23.1 %
Surfside Beach	2.2 %	6.7 %	20.1 %	33.7 %	15.6 %	21.7 %
Brazoria County	2.2 %	2.7 %	21.7 %	26.1 %	28.2 %	19.1 %
State of Texas	2.8 %	3.0 %	24.7 %	30.0 %	25.0 %	14.5 %

Source: U.S. Census Bureau, 2000b.

3.18.4 Economics

3.18.4.1 Historical Perspective

The Port Freeport area has been an important trade and shipping area since the nineteenth century. The navigation of the Port of Freeport began as early as 1821, when Stephen F. Austin chose the mouth of the Brazos River as a location for development of a deepwater port. In 1889, Congress authorized the Brazos River and Dock Company to construct a navigable channel between the mouth of the Brazos River and the Gulf of Mexico (BRHND, 2004).

The first dock and terminal facilities were constructed in the early 1950's and by 1961 the channel was dredged to a depth of 36 ft. Since that time, additional land has been purchased and developed for deepening and widening of the jetty system, construction of additional office and warehouse space, and numerous infrastructure improvements. The Port of Freeport was authorized in 1988 to accept, operate and maintain a Foreign-Trade Zone within its boundaries (BRHND, 2004).

On November 17, 1986, President Reagan signed "The Water Resources Development Act of 1986" which authorized the Freeport Harbor, Texas, 45-Ft Project. The project included the construction of the Surfside Jetty Park Complex. In 1999, the main entrance was rebuilt and widened and in 2000, the Deep Berthing Area was dredged to a depth of 70 ft (BRHND, 2004).

To diversify the Port's cargo base, in 2004, the Port has began major projects that include: a cool storage facility to handle temperature-sensitive commodities; construction of Berth 7, to accommodate vessels up to 48-ft draft; and the signing of a land lease agreement with Freeport LNG to facilitate the construction

of a liquefied natural gas receiving facility. These projects are in addition to multiple existing warehouses, transit sheds, dock facilities, and terminals (BRHND, 2004).

3.18.4.2 Current Regional Economics

The economy of Brazoria County and the Port of Freeport area is broadly based in manufacturing, agriculture, and fishing. The primary economic bases of the county include chemical manufacturing, petroleum processing, offshore production maintenance services, biochemical and electronic industries, commercial fishing and agriculture. The deep-water channel and port facilities, sports fishing services and tourism are major components of the county's economic base (BRHND, 2004).

Port of Freeport handles large volumes of commodities including petroleum products, agricultural products, and general cargo including animal feed, synthetic rubber, and automobiles (BRHND, 2004). The Port is ranked 16th in U.S. foreign tonnage and 12th in the U.S. in total tonnage (Texas Explorer, 2006; *The Alliance*, 2005b). Top import countries include Guatemala, Honduras, and Mexico and top export countries include Brazil, Honduras, Saudi Arabia, and the Dominican Republic, as well as various countries within Africa (Texas Explorer, 2006). As stated in the Comprehensive Annual Financial Report for the Port of Freeport (BRHND, 2004), if the Port Freeport harbor is deepened to 60 ft, it will boast the deepest-draft port facility on the Gulf of Mexico. The deepening project is currently in the feasibility stage in partnership with the USACE.

The Port of Freeport totaled over $1.9 million in payroll and related expenses in 2004, an increase of approximately $176,000 from 2003 (BRHND, 2004). As a result of local and regional purchases by the 8,100 employees, an additional 8,116 induced jobs are estimated to be supported in the regional economy; also 9,589 indirect jobs are supported by $675.9 million in local purchases by businesses supplying services at the marine terminals and by businesses dependent upon the Port of Freeport for shipment and receipt of cargo (Port Freeport, 2004).

The Port will become BASF Corporation's manufacturing base for nylon intermediates and polymers in North America with the construction of a $59 million polycaprolactam plant to be constructed on-site in 2006 (*The Alliance*, 2005a). The plant will build on existing operations and will add 10 permanent positions and construction will employ 190 workers at its peak (*The Alliance*, 2005a).

Gulf Coast Regional Spaceport Development Corporation is anticipating the long-awaited commercial spaceport to begin by the end of 2006. The spaceport site would encompass 3,000 acres near Demi-John and could generate thousands of high-tech jobs in the area (*The Alliance*, 2006e).

3.18.4.3 Tourism and Recreation

Tourism is a major contributor to the study area economy. The natural resources of the Gulf of Mexico provide extensive recreational opportunities in the Freeport area. Outdoor recreation in the area includes

fishing, bird-watching, windsurfing, boating, jet skiing, swimming, shelling, and beach combing (among others).

Brazoria County was chosen as the location for this year's Texian Rally sponsored by The Texas Independence Trail Region. Brazoria County was chosen because of its association with the Texas Independence Trail as well as being the burial place of Stephen F. Austin before his grave was moved to Austin. In addition, the Masonic Oak in Brazoria County was the location of the first Masonic Lodge meeting held in Texas in 1835 (*The Alliance*, 2006f).

Freeport ranks as one of the top areas in the nation for diversity of species and number of species encountered (Texas Explorer, 2006). There are several marinas located within the Freeport area that support recreational as well as commercial fishing. There are numerous parks located within the area that provide beach access. The Freeport Bryan Beach is located southwest of the Village of Quintana at the end of FM 1495 and has a 3½-mile beach, named one of the cleanest beaches in Brazoria County. Follet's Island Beach is located near and northeast of the Village of Surfside Beach. It has 10 miles of beach and is used for swimming, picnicking and fishing. Quintana Beach Park includes such amenities as restrooms, showers, concession stand, board walks, picnic areas, and shaded pavilions for group rentals. On the property is the Coveney House that has a beach ecology lab that features hands-on displays. One of the newest parks is the Surfside Jetty Park which has a visitor's center, shuffle board, picnic tables, public showers, convenience store, restrooms, playground, horseshoe pits, lighted volleyball courts, and a sidewalk from the park to the jetty and beach. The Surfside Pedestrian Beach is located on the west side of Surfside Beach and does not allow vehicles. Amenities include portable restrooms located along the beach (City of Freeport, 2006).

The City of Freeport and TPWD have signed an agreement that authorizes planning, design, layout and clearance activities for the planned 2.9-mile oyster shell-surfaced trail, benches and signs for the Bryan Beach Park. This addition will help make the park a family oriented beach and establish an outdoor recreational area (*The Alliance*, 2006g).

Also in Freeport is a proposed marina on the Old Brazos River that could become the catalyst for downtown revitalization with restaurants, hotels and gift shops.

An agreement has been reached for Surfside Beach to lease a ½ acre, adjacent to city hall, for a nature trail and home for Surfside Beach's Save Our Beach Association (*The Alliance*, 2005c). The former Surfside Beach tourist center could house the group's monthly meetings as well as become a learning center for area residents and visitors.

3.18.4.4 Community Values

Overall, the communities in the study area support development at the Port of Freeport. Future growth at the Port include new construction and expansion of existing facilities for companies such as Freeport LNG, BASF Corporation, Dow Chemical and ConocoPhillips. New jobs in the Brazosport community are

a direct result of the expansion of the Port of Freeport. According to *The Alliance*, a newsletter distributed by the Economic Development Alliance for Brazoria County, Phase I of the Freeport LNG terminal has benefited Quintana by providing more than 400 jobs since 2005 and LNG anticipates an additional 60 plant operator positions once the site is open (*The Alliance*, 2006h). The community is expected to benefit from the long-term investment of Freeport LNG by projects such as the maintenance of beaches, roads, water system, and helping to keep the tax rate low. In addition, the facility would assist in retaining local jobs in the chemical industry. Even with the economic and community service benefits from facilities such as Freeport LNG, some residents are concerned about the size of the facility and the security demands that may ultimately affect Quintana's residents. Throughout Brazoria County, particularly in the project area, future projects include expansion of highways, new schools, new businesses, and water and sewer projects in Surfside Beach as big industrial employers such as BASF, Dow Chemical, and Conoco Phillips, expand their facilities (*The Alliance*, 2006b).

3.18.4.5 Commercial Fisheries

There is little commercial fishing in the Freeport area. Commercial fishing within the Galveston Bay system is a relatively moderate contributor to the Freeport area economy compared to other industry sectors.

3.18.4.6 Tax Base

In Texas, the state sales tax is 6.25%, with local sales/use tax not to exceed an additional 2.00%. Property taxes within Brazoria County are collected by the Brazoria County Tax Office. Table 3.18-12 provides a summary of property tax jurisdictions and tax rates for jurisdictions that affect the population living in the study area.

TABLE 3.18-12

PROPERTY TAX JURISDICTIONS, BRAZORIA COUNTY – 2005

Tax Jurisdictions	Tax Rate per $100 of Appraised Valuation
Brazoria County	0.347987
Brazosport ISD	1.5728
City of Freeport	0.71
City of Oyster Creek	0.4521
Town of Quintana	0.04
Village of Surfside Beach	0.49

Source: Brazoria County Appraisal District, 2005.

In Texas, property is appraised and property tax is collected by local (county) tax offices or appraisal districts, and these funds are used to fund many local needs, including public schools, city streets, county roads, and police and fire protection (Texas Comptroller of Public Accounts, 2006).

Activity at the Port of Freeport terminals generates $163.6 million in state and local taxes. Also, the Federal government receives $6.3 million of customs revenue from cargo activity at the public and private facilities (Port Freeport, 2004).

3.18.5 Environmental Justice

In compliance with Executive Order (EO) 12898 — Federal Action to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations, an analysis has been performed to determine whether the proposed project would have a disproportionate adverse impact on minority or low-income population groups within the study area. The EO requires that minority and low-income populations do not receive disproportionately high adverse human health or environmental impacts and requires that representatives of minority or low-income populations, who could be affected by the proposed project, be involved in the community participation and public involvement process.

The data used in this study to determine the potential for disproportionate impacts to low-income and/or minority populations within the study area and the State are presented in tables 3.18-13 and 3.18-14. The information is based on 2000 U.S. Census Bureau state, county, and block group level data for ethnicity and income.

TABLE 3.18-13

DETAILED 2000 POPULATION CHARACTERISTICS IN STUDY AREA

		Population of One Race/Not Hispanic or Latino								
Area	Total Population	White	Black or African American	American Indian/ Alaskan Native	Asian	Native Hawaiian other Pacific Islander	Hispanic or Latino of any race	Total Minority Population	Median Household Income	% Below Poverty
CT 6642 BG 3	872	90.3	2.8	0.2	0.0	0.0	2.3	9.7	$42,308	11.3
CT 6644 BG 6	1,267	56.7	19.9	0.0	0.0	0.00	23.4	43.3	22,425	25.5
Freeport	12,717	33.0	13.2	0.1	0.3	0.1	51.6	67	$30,245	22.9
Oyster Creek	1,200	75.7	4.7	0.4	0.4	0.0	17.6	24.3	$35,144	19.2
Quintana	44	81.8	0.0	0.0	0.0	0.0	18.2	18.2	$25,500	18.2
Surfside Beach	764	90.1	3.1	0.3	0.0	0.0	2.4	9.9	$37,778	12.6
Brazoria County	241,767	65.3	8.3	0.4	1.9	< 0.1	22.8	34.7	$48,632	10.2
State of Texas	20,851,820	52.4	11.3	0.3	2.6	< 0.1	32.0	47.6	$39,927	15.4

Source: U.S. Census Bureau, 2000b.

TABLE 3.18-14

PERCENTAGE OF LIMITED ENGLISH PROFICIENCY PERSONS IN STUDY AREA

Area	Percent of Persons that Speak English "Not Well"	Percent of Persons that Speak English "Not at All"
CT 6642 BG 3	1.1	0.0
CT 6642 BG 6	3.7	0.7
Freeport	8.9	5.1
Oyster Creek	1.1	0.5
Quintana	0.0	0.0
Surfside Beach	1.2	0.0
Brazoria County	3.0	1.2
State of Texas	4.7	2.7

Source: U.S. Census Bureau, 2000b.

In terms of ethnicity, the population living within the study area block groups is less ethnically diverse than Brazoria County and the State of Texas (Table 3.18-13). The number of White persons within the BG 2 and BG 3 are 77.6% and 90.3%, respectively. This is much higher than Brazoria County (65.3%) and substantially higher than Freeport (33%) or the state, with 52.4%. The percentage of Hispanics within BG 3 (2.3%) and Surfside Beach (2.4%) is substantially lower than Brazoria County (22.8%), the state (32%), and Freeport (51.6%). The percent minority persons within the study area ranges from the lowest, 9.7% in CT 6642 BG 3, to the highest, which was Freeport with 67%. Within the study area, Freeport has the largest percentage of minority population (67%), which is predominately composed of Hispanic and African American persons. This block group also has the highest percentage of people living below the poverty line in the study area, with 22.9%. The percent of persons living below poverty within the study area ranges from 10.2% in Brazoria County to 22.9% in Freeport. The percent of persons living below poverty within the study area block groups is, on average, higher than Brazoria County (10.2%) and the State of Texas (15.4%).

EO 13166, "Improving Access to Services for Persons with Limited English Proficiency (LEP)", signed by President Clinton on August 11, 2000 calls for all agencies to ensure that their Federally conducted programs and activities are meaningfully accessible to LEP individuals. Table 3.18-14 contains the percent LEP population for the study area.

As shown in Table 3.18-14, a low percentage of persons in the study area do not speak English or have difficulty speaking English. Data for "Ability to Speak English" for the population five years and over indicates 1 to 9% of the population in the study area speak English "Not Well", while zero to 5% of the population speak English "Not at All." None of the LEP populations would be discriminated against as a result of the proposed project because steps would continue to be taken to ensure that such persons have meaningful access to the programs, services, and information that USACE provides. Therefore, the requirements of EO 13166 appear to be satisfied.

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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 AIR QUALITY

This section provides a discussion of the air quality impacts associated with the no-action and proposed alternatives. It addresses both direct and indirect effects and discusses their impacts relative to the inventory of air emissions for the Houston-Galveston Nonattainment Area. As discussed in Section 3.1, for air quality monitoring and planning purposes, the EPA relies on the designation of nonattainment areas for air pollutants within the boundaries of geographical planning units. For consistency with the EPA's designations, the HGA, designated as a non-attainment area by the EPA, was selected as the appropriate area for consideration of the potential air quality impacts of the proposed alternatives.

The evaluation of impacts to air quality associated with the alternatives was based on the identification of air contaminants and estimated emission rates. The air contaminants considered are those covered by the NAAQS (except for lead (Pb), which is not relevant to project emissions) including carbon monoxide (CO), ozone (O_3), nitrogen oxide (NO_X), particulate matter with diameters less than 10 microns (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and sulfur dioxides (SO_X). Air emissions were considered for channel widening activities and placement of dredged material as well as emissions from vehicular traffic associated with the project employee commute. Project emissions were estimated based on preliminary assumptions provided by the project sponsors. It is not within the scope of this analysis to perform the refined dispersion modeling necessary to predict concentrations for each contaminant and alternative. Rather, the impact of emissions was analyzed relative to the existing inventory and monitored data for air contaminant emissions in the HGA nonattainment area.

The estimated air contaminant emissions, except O_3 and its precursors, were compared to the 2001 emissions inventory for the HGA. Assuming an increase in air emissions will result in a corresponding increase in the ambient air concentration for that air contaminant, the ratio of the estimated emissions to the existing 2001 emissions for that contaminant provided a relative indication of the potential increase in ambient concentrations for the air contaminant. That difference was then compared to the NAAQS. As shown in Table 3.1-4 in Section 3.1, monitored values suggest that concentrations of air contaminants (except O_3) for this area are well below the NAAQS and even appear to be on the decline over the years for which monitored values are available. Because air emissions are generally dispersed with distance and time, a relatively small increase in emissions may be assumed to cause a correspondingly small increase in ambient air quality concentrations for that air contaminant, and it is therefore, expected that the increase in emissions will not cause an exceedance of the NAAQS.

As discussed in Section 3.1, the CAA, under 42 U.S.C. 7506(c) (1), prohibits Federal agencies from funding, permitting, or licensing any project that does not conform to an applicable SIP. The purpose of this General Conformity requirement is to ensure Federal agencies consult with state and local air quality districts to assure these regulatory entities know about the expected impacts of the Federal action and can include expected emissions in their SIP emissions budget. The conformity requirements were

promulgated to ensure attainment and maintenance of the NAAQS and to ensure that Federal actions will not cause or contribute to new violations of the NAAQS. Because permitting for the project is considered a Federal Action, emissions were also considered in terms of the General Conformity rules.

4.1.1 Alternative 1: No-Action

No construction or new operating emission sources are associated with the No-Action alternative. However, it is expected that air contaminant emissions will increase due to continued operational constraints on the existing system and projected increased ship traffic resulting both from growth of existing business and from new business at the Port.

4.1.2 Alternative 2: Proposed Action with Placement at Quintana

The evaluation of air quality impacts associated with Alternative 2 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 schedule, equipment use, capacity, and other related assumptions provided by the project sponsors. Detailed emissions estimates are contained in the reference document (PBS&J, 2006).

The emission sources will consist of harbor vessels and land-based mobile sources that will be utilized during the channel widening activities, as follows:

- Harbor Vessels – includes dredges (cutterhead, bucket crane, and hopper) and support equipment (tugboats, runabouts, and tenders), and shrimp trawlers
- Land-based – include off-road (bulldozers) and on-road (employee vehicles)

Air contaminant emissions associated with the channel widening would be primarily combustion products from fuel burned in equipment used for project dredging, support, vessels, and dredged material reuse equipment. Activities at dredged material reuse/placement sites would involve the use of earth-moving equipment such as bulldozers. The harbor vessel emission sources will be primarily diesel-powered engines. The off-road equipment was assumed to be all diesel-powered and the on-road vehicles all gasoline-powered vehicles.

4.1.2.1 Methods Used for Estimation of Air Contaminant Emissions

The primary air contaminant emissions from this project would be from dredging activities, emissions from the equipment used for beach placement, and secondary emissions resulting from employee vehicular traffic. The basis for emissions included the following:

- Preliminary project description and other information, as provided by the project sponsor.
- Emissions from harbor vessels in support of the dredging activities were estimated for the years 2007 and 2008, as the project is expected to begin in the fourth quarter of 2007 with an expected duration of not more than one year. The basis for emissions estimates consisted of the operating

hours for each specific type of equipment engine, engine load factor, and engine horsepower. Emission rates (tons per hour) from dredges, dredging support equipment, and other harbor vessels were calculated for each criteria pollutant and were derived based on the following formula:

*Emission Rate = Engine Horsepower * Engine Load Factor * Emission Factor*

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. Emission amounts (tpy) for each of the pollutants were then calculated based on the following formula:

*Emission Amount (tons/year) = Emission Rate (tons/hr) * Working Hours (hrs/year)*

Detailed emission calculations for the marine equipment can be found in Tables A-1 to A-4, B-1 to B-3, and C-1 to C-4 in the reference document (Appendix F).

- The EPA, NONROAD emission factor model, Final 2005 Version, was used to predict emissions resulting from landside, off-road construction equipment used for beach placement with inputs for assumed equipment usage developed by the project sponsors. This model may be used to predict air emissions for off-road construction equipment based on information including geographic location, equipment type, and fuel use for specific years that may be selected. It provides an estimate of emissions for different equipment based on equipment population, load factor, available horsepower, deterioration and applicable standards.

  The NONROAD model was run to generate an emission factor for the criteria air contaminants, resulting from the use of bulldozers in Brazoria County during the model year of 2007. These emission factors were then used to estimate the total emissions from the use of bulldozers in dredged material reuse/placement activities associated with the project. Detailed emission calculations for the off-road construction equipment can be found in Tables D-1 to D-3 in the reference document (see Appendix F).

- Mobile on-road emissions associated with employee vehicles were calculated with the use of the EPA MOBILE6.2 emission factor model. MOBILE6 is a model for predicting emission factors from motor vehicles under various conditions. This model is recommended by the EPA for modeling of motor vehicle emission factors. The model accounts for general factors that may affect emission factors including changes in vehicle emission standards, changes in vehicle populations and activity, and variation in local conditions such as temperature, humidity, and fuel quality.

  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. Detailed emission calculations for employee vehicles can be found in Tables E-1 and E-2 in the reference document (see Appendix F).

4.1.2.2 Air Quality Analysis Results

Emissions from the activities associated with Alternative 2 would include VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$. As $PM_{2.5}$ is a subset of PM_{10} particles, when the estimation model used did not specifically provide a $PM_{2.5}$ emission rate, the estimated $PM_{2.5}$ emission rate was conservatively assumed to be equivalent to that of PM_{10}. These activities would be considered one-time activities; i.e., the channel widening activities would not continue past the date of completion. Because of the high moisture content of the dredged material, it is expected that there will be no particulate matter emissions from the placement of dredged material on beaches.

A summary of the estimated emissions in tpy resulting from the use of harbor vessel equipment, nonroad equipment, and on-road equipment is presented in Table 4.1-1. Detailed summary of emissions can be found in Tables 1 to 10 in the reference document (see Appendix F).

TABLE 4.1-1

TOTAL ESTIMATED EMISSIONS BY SOURCE

Air Contaminant	Annual Harbor Vessel Emissions (tpy)	Annual Nonroad Vehicle Emissions (tpy)	Annual On-road Vehicle Emissions (tpy)
CO	49.07	0.14	0.661
NO_X	429.45	0.51	0.049
$PM_{2.5}$	9.73	0.02	0.0011
PM_{10}	10.27	0.02	0.0024
SO_2	71.26	0.02	0.0007
VOC	4.94	0.04	0.063

For a discussion of air quality impacts, the air contaminant emissions from Alternative 2 were compared to the 2001 emissions inventory for Brazoria County as described in Section 3.1.1. The comparison is presented in Table 4.1-2.

TABLE 4.1-2

TOTAL ESTIMATED PROJECT EMISSIONS
COMPARED WITH BRAZORIA COUNTY EMISSIONS (2001)

Air Contaminant	Maximum Estimated Project Emissions (tpy)	Brazoria County Emissions (tpy)	Site Emissions % of Brazoria County Emissions
CO	49.87	82,693	0.06
NO_X	430.01	53,790	0.80
$PM_{2.5}$	9.76	8,583	0.11
PM_{10}	10.29	39,743	0.03
SO_X	71.28	12,660	0.56
VOC	5.05	15,759	0.03

As shown in Table 4.1-2, air contaminant emissions from Alternative 2 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 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.

4.1.2.3 General Conformity

With respect to General Conformity, all Federal Actions are covered unless otherwise exempt. A general conformity determination is required for each pollutant where the total of direct and indirect emissions in a nonattainment area would exceed emission thresholds as specified in the General Conformity Rules (40 CFR § 51.853(b) (1)). For the HGA, designated by the EPA as a nonattainment area, the exemption thresholds for O_3 precursor pollutants are 100 tpy of VOC or of NO_X. If the alternatives result in air emissions of less than 100 tpy for either of these air contaminants, the General Conformity rules do not require a General Conformity evaluation and no further analysis is required to demonstrate that such actions conform to the SIP. These actions may be presumed to conform and may be considered less than significant in terms of their impact on attainment of the 8-hour O_3 ambient air quality standard for this region.

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 4.1-3 and 4.1-4 for each year during which the project activities are anticipated to occur. Emissions of CO, SO_2, and particulate matter are not considered in the General Conformity evaluation, as this area is in attainment with the NAAQS for each of those pollutants.

As shown in Table 4.1-3, direct and indirect emissions of VOC for the activities subject to USACE responsibility are exempt from a General Conformity Determination because they are below the 100 tpy threshold.

TABLE 4.1-3

SUMMARY OF VOC EMISSIONS (tpy)

Activity	2007	2008
Dredging Activities – Dredging Vessel Equipment and Dredging Support Vessels	1.10	2.50
Dredging Vessels in Transit During Mobilization or Placement of Dredged Material	0.71	0.64
Land-side Dredged Material Placement – Bulldozing Equipment	0.04	--
On-Road – Employee Commuter Vehicles	0.03	0.03
Totals	**1.88**	**3.17**

As shown in Table 4.1-4, NO_X emissions for activities subject to USACE responsibility show the project would exceed the conformity threshold; i.e., greater than 100 tpy, for the years 2007 and 2008. Therefore, a General Conformity Determination for NO_X emissions would be required for these years. As part of the General Conformity process, the USACE, in consultation with the TCEQ and the EPA, will prepare a discussion on whether the emissions that would result from the proposed Freeport Channel Widening Project are in conformity with the Texas SIP for the Houston-Galveston Nonattainment Area. This document entitled "Draft General Conformity Determination, Freeport Channel Widening Project, Port of Freeport, Texas," October 2006 (PBS&J, 2006) will be prepared by the USACE for submittal to the TCEQ, EPA and other air pollution control agencies, as appropriate. As part of the general conformity process, the USACE will make this document available to the public for review and comments for a period of 30-days. Following the 30-day comment period, the USACE will prepare a Final General Conformity Determination that provides the USACE final determination with regard to the conformity of this project with the SIP.

TABLE 4.1-4

SUMMARY OF NO_X EMISSIONS (tpy)

Activity	2007	2008
Dredging Activities – Dredging Vessel Equipment and Dredging Support Vessels	84.98	196.21
Dredging Vessel Propulsion in Transit During Mobilization or Placement of Dredged Material	75.61	72.65
Land-side Dredged Material Placement – Bulldozing Equipment	0.51	–
On-Road – Employee Commuter Vehicles	0.02	0.02
Totals	**161.13**	**268.88**

4.1.3 Alternative 3: Proposed Action with Placement at Surfside

The alternative placement at Surfside will affect only the travel time made by marine vessels and dredge equipment. Since the distance traveled by marine vessels and dredge equipment to place dredged material at Surfside will differ only slightly, the estimated project emissions for this alternative would be essentially the same as discussed in Section 4.1.2, Alternative 2: Proposed Action with Placement at Quintana.

4.2 NOISE

Project-related noise impacts were evaluated by calculating the noise emissions related to dredge and placement operations of the proposed channel widening 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. Noise levels at noise-sensitive receivers were estimated based on numerous properties of noise attenuation and industry accepted standards. The following information summarizes assumptions and properties used in the calculation of estimated noise levels.

Sound pressure levels of two separate sources are not directly additive. Therefore, as shown in Table 4.2-1, if a sound of 60 dB is added to another sound of 60 dB, the resulting noise level is 63 dB, not 120 dB. For example, if the noise level of a hopper dredge is measured at 85 dB at 50 ft, and the noise level of a tug boat is measured at 82 dB at 50 ft, the combined noise level of both would be approximately 87 dB. Also, noise attenuation between dredge activities and sensitive receivers was calculated based on the assumption that noise attenuates 6 dB per doubling distance from its source. For example, if dredging activities are measured at 87 dB at 50 ft, the noise levels would decrease by 6 dB at 100 ft (81 dB), decrease an additional 6 dB at 200 ft (75 dB), and decrease to 69 dB at 400 ft, etc.

TABLE 4.2-1

DECIBEL ADDITION

Difference Between Two Sources	For Example	Add To Higher Level	Resultant Sound Level
0 dB	60 and 60 dB	3 dB	63 dB
1 dB	60 and 61 dB		64 dB
2 dB	60 and 62 dB	2 dB	64 dB
3 dB	60 and 63 dB		65 dB
4-9 dB	60 and 65 dB	1 dB	66 dB
10 or more	60 and 70 dB	0 dB	70 dB

Source: TxDOT, 1996.

4.2.1 Alternative 1: No-Action

Under the No-Action alternative, the channel would not be widened to project specifications. However, the existing regime of maintenance dredging, which generally includes a hopper dredge and tending boats, would continue as normal. The majority of mechanical dredging equipment on a hopper dredge is housed below the vessel's deck; therefore, noise levels associated with the equipment are comparable to tug boats. Table 4.2-2 summarizes dredging-related noise levels produced by equipment type.

TABLE 4.2-2

TYPICAL NOISE LEVELS

Equipment	Noise Level (dBA)
Cutterhead Dredge (at 160 ft)	79[1]
Hopper Dredge (at 50 ft)	87[2]
Large Tug boat (at 50 ft)	87[3]
Small Tug Boat	72[3]
Bulldozer (at 50 ft)	82[4]
Bucket Crane (at 50 ft)	82[4]

[1] Geier & Geier Consulting, 1997.
[2] Assumed same as large tug.
[3] Epsilon Associates, 2006.
[4] FHWA, 2006.

No permanent noise impacts will result under the no-action alternative The nearest noise-sensitive receivers are located within Surfside Beach. The Surfside Beach Jetty Park is located approximately 220 ft from the channel, and the nearest residences are located approximately 880 ft from the channel. Noise levels during the maintenance dredging operations were estimated to be 75 dBA and 63 dBA at the park's shoreline and nearest residences, respectively. As discussed in Section 3.2, existing ambient noise levels ranged from 49 dBA to 61 dBA (hourly L_{eq}). The No-Action alternative does not result in permanent noise impacts, however, short-term noise-level increases of approximately 14 dBA to 26 dBA at the Surfside Beach Jetty Park, and approximately 2 dBA to 14 dBA at the nearest residences are expected during periodic dredging maintenance activities.

4.2.2 Alternative 2: Proposed Action with Placement at Quintana

Under Alternative 2, the channel would be widened to project specifications with placement of 300,000 cy of silty sand dredged material on the Quintana shoreline and the rest of the dredged material offshore. Equipment and duration for the proposed action includes a cutterhead dredge, one small tug boat, one large tug boat, two runabouts in the jetty channel for approximately 24 hours/day for 12 days; a bucket crane, one large tug, and one runabout in the jetty channel for approximately 19 days; and a hopper dredge, two runabouts, and a shrimp boat in the channel for an estimated 265 days.

The proposed action under Alternative 2 is not expected to result in long-term noise impacts. No permanent noise sources will be installed as part of this project. The proposed action, however, will create short-term noise impacts at noise-sensitive receivers during construction and maintenance dredging. Dredging operations during construction are expected to have the greatest impact during the 12-day period that the cutterhead dredge and its associated support vessels are operating. It was estimated that noise-levels on the shoreline at Surfside Beach Jetty Park could reach 79 dBA, while noise-levels at the nearest residences could reach approximately 67 dBA. This reflects a temporary increase of 17 dB to 30 dB over ambient conditions at the park, and a temporary increase of 6 dB to 18 dB over ambient conditions at the nearest residences. Therefore, when compared to current maintenance dredging operations, noise levels associated with the proposed action are expected to increase by approximately 3 to 6 db at Surfside Beach Jetty Park by approximately 4 db at the nearest residences. Hopper dredging and operation of the bucket crane are expected to be slightly louder than cutterhead dredging. Short-term impacts related to these operations would be nearly identical to the short-term impacts that occur during current maintenance dredging as discussed above in Section 4.2.1.

4.2.3 Alternative 3: Proposed Action with Placement at Surfside

Under Alternative 3, the channel would be widened to project specifications with placement of silty sand dredged material on the Surfside shoreline. Equipment and duration for the proposed action is identical to those of Alternative 2.

The proposed action under Alternative 3 is not expected to result in long-term noise impacts. No permanent noise sources will be installed as part of this project. The proposed action, however, will create short-term noise impacts at noise-sensitive receivers that are identical to those under Alternative 2.

4.3 PHYSIOGRAPHY, TOPOGRAPHY, AND BATHYMETRY

4.3.1 Alternative 1: No-Action

The No-Action alternative would have no impact on physiography, topography, or bathymetry. However, alterations to bathymetry from maintenance dredging of existing ship channels and changes from the placement of that dredged material at DMPAs, would continue under the No-Action scenario. In the absence of project activity, the existing patterns of shoreline erosion on both the Surfside and Quintana beaches are expected to continue. The current average rate of shoreline retreat is approximately 9 to 10 ft per year (GLO, 2006).

4.3.2 Alternative 2: Proposed Action with Placement at Quintana

Widening of the Freeport Entrance and Jetty Channels will change the bathymetry within the existing channels. The proposed channel widening would impact approximately 5.25 miles of the existing Freeport Harbor Channel from the Lower Turning Basin to (offshore) Channel Station -220+00.

The channel widening to 600 ft would generate approximately 3.2 mcy of dredged material. Of this, approximately 300,000 cy of material is silty sand and can be used for beach nourishment. At a fill template of 50 cy per linear foot, this would create approximately 9 acres of beach area at initial equilibrium. About 1.25 miles of shoreline (~91 acres) located along Quintana Beach would be affected by the proposed beach nourishment. It is expected that the material will increase the elevation of the beach by 1 to 2 ft and move the shoreline contours out roughly 50 to 100 ft. During the time placement is occurring, a high degree of turbidity is expected because the material is less than 90% sand. Once the material is exposed to wave action, the finer particles will be carried away and the remaining sand should be suitable for beach use.

Erosion tends to occur in relatively brief storm events which may or may not occur in any given year, thus it is not feasible to predict how long the material will remain on the beach. It clearly will not reverse the long-term rate of shoreline recession of 9 to 10 ft per year. While Alternative 2 will not reverse the trend, it will extend the period of time until erosion impacts the seaward levee of the Seaway PA.

While local changes would occur to bathymetry and topography with construction of the proposed project, these alterations would be expected to have negligible impacts on the regional physiography, topography, and bathymetry of the submerged and subaerial portions of the project area.

4.3.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are similar to that of Alternative 2, but the 300,000 cy of material would be placed on the Surfside Beach. One difference is that while the Quintana Beach is largely undeveloped, the Surfside beach has extensive private residences, some of which are now on land that appears to be below Mean High Water. This can be expected to pose more technical challenges in the material placement.

Similar to Alternative 2, the long-term effect of placement of the material on the Surfside beach will be positive in terms of delaying the shoreline retreat, but it will not provide a permanent solution to the problem.

While local changes would occur to bathymetry and topography during construction of the proposed project, these alterations would be expected to have negligible impacts on the regional physiography, topography, and bathymetry of the submerged and subaerial portions of the project area.

4.4 GEOLOGY

4.4.1 Alternative 1: No-Action

The No-Action alternative would not impact geology within the project area.

4.4.2 Alternative 2: Proposed Action with Placement at Quintana

Under alternative 2, the impacts on the local geology during dredging associated with the proposed project would include redistribution of existing sediment and potential changes of local scouring and shoaling rates. Net impacts on local geology are anticipated to be minimal from these operations.

Additionally, no impacts or modifications to geologic hazards such as faulting, subsidence, and jetty stability are expected. The most recent study for jetty stability showed that jetty stability would not be jeopardized by the proposed widening (Fugro, 2005).

4.4.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are similar to that of Alternative 2.

4.5 ENERGY AND MINERAL RESOURCES

4.5.1 Alternative 1: No-Action

The No-Action alternative would have no impact on energy or mineral resources. None of the project area or proposed PAs are actively involved in the commercial mining of minerals or the production of energy. Maintenance dredging of existing ship channels would continue under the No-Action scenario.

4.5.2 Alternative 2: Proposed Action with Placement at Quintana

There are no reported oil/gas wells located within the project area that will be directly or indirectly impacted by the proposed dredging or dredged material placement components of the project. There are two reported pipelines that cross the ship channel within the Entrance Channel. The depth of these pipelines is undetermined, but since the current channel depth would be maintained, no direct impact is anticipated. None of the reported petroleum pipelines are located within the proposed DMPAs or along the portions of the coastline identified for beach nourishment (Railroad Commission of Texas, 2006).

4.5.3 Alternative 3: Proposed Action with Placement at Surfside

The impacts of this alternative are identical to those described for Alternative 2.

4.6 SOILS

4.6.1 Alternative 1: No-Action

Any impact of the No-Action alternative on surface soils would depend on the type of future development that would take place within the proposed beach nourishment areas of the project site.

4.6.2 Alternative 2: Proposed Action with Placement at Quintana

Under this alternative, the proposed beach nourishment area located along Quintana beach would be impacted by placement of 300,000 cy of silty sand material. However, due to ongoing shoreline erosion and periodic beach maintenance such as grooming and sand importation, impacts to native surface soils within this project area would be consistent with current practices. Furthermore, precautions are exercised to preserve any existing dunes during dredge pipeline placement and discharge operations and adverse impacts are not expected during these operations.

Possible impacts to surface soils exist from the potential release of petroleum products during construction and hazardous material spills from hazardous cargo during shipping operations. However, the use of BMPs for potential hazardous material spills that could occur at the project area would greatly minimize the potential for this type of impact, and shipping operations should be safer than at present.

4.6.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are similar to that of Alternative 2.

4.7 GROUNDWATER HYDROLOGY

4.7.1 Alternative 1: No-Action

The No-Action alternative would not impact groundwater hydrology within the project area. Any groundwater quality impacts are contingent upon the amount and type of development that would take place in lieu of beach nourishment on the project site.

4.7.2 Alternative 2: Proposed Action with Placement at Quintana

Construction and operation activities associated with the proposed project are not expected to result in impacts to groundwater hydrology, quantity, or quality. In addition, no groundwater withdrawals are anticipated for the project. No apparent private, public or industrial water wells registered with the TWDB (2006) would be destroyed and/or affected from the proposed project based on their proximal distances and completed depths below surface grade.

Other possible impacts to shallow groundwater exist from the potential release of petroleum products during construction and hazardous material spills from shipping interests; however, the use of BMPs for potential hazardous material spills that could occur at the project area would greatly minimize the potential for this type of impact, and shipping operations should be safer than at present. BMPs which meet local, State and Federal requirements would be developed and implemented as part of the Spill Response Plan for the project to address potential spills.

4.7.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are the same as Alternative 2.

4.8 HAZARDOUS MATERIALS

4.8.1 Alternative 1: No-Action

The No-Action alternative would have no impact on regulated facilities or sites associated with a release, storage, disposal, or generation of hazardous material or hazardous waste. However, maintenance dredging of existing ship channels would continue under the No-Action scenario.

4.8.2 Alternative 2: Proposed Action with Placement at Quintana

The history of industrial activity along the Freeport Ship Channel has resulted in quantifiable impacts to the air, soil, groundwater, and surface water. The Freeport Harbor Channel receives surface water runoff, wastewater discharge, and some groundwater discharge from these industrial facilities. Some of these contaminants can accumulate in the sediment of the waterway. Therefore, the potential exists for the project to encounter contaminated material during dredging activities. However, these industrial facilities are landward of the project footprint, and according to the results of chemical analysis on ten samples of

sediment and soil collected from the entrance channel (PBS&J, 2005), no detectable concentrations of organic halides, VOCs, pesticides, or PCBs were reported. Only one semivolatile organic compound (fluoranthene) was detected in one sample. Several metals were also reported, but only one (nickel) exceeded a conservative screening level for marine sediment. Based on this information, there is only a slight potential for encountering contaminated material during construction of the project.

4.8.3 Alternative 3: Proposed Action with Placement at Surfside

The impacts of this alternative are the same as those described for Alternative 2.

4.9 WATER AND SEDIMENT QUALITY

4.9.1 Water Quality

4.9.1.1 Water and Elutriate Chemistry

4.9.1.1.1 Alternative 1: No-Action

Under the No-Action alternative, there would be no construction dredging; therefore, there would be no new work material for placement. Although no turbidity or possibility for the release of undesired chemicals would occur because there would be no placement, likewise, there would be no chance for the increase of safety and the concomitant decrease in the possibility of spills of contaminants and no beach nourishment would occur.

Under the No-Action alternative, the effects of maintenance material disposal on water quality would be as it is presently, as described in Section 3.9.2.

The No-Action alternative may or may not affect DO concentrations in the water column at ODMDSs (Brown and Clark, 1968; Pearce, 1972; Hopkins, 1972; May, 1973; Windom, 1972; Wakeman, 1974). May (1973) found that although the water column DO did not change, there was a temporary decrease in DO at the water/sediment interface in the areas of mud flow. He also found little apparent difference in the immediate oxygen demand between recently deposited sediments from dredged material placement and other sediments. May (1973), Jones and Lee (1978), Peddicord (1979), and Lee (1976) agree that high total oxygen demand, as measured in the laboratory, does not necessarily lead to oxygen depletion upon placement since only a small part of the oxygen demand is exerted at placement and the only placement at Freeport during maintenance activities would be offshore in 35 to 40 ft of water.

The most obvious impact of the No-Action alternative to the estuarine water column is turbidity associated with maintenance dredging and placement, which has been shown to reduce primary production in laboratory studies (Sherk, 1971). Field studies, however, have shown essentially no biological impacts from turbidity (Odum and Wilson, 1962; May, 1973), probably because both coastal and estuarine animals are accustomed to large variance in turbidity from a variety of sources; e.g., storms, tidal fluctuations, currents (Clarke and Wilber, 2000). May (1973) found that on a still day, the turbidity

plume from open-bay placement was detectable from an aircraft only a little more than a mile down current. On days when winds caused natural turbidity in an estuarine system, the plume was not detectable more than a few hundred yards down current from active disposal in an open-bay PA. Deeper water for the offshore placement, relative to the depths studied by May (1973), should reduce turbidity and any associated impacts. After conducting a literature review of the biological effects from suspended material produced by dredging operations, Clarke and Wilber (2000) state, "If a probable dredging-induced dosage of ≤1,500 mg/L for ≤1 day is assumed for motile fishes…documented detrimental impacts observed for juvenile and adults were limited to tests that used fuller's earth rather than natural sediments. Fuller's earth produces negative responses at lower concentrations than natural sediments (Sherk et al. 1974)." They also note that sessile animals are unlikely to be exposed for more than 5 days at a given hydraulic dredging site, even without tidal flushing. While this would not be true of sessile organisms in the active placement zone of an ODMDS, because of the site selection process, it would apply to any place outside the ODMDS, even at the edges. The suspended sediment concentrations that cause reduced growth in hard clams (Pratt and Campbell, 1956) and reduced survival in oysters (Kirby, 1994), are higher than can be expected in estuaries under natural conditions and during typical dredging operations (Clarke and Wilber, 2000). Colby and Hoss (2004) noted that Minello et al. (1987) had found reduced feeding in adult Atlantic croaker and pinfish but that the potential impact of TSS from dredging operations to larval fish was not well understood. Therefore, they conducted a study exposing five larval fish (menhaden, pinfish, spot, croaker, and flounder), collected with a 945-µm net, to varying concentrations of TSS (20, 200, 2,000, and 20,000 mg/L) and brine shrimp nauplii (1.0, 0.1, and 0.01 nauplii/ml) for 31 minutes. The prey consumption was determined in each of the 2.733 liter test vessels containing one of the combinations of TSS and prey concentrations, and logistic regression models were applied to the data. An additional experiment was conducted in which natural plankton assemblages were fed to menhaden, spot, and flounder to determine if there was a difference between consumption of natural prey and brine shrimp. They note that the highest two TSS concentrations are not likely to be encountered except very near dredges or discharges. The prey consumption varied among the species with spot and menhaden more likely to feed on natural prey than brine shrimp but flounder consumed more brine shrimp. Likewise, menhaden and flounder prey consumption correlated more strongly to TSS than prey concentration but flounder was most sensitive to both. Flounder did not feed when prey concentrations were low and TSS was high but did when the conditions were reversed. Pinfish, spot, and croaker consumption correlated more strongly to prey concentration and these larval fish fed even at the highest TSS concentrations. All of the animals fed, to some extent, at the three lower TSS concentrations.

Significant detrimental environmental effects have not been noted in past maintenance operations.

4.9.1.1.2 Alternative 2

The construction material has been tested for contaminants (Section 3.9.3.1) and no causes for concern were found. Therefore, there should be no water quality impacts from beach nourishment, aside from

turbidity as the silts and clays are winnowed away from the sands. Additional effects of ocean placement can be found in Appendix C.

There should be very little change in water quality impacts between Alternative 1 and Alternative 2. While there will be more maintenance material associated with Alternative 2, the source of the maintenance material will not change and the method of placement will not change. There is the possibility of contamination of the maintenance material by a spill or other event, as there is now, but widening the channel should increase safety and decrease the probability of a spill. Additionally, the USACE routinely tests the elutriates prepared from maintenance material according to RIA and Green Book protocols before dredging to ensure that there are no causes for concern. As noted in Section 3.9.2, Tier I and Tier II evaluations of maintenance material elutriates with chemical analyses and water column bioassays have indicated no cause for concern.

4.9.1.1.3 Alternative 3

Water quality impacts from Alternative 3 would be the same as those from Alternative 2 except for the location of the turbidity associated with beach nourishment.

4.9.1.2 Ballast Water

4.9.1.2.1 No-Action Alternative

Currently 882 ships enter the Freeport Harbor and release ballast water. Ballast water is one of the major pathways for the introduction of nonindigenous marine species (exotic species), having the potential to cause ecological and economic damage. Aquatic nuisance species (ANS) are those organisms whose introductions have adversely impacted their new habitats, becoming one of the greatest threats to the marine environment. Ballast water is pumped into the ballast tanks at one port and released into the ocean at the next port-of-call. This release of ballast water can introduce ANS into the port of discharge. ANS can thrive in their new environment due to the absence of their natural predators and in some cases displace native organisms by preying on them or out competing native species for food and habitat space. However, not all nonindigenous species introductions are harmful, and some may become economically profitable if they are harvested for food or commercial goods (USCG, 2006b).

In addition to the environmental impacts, economic damage may also occur when an ANS displaces species that are harvested for food or other goods, or when they damage structures. The public health impact also has the potential to be significant. The ballast water may contain biological contamination and when discharged into the local waters may infect fish and shellfish populations, which could be harvested for human consumption (USCG, 2006b).

4.9.1.2.2 Alternative 2

Under Alternative 2, impacts to ballast water will remain as described above since the number of vessels and the origins of those vessels is not predicted to change.

4.9.1.2.3 Alternative 3

Under Alternative 3, impacts to ballast water will remain as described above since the number of vessels and the origins of those vessels is not predicted to change.

4.9.2 Sediment Quality

4.9.2.1 Surficial Sediments (Construction Material)

4.9.2.1.1 Alternative 1: No-Action

There will be no construction material with the No-Action alternative.

4.9.2.1.2 Alternative 2: Proposed Action with Placement at Quintana

The quality of surficial sediments from the project area is discussed in Section 3.9.3.1. These are the surficial sediments that will be dredged during project construction. The discussion in Section 3.9.3.1 indicates no cause for concern with the construction material. The 300,000 cy of silty sand construction material was determined to be of sufficient quality to be used for BUs (PBS&J, 2005) on the Quintana Beach and there was no cause for concern for the fine material from the rest of the project, which is projected to be placed offshore.

4.9.2.1.3 Alternative 3: Proposed Action with Placement at Surfside

As with Alternative 2, there are no causes for concern with placing the 300,000 cy of silty sand material on the Surfside Beach. However, the material destined for beach nourishment is expected to contain only less than 90% sand and it will make the beach water muddy for some period of time. The only difference between Alternatives 2 and 3 is that the Quintana Beach is not in the immediate vicinity of a residential area, as is the Surfside Beach. Thus, aesthetic impacts associated with the placement of the silty sand material would be more noticeable at Surfside (see Section 4.17).

4.9.2.2 Maintenance Material

4.9.2.2.1 Alternative 1: No-Action

The existing maintenance material was described in Section 3.9.3.2. The quantity and quality of this material would not be expected to change with the No-Action alternative.

4.9.2.2.2 Alternative 2: Proposed Action with Placement at Quintana

The quantity and quality of this material would not be expected to change significantly with Alternative 2. While slightly more maintenance material is estimated with Alternative 2, the source of the maintenance material will not change and the method of placement will not change. As noted above, project actions should increase safety and decrease the probability of a spill. The USACE also routinely tests the maintenance material according to RIA and Green Book protocols before dredging to ensure that there are

no causes for concern. As noted in Section 3.9.3.2, past testing of maintenance material with chemical analyses, whole mud bioassays, and bioaccumulation studies has indicated no cause for concern.

4.9.2.2.3 Alternative 3: Proposed Action with Placement at Surfside

Alternative 3 is equivalent to Alternative 2 relative to maintenance material.

4.10 COMMERCIAL AND RECREATIONAL NAVIGATION

The main effect of the alternatives considered will be on allowing greater flexibility in handling large vessels, including LNG carriers, and in reducing the periods when there are restrictions on navigation, including concommitment cost savings. These restrictions, which include length and beam limitations during periods of cross winds and strong currents at the end of the jetties, are discussed in detail in Section 3.10.1.

4.10.1 Alternative 1: No-Action

Without the channel widening the existing restrictions on operations, described in section 3.10.1, would continue. These restrictions are accommodated in routine operations and would continue to be the case under the no-action alternative. However, there is a long-term trend of increase in vessel size such that the frequency of restriction can be expected to increase with time. In addition, the restrictions would be a negative factor in new proposed LNG carrier operations, as these vessels tend to be new and to have dimensions that would tend to encounter restrictions more often.

However, the no-action alternative would eliminate the temporary traffic delays that would be produced by either alternative 2 or 3 during construction.

4.10.2 Alternative 2: Proposed Action with Placement at Quintana

The proposed action would reduce the frequency of restrictions on operations and improve the efficiency of the Port. The effect would be most significant for the larger vessels, and would not affect smaller vessels. TranSystems Corporation (2006) estimated that two-way traffic with the 600-ft-wide channel would reduce vessel delay times by 1,185 hours annually in 2010 and by 5,540 hours annually in 2060. This translates into present value economic benefits to the Port and Nation of at least $24.37MM over the 50-year life of the project or total annual National Economic Benefits of $487,415 (Martin Associates, 2006).

Relative to safety, it is assumed that routine operations at the Port would be conducted to maintain an equivalent level of safe navigation for all vessels. The greater channel width would have the effect of reducing delays for larger vessels, but would not be presumed to produce a net increase in the level of safety for these vessels. Vessels not subject to operational restrictions would experience a larger channel and a greater safety margin for normal operations.

All vessel traffic would experience some delays during the dredging process. This can be minimized through scheduling and planning, but would be a factor due to the constrained nature of the channel. However, since most dredging would likely be accomplished by a mobile hopper dredge and be restricted to the widened portion of the channel, delays during dredging should be small.

4.10.3 Alternative 3: Proposed Action with Placement at Surfside

There is not expected to be a significant difference between alternatives 2 and 3 in terms of commercial and recreational navigation.

4.11 VEGETATION

4.11.1 Alternative 1: No-Action

Most of the uplands in the project area are developed (urban or industrial). It is assumed that the undeveloped upland areas will be developed as the Port of Freeport and the communities of Freeport, Surfside, and Quintana continue to grow.

4.11.2 Alternative 2: Proposed Action With Placement at Quintana

Because the proposed channel widening project is limited to the open water areas of the Entrance and Jetty Channels of the Freeport Harbor Channel, there should be no additional impacts to uplands from dredging associated with construction of the proposed project beyond what is expected for the No-Action alternative.

Although marsh creation and/or restoration options were evaluated during the development of the DMMP, no suitable sites were identified (see Appendix B). The only potential impacts associated with the DMMP would be from the BU of dredged material on the Gulf shoreline in front of the Seaway PA for beach nourishment. It is assumed that placement would occur on unvegetated parts of the beach, so no plant communities would be directly impacted. There may be positive impacts by mitigating the erosion of the beach and dune complex and also, by enhancing accretion of the active delta of the Brazos River. The active delta would be affected because the dredged material would be ultimately transported southwest along the shoreline by longshore drift and accumulate on the delta. More of the dredged material would be transported to the delta with this alternative than with the No-Action alternative.

4.11.3 Alternative 3: Proposed Action With Placement at Surfside

The potential impacts associated with this alternative are similar to those described for Alternative 2, except that the beach nourishment on Surfside Beach would not be expected to contribute much, if any, material to the accretion of the active delta of the Brazos River. As described in Section 3.3, the longshore drift to the southwest would be blocked by the jetties.

4.12 WETLANDS

4.12.1 Alternative 1: No-Action

The condition and distribution of wetland types can be affected by changes in depth and frequency of inundation as well as salinity. There are three primary factors affecting the potential impact of the proposed project on wetlands.

- No wetlands are located in the footprint of the proposed project. The largest wetlands near the project are primarily north and south of the area near the Harbor Channel.
- The proposed project is limited to widening an existing channel, which would minimize potential changes to salinity and tidal inundation.
- The Brazos River diversion in 1929 cut off the direct connection between the river and the freshwater inflow into the Freeport Harbor Channel, leading to concomitant changes in the wetland community in response to the changes in physical factors since that time.

Unlike the expected industrial and urban development of the upland areas, development of the wetlands will be more limited because of State and Federal protection.

Evaluating the impacts of changes that will occur without the proposed project is confounded by ongoing changes in relative sea level. White et al. (2005) found that relative sea level rise in the Freeport area exceeded 0.43 in/yr from 1959 through 1971. The overall relative sea level is also affected by subsidence, which may have been as much as 5 ft from 1943 to 1973 in the Freeport area (White et al., 2005). Assuming it will continue into the future, the impact of this change would be profound in comparison to the proposed project.

4.12.1.1 Estuarine Submerged Aquatic Vegetation

There is no aquatic vegetation mapped (FWS, 1992a) within 1 mile of the proposed project and none was observed in the immediate area of the ship channel during recent site visits. The No-Action alternative would not directly impact SAV since there will be no dredging of new work material. Dredged maintenance material from the existing channels would continue to be placed offshore and would have no impacts on SAV.

4.12.1.2 Estuarine Marshes, Tidal Flats, Scrub-Shrub Wetlands

These habitats occur closer to the proposed project than do SAV, although still not within the footprint. They are not directly adjacent to the channel and, therefore, are not susceptible to shoreline erosion.

Continued industrial expansion coupled with increased ship traffic increases the probability for collisions and hazardous materials spills under the No-Action alternative, which could negatively impact the wetlands.

4.12.1.3 Freshwater Wetlands (Aquatic Vegetation, Marshes, Scrub-Shrub, Flats, Forested Wetlands)

There are few freshwater wetlands within the project area. A review of historic aerial photographs shows that past development has already converted most to uplands. Continued industrial and urban expansion would be expected to impact the remaining freshwater wetlands.

4.12.2 Alternative 2: Proposed Action With Placement At Quintana

4.12.2.1 Estuarine Submerged Aquatic Vegetation

The proposed alternative would have similar lack of positive or negative impacts on SAV as the No-Action alternative. The only changes in this community would be associated with salinity changes, but none are expected. It may be assumed that, if any changes occur, they would be minor and well within the tolerances and natural ranges of the common SAV species. Also, considering the distance of any known SAV beds from the project, any impact seems highly unlikely. Estuarine SAV in the inter-ridge swales of the Brazos River delta may receive some protection from Gulf shoreline erosion as a result of proposed beach nourishment associated with Alternative 2.

4.12.2.2 Estuarine Marshes, Tidal Flats, Scrub-Shrub Wetlands

It is unlikely that the minimal changes in salinity and tidal influence would have significant impact on the vegetative communities within any of these habitats. If there were measurable changes in the wetland communities, minor shifts in species composition would be more likely than major changes in geographic distribution, community type (e.g., salt to brackish marsh), or marsh loss (conversion to open water). Like SAV, the deltaic marshes could indirectly benefit from beach nourishment associated with the DMMP.

4.12.2.3 Freshwater Wetlands (Aquatic Vegetation, Marshes, Scrub-Shrub, Flats, Forested Wetlands)

The only freshwater wetlands that could be conceivably impacted by the proposed project would be those with some hydrologic connection to the estuarine waters. Since the ship channel is no longer part of the Brazos River, many of the connections are indirect (e.g., via the GIWW). The lack of direct connection and distance from the proposed project make it highly unlikely that any measurable impact would occur. This includes the inland area of the Columbia Bottomlands.

4.12.3 Alternative 3: Proposed Action With Placement At Surfside

4.12.3.1 Estuarine Submerged Aquatic Vegetation

This alternative would have the same impact on estuarine SAV as Alternative 2 other than the possible differences in contributions to Brazos River delta and SAV within its inter-ridge swales associated with the DMMP.

4.12.3.2 Estuarine Marshes, Tidal Flats, Scrub-Shrub Wetlands

This alternative would have the same impact on estuarine wetlands as Alternative 2 other than the possible differences in contributions to Brazos River delta and marshes within its inter-ridge swales.

4.12.3.3 Freshwater Wetlands (Aquatic Vegetation, Marshes, Scrub-Shrub, Flats, Forested Wetlands)

This alternative would have the same impact on wetlands as Alternative 2.

4.13 TERRESTRIAL WILDLIFE

4.13.1 Alternative 1: No-Action

Under the No-Action alternative, impacts to the terrestrial wildlife species or wildlife habitats at or near the proposed project area would continue to occur consistent with current channel maintenance activities.

4.13.2 Alternative 2: Proposed Action with Placement at Quintana

4.13.2.1 Dredging/Construction Activities

While dredging activities from the proposed project are unlikely to have a direct impact on terrestrial wildlife species, they may have an indirect impact. Such activities may cause temporary, local impacts to aquatic communities and habitats, including increased turbidity (Section 4.9.1), which in turn may indirectly affect birds in the immediate vicinity by potentially reducing the availability of the food supply. These impacts are local and temporary and are not likely to be significant, considering the overall availability of similar habitats in the general area and the mobility of the birds. The slightly increased possibility of accidental spills of oil, chemicals, or other hazardous materials during construction dredging activities also poses a threat to the aquatic community and, thus, the food source of many coastal birds in the area. Accidental spills could adversely affect phytoplankton and zooplankton assemblages, which make up the foundation of the aquatic food chain. While adult shrimp, crabs, and fish are mobile enough to avoid areas of high concentrations of pollutants, larval and juvenile finfish and shellfish are more susceptible to those threats. Any effects would be short-term.

The noise of equipment and increased human activity during construction dredging activities (Section 4.2) may disturb some local wildlife, particularly birds, especially during the breeding season. Such impacts, however, should be temporary and without significant long-term implications. Salinity effects are unlikely and most infaunal organisms in the area are relatively tolerant of salinity fluctuations.

Dredging activities for the channel improvement would occur immediately adjacent to Rookery 610-101 (FWS, 2006b) (Bryan Beach State Park), which is on the north shore of the Freeport Channel (see Figure 3.13-1). This rookery historically supported nesting populations of black skimmer (*Rynchops niger*) and least tern; however, the black skimmer has not nested at the site since 1991 and least terns have

been absent since 1982 (FWS, 2006b). Other rookeries in the study area include 610-100 (Freeport Dow), 610-102 (Bryan Beach Spoil), 610-103 (Bryan Mound), 610-104 (Dow Gate A-40), 610-105 (Dow Tern), and 610-106 (Bryan Beach Diked Spoil). Dredging activities associated with the proposed project would not result in impacts to these rookeries, however.

Approximately 300,000 cy of the dredged material would be deposited in front of the Seaway PA on Quintana Beach. Placement of dredged material at this site would have similar impacts to the dredging activities in that they would be unlikely to result in direct effects on terrestrial wildlife species but may have indirect effects. Temporary impacts to aquatic communities and habitat from increased sedimentation and turbidity would be expected. This in turn may affect birds in the area by potentially reducing the availability of their local food supply temporarily. The impacts may be more noticeable since the site is located near known bird rookeries. Noise and increased human activities during construction may temporarily affect terrestrial wildlife in areas adjacent to the BU sites. These impacts would likely be minor and short-term.

Construction activities during the placement of material on the beach may temporarily preclude its use by wildlife; however, the duration of the activity will be temporary and size of the construction area would not be large enough to cause any significant loss of habitat. The resultant additional beach will provide additional terrestrial habitat for wildlife in the area. Therefore, the proposed activity may affect, but is not likely to adversely affect terrestrial wildlife.

4.13.2.2 Operational Activities

Upon completion of the initial dredging activities associated with the project, few impacts are likely. Maintenance dredging activities would have similar temporary impacts as the initial dredging, but on a much smaller scale and for a shorter term and would be similar to existing maintenance activities. The number of vessels in the area would not increase or decrease; therefore, the potential for erosion of PAs would not change. The possibility of accidental oil or chemical spills would decrease because of safer navigability. Such spills pose a threat to the aquatic community and, thus, the food source of many coastal birds in the area. Impacts from noise and human activity are unlikely to be a factor and should increase only slightly over existing maintenance conditions.

4.13.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts to wildlife resulting from dredging/construction and operational activities associated with Alternative 3 would be similar to those associated with Alternative 2.

4.14 AQUATIC ECOLOGY

4.14.1 Alternative 1: No-Action

4.14.1.1 Aquatic Communities

Under Alternative 1, aquatic communities will remain as described in Section 3.14.1. Impacts from current maintenance dredging include increased water column turbidity during and for a short time after dredging activities and burial of benthic organisms. No long-term effects are to be expected.

4.14.1.1.1 Recreational and Commercial Species

Under the No-Action alternative, current maintenance dredging operations would continue and impacts to recreational and commercial species will remain as described in Section 3.14.1.1. Impacts from current maintenance dredging include altering or removing productive fishing grounds and short-term increases in turbidity, although reductions in the numbers of important species are not expected.

4.14.1.1.2 Oyster Reef Habitat

Under Alternative 1, oyster reef habitat will remain as described in Section 3.14.1.2.

4.14.1.1.3 Offshore Sands

Under Alternative 1, offshore sand habitat will remain as described in Section 3.14.1.3. Impacts from current maintenance dredging include increased water column turbidity and burial of benthic organisms, although no long-term effects are expected.

4.14.1.1.4 Artificial Reefs

Under Alternative 1, artificial reefs will remain as described in Section 3.14.1.4.

4.14.1.2 Essential Fish Habitat

Under Alternative 1, EFH will remain as described in Section 3.14.2. Impacts from current maintenance dredging include short-term increases in water column turbidity, although no long-term effects are expected.

4.14.2 Alternative 2: Proposed Action with Placement at Quintana

4.14.2.1 Aquatic Communities

Construction and future maintenance activities will generate suspended solids and turbidity, as have past construction and maintenance activities. Turbidity in estuarine and coastal waters is generally credited with having a complex set of impacts on a wide array of organisms (Thompson, 1973; Hirsch et al., 1978; Stern and Stickle, 1978; Wright, 1978). Suspended material can play both beneficial and detrimental roles

in aquatic environments. Turbidity from TSS tends to interfere with light penetration and thus reduce photosynthetic activity by phytoplankton. Such reductions in primary productivity would be localized around the immediate area of the maintenance dredge operations and construction dredging and placement, and would be limited to the duration of the plume at a given site. Conversely, the decrease in primary production, presumably from decreased available light, has been found to be offset by increased nutrient content (Morton, 1977). In past studies of impacts of dredged material placement from turbidity and nutrient release, the effects are both localized and temporary (May, 1973; Odum and Wilson, 1962; Brannon et al., 1978). Thus, due to the capacity and natural variation in phytoplankton populations, the impacts of maintenance dredged material placement and construction dredging within the project area are not expected to be significant.

Although water column turbidity would increase during the project construction and maintenance dredging, such effects are usually temporary and local. Detrimental effects are generally recognized at TSS concentrations greater than 500 mg/L and for durations of continuous exposure ranging from several hours to a few days. Turbidities exceeding 500 mg/L have been observed around maintenance dredging and placement operations (EH&A, 1980), and such turbidities may affect some aquatic organisms near the active dredges and outflow weirs. In a study in Corpus Christi Bay, Schubel et al. (1978) reported TSS values greater than 300 mg/L but only in a relatively small area near the bottom. They also found that TSS from maintenance dredging in Corpus Christi Bay is not greater than that from shrimping and affects the bay for much shorter time periods. May (1973) found that TSS was reduced by 92% within 100 ft of the discharge point, by 98% at 200 ft, and that concentrations above 100 mg/L were seldom found beyond 400 ft from the point of placement. Elevated turbidities during construction and maintenance dredging may affect some aquatic organisms near the dredging activity; however, turbidities can be expected to return to near ambient conditions within a few hours after dredging ceases or moves out of a given area. Shideler (1984) reports similar TSS levels from dredging and storm events. Overall, motile organisms are mobile enough to avoid highly turbid areas (Hirsch et al., 1978). Under most conditions, fish and other motile organisms are only exposed to localized suspended-sediment plumes for short durations (minutes to hours) (Clarke and Wilber, 2000).

Effects of elevated turbidities on the adult stages of various filter-feeding organisms such as oysters, copepods, and other species include depression of pumping and filtering rates and clogging of filtering mechanisms (Stern and Stickle, 1978). These effects are pronounced when TSS ranges from 100 to 1,000 mg/L and higher, but are apparently reversible once turbidities return to ambient levels. Notwithstanding the potential harm to some individual organisms, compared with the existing condition, no significant impacts to finfish or shellfish populations are anticipated from project construction or maintenance dredging activities.

Dredging represents two problems for benthic communities: excavation and disposal; however, disposal is more harmful than excavation. Excavation buries and removes organisms, but organisms can rapidly recolonize, whereas disposal smothers or buries existing benthic communities. Placement of dredged material may cause ecological damage to benthic organisms in three ways: (1) physical disturbance to

benthic ecosystems; (2) mobilization of sediment contaminants, making them more bio-available; and (3) increasing the amount of suspended sediment in the water column (Montagna et al., 1998). Organisms that are buried must vertically migrate or die (Maurer et al., 1986). Maurer et al. (1986) demonstrated that many benthic organisms were able to migrate vertically through 35 inches of dredged material under certain conditions; however, the species present in early successional stages of recovery are not the same as those buried by the dredged material. Although vertical migration is possible, most organisms at the center of the disturbance do not survive, and survivability was shown to increase as distance from the disturbance increased (Maurer et al., 1986).

Repeated dredging in one place may prevent benthic organisms from fully developing (Dankers and Zuidema, 1995). Evacuation destroys the community that previously existed but creates new habitat for colonization (Montagna et al., 1998). Evacuation can actually maintain high rates of macrobenthos productivity (Rhoades et al., 1978). By repeatedly creating new habitat via disturbance, new recruits continually settle and grow. However, these new recruits are always small, surface-dwelling organisms with high growth rates. Large, deep-dwelling organisms that grow slower and live longer are lost to the areas of repeated excavation. In this way, excavation may not cause a decrease in production, but rather a shift in community structure (Montagna et al., 1998).

Placement of construction and maintenance dredged material at the proposed offshore placement sites would bury those benthic organisms incapable of escaping or burrowing up through the dredged material. Burial of benthic organisms will occur during initial construction placement offshore, but the material is virgin ocean bottom, and so recolonization should be rapid (see Appendix C for more detail). Benthic community structure and abundance will eventually return to pre-placement levels at the ODMDS site since it will be used once only for placement of construction material. Potential beneficial effects of the suspended material associated with dredging operations include a resuspension of nutrients, absorption of contaminants in the water column, and addition of a protective cover allowing certain nekton to avoid predation (Stern and Stickle, 1978). As with various potential detrimental effects, the importance of each of these latter effects would vary among groups and with the physiochemical parameters existing at the time of dredging and placement operations.

With the widening of the channel, a slight increase in salinity may be observed. Most organisms occupying these environments are ubiquitous along the Texas and Louisiana coast and can tolerate a wide range of salinities (Pattillo et al., 1997; Parker, 1965). Additionally, no sensitive estuarine or marsh environments occur within the Freeport Harbor Channel and therefore no adverse effects are expected to occur to finfish or shellfish populations due to changes in salinity.

In the unlikely event a petroleum product spill should occur, adult crustaceans, such as shrimp and crabs, and adult finfish are probably motile enough to avoid most areas of high oil concentrations. Larval and juvenile finfish and shellfish tend to be more susceptible to oil than adults and could be affected extensively by an oil spill during their active immigration periods. Due to their lack of mobility, they are less likely to be able to avoid these areas and could be negatively impacted if a spill were to occur.

Benthic fauna may be killed, but phytoplankton may be adversely or favorably affected by oil spills. It is unlikely that an oil spill in the project area would result in significant, long-term impacts to either phytoplankton or benthic communities, since these organisms have the ability to recover rapidly from a spill due primarily to their rapid rate of reproduction and to the widespread distribution of dominant species. There should be a slight decrease in the likelihood of oil spills with Alternative 2, relative to the No-Action alternative.

4.14.2.1.1 Recreational and Commercial Species

Temporary and minor adverse effects to recreational and commercial fisheries may result from altering or removing productive fishing grounds and interfering with fishing activity. However, no significant impacts to food sources for nekton are likely, therefore, reductions of nekton standing crops would not be expected. Major species of nekton, including sciaenid fishes and penaeid shrimp, should not suffer any significant losses in standing crop. Thus, the limited amount of recreational and commercial fishing would not be expected to suffer from reductions in the numbers of important species.

Repeated dredging and placement operations for channel maintenance may temporarily reduce the quality of recreational and commercial fisheries in the vicinity of dredging operations. This may result from decreased water quality and increased turbidity during dredging as well as from a loss of attractiveness to game fish resulting from loss of benthic prey. This condition is not permanent and the quality of fishing in the vicinity of the channel and PAs should steadily improve after dredging is completed and would likely be similar to existing maintenance dredging, as described for Alternative 1. Maintenance dredging operations will only cause temporary effects to the immediate area during the proposed dredging process.

During construction dredging, game fish would leave prime recreational fishing areas for more favorable, less turbid locations; however, once construction is completed, conditions would improve and game fish will return to the area. The placement of 2.9 mcy of dredged material in an existing, but inactive, ODMDS offshore may result in a localized effect on recreational and commercial fishing in the area. However, construction activity should not significantly affect overall fishing in the general project area.

4.14.2.1.2 Oyster Reef Habitat

Under Alternative 2, oyster reef habitat will remain as described in Section 3.14.1.2.

4.14.2.1.3 Offshore Sands

Water column turbidity would increase during the project construction and maintenance dredging but such effects are temporary and local. Offshore placement of construction and maintenance dredged material is located in sites already designated for placement or currently being used for placement. At the ODMDS site, benthic organisms would be buried and subsequently killed during placement of the construction dredged material; however, recolonization should be rapid. Benthic community structure and abundance will eventually return to preplacement levels at the construction-material ODMDS since it will

be designated for one-time use. Repeated placement of maintenance material at the existing maintenance-material ODMDS will bury benthic organisms and may prevent them from fully developing following placement. However, the site is currently an active ODMDS, thus conditions would not change from existing conditions.

4.14.2.1.4 Artificial Reefs

No artificial reefs are located near enough to the project area such that impacts could be expected with Alternative 2.

4.14.2.2 Essential Fish Habitat

EFH for adult and juvenile brown, white, and pink shrimp, red drum, gag grouper, scamp, red snapper, gray snapper, lane snapper, greater amberjack, king mackerel, Spanish mackerel, and cobia occurs in the project area and includes estuarine emergent wetlands, estuarine mud and sand substrates, estuarine water column, marine water column, and marine nonvegetated bottoms.

Initial placement of dredged material in the construction-material ODMDS would cover benthic organisms with dredged material resulting in a loss of food source. Recovery of some benthic organisms would likely occur relatively quickly, although the assemblage in the dredged material might differ from the assemblage that existed at the PA prior to construction.

As noted in Section 4.9.1.1.1, turbidity is the most obvious impact of dredged material placement. A thorough discussion of turbidity impacts is included in Section 4.9.1.1.1. Material to be dredged is not contaminated and should not pose contamination issues with respect to EFH. In summary, impacts to EFH from turbidity associated with ocean placement are not expected to be significant.

Accidental spills have the potential to impact EFH, and larval and juvenile finfish could be affected significantly should a spill occur. Larval and juvenile finfish tend to be more susceptible to spills than adults and could be affected extensively by a spill during their active immigration periods. Due to their lack of mobility, they are less likely to be able to avoid these areas and could be negatively impacted if a spill were to occur. However, because of increased safety with the wider channels, there should be a slight decrease in the likelihood of oil spill chances with the Alternative 2.

There is no EFH at the beach nourishment site on Quintana. Therefore, there will be no EFH impacts from beach nourishment.

This DEIS will serve to initiate EFH consultation under the Magnuson-Stevens Fishery Conservation and Management Act. The NMFS will review the DEIS and provide comments on EFH impacts.

4.14.3 Alternative 3: Proposed Action with Placement at Surfside

4.14.3.1 Aquatic Communities

Under Alternative 3, impacts to aquatic communities will be the same as those described for Alternative 2.

4.14.3.1.1 Recreational and Commercial Species

Under Alternative 3, impacts to recreational and commercial species will be the same as those described for Alternative 2.

4.14.3.1.2 Oyster Reef Habitat

Under Alternative 3, oyster reef habitat will continue as described in Section 3.14.1.2.

4.14.3.1.3 Offshore Sands

Under Alternative 3, impacts to offshore sands will be the same as those described for Alternative 2.

4.14.3.1.4 Artificial Reefs

Under Alternative 3, artificial reefs will continue as described for Alternative 2.

4.14.3.2 Essential Fish Habitat

Under Alternative 3, impacts to EFH will be the same as those described for Alternative 2.

4.15 ENDANGERED AND THREATENED SPECIES

A Biological Assessment (BA) for this project is being prepared to fulfill the USACE requirements as outlined under Section 7(c) of the ESA of 1973, as amended, and is included in Appendix G. NMFS and FWS will review the BA and will issue a Biological Opinion (BO), if necessary, to ensure that all potential project impacts have been discussed and coordinated with the appropriate agencies during various workgroup meetings.

4.15.1 Alternative 1: No-Action

The No-Action alternative would result in no immediate direct impacts to any endangered plant, terrestrial wildlife, or fish species or endangered species habitat at or near the proposed project area, although some of the habitats may change over time independent of the project. Existing dredging activities and placement of dredged material could result in sedimentation and altered hydrology, which could have an impact on the brown pelican and other birds, although none have been documented. Impacts to sea turtles from ongoing maintenance activities are covered by an existing BO (NMFS, 2003, 2005).

Since there are no Federally protected fish species in the project area (Section 3.15.2.4), Alternative 1 will have no adverse impacts on any endangered or threatened fish. Under Alternative 1, fish species of concern and candidate species will remain as described in Section 3.15.2.4.

4.15.2 Alternative 2: Proposed Action with Placement at Quintana

4.15.2.1 Dredging/Construction Activities

No Federally or State-listed plant species are of potential occurrence in Brazoria County (NDD, 2005; FWS, 2006a). Thus, Alternative 2 would not result in impacts to any endangered or threatened plant species.

The proposed project is unlikely to affect the any endangered and threatened terrestrial species. Many are inland species that are not likely to occur in the affected areas, while others are migrants that pass through the region seasonally. Listed species likely occurring in the project area at some time of the year include the brown pelican, piping plover, reddish egret, and white-faced ibis.

No documented brown pelican nesting sites occur within the project area, although the species may use portions of the project area for foraging, roosting, and loafing. Commercial development and continued dredging and placement of dredged material occurring in the area could result in increased sedimentation and altered hydrology, which could have secondary impacts on the brown pelican by reducing their food source. Such impacts, however, should be temporary and without significant long-term implications and are similar to the No-Action alternative.

Wintering piping plovers are of potential occurrence on beaches and sand and mudflats along the bay margins within the project area. FWS-designated critical habitat for the piping plover (Critical Habitat Unit TX-36) encompasses approximately 388 acres between the mouth of the Brazos River and FM 1495 and includes portions of Bryan Beach and other adjacent beach habitat (66 FR 17; 36142, 10 July 2001). No beach nourishment operations will be conducted within Critical Habitat. The project site is not likely to be an important feeding and resting area for piping plover due to year round human recreational use. Construction activities during the placement of material on the beach may temporarily preclude its use by piping plover for feeding and resting. The duration of the activity would be short and the size of the construction area would not be large enough to cause any significant loss of habitat for the piping plover. The resultant additional beach would provide additional habitat for piping plovers that might use the area. Therefore, the proposed activity may affect, but is not likely to adversely affect piping plovers; no impacts to piping plover critical habitat would occur.

The white-faced ibis and reddish egret likely occur in the general area; however, these species typically inhabit marshes, a habitat that the proposed project is unlikely to affect directly. Dredging activities may indirectly affect these species by reducing the availability of food supplies, particularly if the activities take place during the nesting season. The proposed project is unlikely to have direct effects on any known active rookeries. The decreased potential for chemical or oil spills would reduce impacts to the nekton

community and, thus, the food source of the white-faced ibis and reddish egret. Therefore, the project is not likely to adversely affect the white-faced ibis or reddish egret.

Five species of sea turtles are of potential occurrence in project area waters. The proposed project calls for the use of both pipeline dredges and hopper dredges. It has been well documented that hopper dredging activities occasionally result in sea turtle entrainment and death, even with seasonal dredging windows, v-shaped turtle-deflector dragheads, and concurrent relocation trawling (NMFS, 2003). Between February 1995 and September 2002, hopper dredging activities by the USACE Galveston district resulted in 29 lethal takes of sea turtles: 15 loggerheads, 8 green turtles, and 6 Kemp's ridleys (NMFS, 2003). At Freeport Habor Channel, dredging activities have resulted in the take of 10 sea turtles since 1980: 5 loggerhead sea turtles in 1996, 1 in 1999, and 2 in 2000, and 2 green sea turtles in 2006. Thus, minor impacts to sea turtles could result from mortality associated with dredging activities. Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Apart from direct mortality, dredging activities could have an impact on sea turtles through an increase in sedimentation, turbidity, and resuspension of toxic sediments. However, sediments to be dredged have been tested and there is no concern relative to toxicity.

The sedimentation may affect food sources for the turtles, and the turbidity could affect primary productivity. This would be short-term, however, and would be similar to the No-Action alternative. The increased possibility of spills during construction could pose a threat to turtles both directly and indirectly through their food source. While adult sea turtles may be mobile enough to avoid areas of high concentrations, hatchlings, post-hatchlings, and juveniles in the area would be more susceptible. The widened channel is not anticipated to result in an increase in marine traffic, so there should be no higher incidence of collision with sea turtles. Other potential impacts because of the project include disorientation because of lighting on vessels, increased accumulation of plastic detritus, and beach nourishment activities. If sea turtles are present at disposal sites, they may be affected by sedimentation and turbidity. However, all of these conditions exist at present and no significant adverse impacts are expected to sea turtles.

Kemp's ridley sea turtle has been recorded from the project area. In 1994, a headstarted ridley was accidentally caught by an angler on a rod and reel in the GIWW and released alive. This species has also nested in the project area. One nest was found on Quintana Beach in 2002 and another was found near Surfside Beach in 2003 (Yeargan, 2006). If either of these beaches becomes the recipient of beach nourishment activities, the resulting beach may prove to be less attractive to the ridley, or result in a poorer nesting success. Because Kemps' ridley nests during daylight hours, no disorientation for adults from boat lighting would occur. Hatchlings, however, emerge from the nest at night and may be adversely affected by lighting on the boats. Under natural conditions, hatchlings typically take the shortest route to the water's edge. Bright lights on a nearshore hopper dredge may cause the hatchlings to move toward the lights, resulting in a circuitous route to the water or open ocean, thereby exposing them to more danger. While nesting in the study area is uncommon (a maximum of one nest per year), dredging outside of the nesting/emergence season (which occurs between May 1 and October 31), turning off/lowering/shielding

unessential lighting, and use of shielded, low-sodium vapor lights for those that cannot be safely eliminated, would reduce this potential disorientation impact.

As noted above, hopper dredging may also result in mortality of individual Kemps' ridleys. This species is seasonal in nearshore waters of Texas. During the onset of colder waters in December, Kemp's ridley will move away from inshore waters into deeper waters, returning in March with warmer waters, ready to nest on the Texas coast and to forage in tidal passes and bays. Restriction of hopper dredging activities to between December 1 and March 31, whenever possible, would reduce the likelihood of direct mortality. Any dredging activities outside of this timeframe (i.e., between April 1 and November 30) should be with pipeline dredges to reduce mortality. Hopper dredging impacts on sea turtles can also be reduced by having a trawler precede the dredges to capture turtles and relocate them away from the action, which would be required in the dredging contract, as is true for present maintenance dredging. No significant impact to Kemp's ridley because of the project is anticipated.

The loggerhead sea turtle has been recorded from the study area. Between 1995 and 2000, eight loggerheads were caught in Freeport Harbor; and during the Freeport Harbor Project (July 13 to September 24, 2002), one loggerhead was captured by a relocation trawler (NMFS, 2003). The green sea turtle and hawksbill sea turtle are of potential occurrence in the project area. All three species could be negatively impacted by dredging activities. Relocation trawlers working ahead of the dredges would reduce these impacts. No significant impacts to these three species because of the project are anticipated.

Of the five species of sea turtles occurring in Texas waters, the leatherback is the species least likely to be affected by the proposed project because of its rare occurrence and pelagic nature. It is unlikely to occur in the action area and has not been caught in hopper dredges. No impact to this species because of the project is anticipated.

4.15.2.2 Operational Activities

Upon completion of the initial construction dredging activities associated with the project, few impacts are likely beyond those with Alternative 1. Maintenance dredging activities would have similar temporary impacts as the initial dredging, but for a shorter term. The number of vessels in the area is not anticipated to increase or decrease; therefore, the potential for erosion would not change. The possibility of accidental oil or chemical spills would decrease because of safer navigability. Such spills pose a threat to the aquatic community and, thus, the food source for the brown pelican, piping plover, reddish egret, and white-faced ibis. Impacts from noise and human activity are unlikely to be a factor. Impacts to sea turtles would be similar to present maintenance.

Since there are no Federally protected fish species in the project area (Section 3.15.2.4), Alternative 2 will have no adverse impacts on any endangered or threatened fish. Under Alternative 2, fish species of concern and candidate species will remain as described in Section 3.15.2.4.

4.15.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts to endangered and threatened species resulting from dredging/construction and operational activities associated with Alternative 3 would be similar to those associated with Alternative 2, which are discussed in Section 4.15.2.

4.16 CULTURAL RESOURCES

Activities associated with any proposed project have the potential to adversely impact cultural resources through changes in the quality of the archaeological, historical, or cultural characteristics that qualify a property to meet the criteria of eligibility to the NRHP. These impacts occur when an undertaking alters the integrity of location, design, setting, materials, construction, or association that contributes to a resource's significance in accordance with the National Register criteria.

As discussed in 36 CFR 800, adverse impacts on National Register listed or eligible properties may occur under conditions that include, but are not limited to:

1) destruction or alteration of all or part of a property;
2) isolation from or alteration of the property's surrounding environment (setting); or
3) introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.

Impacts may be direct or indirect. Direct impacts are caused by the proposed activities and generally occur concurrently. Indirect impacts include those caused by the activities that occur later in time or are further removed, but are foreseeable. Both direct and indirect impacts may include destruction of a site, alterations in the pattern of land use, changes in population density, or accelerated growth rates, all of which may have an impact on properties of historical, architectural, archaeological, or cultural significance.

The preferred form of mitigation for direct or indirect impacts for cultural resources is avoidance. An alternative form of mitigation of direct impacts can be developed for archaeological and historical sites with the implementation of a program of detailed data retrieval. Additionally, relocation may be possible for some historic structures. Indirect impacts on historical properties and landscapes can be lessened through careful design considerations and landscape.

4.16.1 Alternative 1: No-Action

The No-Action alternative will have no effect on existing or unrecorded terrestrial or nautical cultural resources properties.

4.16.2 Alternative 2: Proposed Action with Placement at Quintana

It is not anticipated that the actions for Alternative 2 for the proposed Freeport Harbor Entrance and Jetty Channels Widening will have any adverse impacts on terrestrial cultural resource sites. The file review did not identify any recorded terrestrial archaeological sites near the area to be dredged or the Quintana beach nourishment site. However, a nautical archaeology survey conducted in March and April of 2005 identified 6 magnetic anomalies within the Freeport Ship Channel that were recommended for additional survey. A close-order survey was performed by PBS&J in February 2006 as a means to further identify these targets (Borgens et al., 2006). Two magnetic anomalies within the Freeport Ship Channel have features indicative of submerged shipwreck sites. Cartographic research suggests that an additional four anomalies could be associated with submerged portions of the historic Velasco townsite. These six anomalies are within the project footprint, would be affected by modifications to the channel, and have been recommended by THC for diver assessment and/or probing by qualified nautical archeolgoists selected by the Applicant prior to project construction.

4.16.3 Alternative 3: Proposed Action with Placement at Surfside

The file review did not identify any recorded terrestrial archaeological sites near the area to be dredged or the Surfside beach nourishment site. It is not anticipated that the actions for Alternative 3 for the proposed Freeport Harbor Entrance and Jetty Channels Widening will have any adverse impacts on terrestrial cultural resource sites. Impacts to marine sites would be the same as for Alternative 2.

Known shipwrecks or potential shipwreck sites also must be considered in an impact assessment. Even though a survey was recorded in the proposed Surfside beach nourishment site, this survey was conducted in the 1970s and less reliable technology was available at that time. Areas near the shore potentially holding known shipwrecks, as discovered in the THC and Automated Wreck and Obstruction Information System (AWOIS) searches, may be impacted by the proposed beach nourishment.

4.17 LAND USE/RECREATION/AESTHETICS

4.17.1 Alternative 1: No-Action

Under the No-Action alternative, the study area (Brazoria County) would continue on its present course of moderate population growth, and of fairly rapid commercial, residential, and industrial land development. The Port of Freeport would continue to function as an important port because of its industrial facilities and international commerce. The Port of Freeport would also continue to develop its industrial properties, but at a slower rate than it would with the proposed action. Many developments would not be built in the proposed location without the widening of the Freeport Harbor Channel. Without the channel widening, safety concerns related to large vessels would continue, as would delays. In addition, without the proposed action, future transportation projects such as improvements to existing roadways, as well as construction of new roadways, may be cancelled or delayed.

No impacts to transportation, community services, aesthetics, or future developments would occur with the No-Action alternative.

4.17.2 Alternative 2: Proposed Action with Placement at Quintana

4.17.2.1 Land Use

The proposed action would not affect any shoreline land uses; therefore, would have a minimal impact on land use. All channel improvements would occur in open-water locations. The only land use implications for the proposed action relate to proposed BU site placement of 300,000 cy of silty-sand on Quintana Beach to protect the Seaway PA from failure due to erosion and indirect future land development that may occur as a result of the proposed project.

The greatest long-term land use consequence of the proposed action would be indirect and would likely be a change in future land uses that could occur in response to the improvements to the channel. These future land uses are speculative and are, therefore, not considered part of the proposed project, but would be less likely to occur without it. The Port of Freeport currently owns property along the Freeport Channel, which is available for development for industrial sites. When the proposed action is completed, the Port would have a wider ship channel providing an incentive for new industrial development at all of the Port properties, based on navigation cost savings. Future industrial development may include oil and gas refineries, petrochemical plants, and bulk grain facilities. The long-term land use effects of these industrial facilities are largely unknown; however, they could lead to an increase in demand for new housing development, new roads, commercial services, schools, and other services within Brazoria County.

4.17.2.2 Transportation

In response to Alternative 2, the existing transportation system within the project area could be temporarily affected by the influx of construction workers and the delivery of construction equipment and materials to the project area. During widening activities, approximately one truck or van for each of the three dredge units would make two round trips from Freeport to a transfer point near the channel for approximately 310 days (Wagner, 2006). The addition of these few employees accessing the project area on a daily basis would not result in a significant increase in volume that would adversely affect traffic on area roadways.

4.17.2.3 Community Services

The proposed action would result in minor temporary or no impacts to local community facilities and services such as police, fire, medical, and waste disposal services. Local communities have adequate infrastructure and community services to meet the needs of the nonlocal workers that would be required for the proposed project. Other construction-related demands on community services could include an

increase in police enforcement and emergency medical services to treat injuries resulting from construction activities.

The proposed action would not affect the delivery of local services, including water, wastewater, or other utilities. No disruption to roads or rail transportation would result from the proposed action. The proposed widening would result in only minor changes in traffic demand on local roads and highways and would not affect the delivery and quality of local services to the population living within the vicinity of the project area. Therefore, Alternative 2 would not result in significant impacts on community services in the project area.

4.17.2.4 Aesthetics

Alternative 2 would have a minimal effect on the overall visual quality within the project area. There would be no significant effect to the appearance of the shorelines that are adjacent to the proposed channel improvements. The project area includes a variety of land uses, including shoreline residential development, commercial development, public and private marinas, parkland, relatively undisturbed natural areas, fishing and tourism-related businesses, civic uses, transportation systems (highways and railways), port facilities, and heavy-industry areas. The only aspects of the proposed action that would affect the visual quality of the study area would be the beach nourishment area. This includes the placement of approximately 300,000 cy of silty sand material dredged from the Jetty Channel on Quintana Beach in front of the Seaway PA. The shoreline areas closest to the Seaway PA are existing public facilities, undeveloped land, and a few residences. The beach nourishment area was requested by the residents and would be visible looking southeast from homes and the Quintana Beach County Park.

4.17.2.5 Future Development and Development Restrictions

The proposed action is compatible with existing and proposed zoning adjacent to the project area. Improvements would neither constrict the future development of planned land uses by local jurisdictions nor inhibit the densification of uses within the project area.

The proposed action supports current local land use objectives for property adjacent to the project area and is consistent with long-range plans to increase cargo capacity into the Port of Freeport. Because the proposed project would not affect any shoreline land uses, it would not require changes in local agency zoning codes or site-specific zoning.

4.17.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2 except the proposed BU site placement of 300,000 cy of dredged material would be on Surfside Beach to provide additional beach in front of several beachfront homes. The beach nourishment area was requested by area residents as a protective measure against erosion. This area would be visible looking southeast from homes along the beachfront.

4.18 SOCIOECONOMICS

4.18.1 Population

4.18.1.1 Alternative 1: No-Action

The No-Action alternative would not relocate businesses, homes, or any other properties, nor would it change population growth trends or development patterns within the study area. Demand for community facilities, services, and housing would increase in response to the projected population growth. The locations of these resources would generally follow development and land use plans identified by the City of Freeport, Quintana, Surfside Beach, and Brazoria County. This alternative would not result in potentially significant impacts.

4.18.1.2 Alternative 2: Proposed Action with Placement at Quintana

The proposed action would not affect any shoreline land uses; therefore, would require no business or residential relocations. This alternative would neither divide nor isolate any particular neighborhood nor separate residents from community facilities.

The proposed action would likely have a negligible effect on population growth trends within Brazoria County. Population in this county is projected to grow at a rapid rate of 78% between 2000 and 2040, regardless of the proposed project. As a result of the proposed action, demand for community facilities, services, and housing would increase at a rate that is consistent with the projected population growth. The location of these resources would generally follow development and land use plans currently identified. Most of the construction workers are likely to come from the labor force that is already living within Brazoria County and if not, the number of these workers is small and their stay would be temporary. Therefore, immigration to Brazoria County area would be fairly minimal. This alternative would not result in potentially significant impacts.

4.18.1.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

4.18.2 Employment

4.18.2.1 Alternative 1: No-Action

The No-Action alternative would have a negligible effect on the local economy within the project area and within Brazoria County. It would not change the number of employed persons nor industry trends. Employment would increase in response to the projected population growth. This alternative would not result in potentially significant impacts.

4.18.2.2 Alternative 2: Proposed Action with Placement at Quintana

All dredging construction work would be performed over a one-year period beginning in late 2007. Indirect and induced employment would occur within Brazoria County as dredge workers spend some of their disposable income locally, and as operation of the dredges would necessitate expenditures on fuel, which would be purchased from firms located in Brazoria County.

The industries that would benefit directly (in terms of employment) from the proposed project during the construction and O&M phases would be dredging contractors and other construction contractors that would be involved in nondredging activities. When the proposed project is completed, it is likely that new industrial development would occur within the Freeport Harbor. The widened ship channel would provide an additional benefit to industry, which would likely attract new companies to locate within the Freeport area. With the widened channel in place, it would be more likely that new petrochemical plants, bulk grain facilities, petroleum, and natural gas refineries would be built within the area. The impact of these new industries on employment within Brazoria County is unknown, but could potentially be substantial. The potential increase in employment may increase the rate of immigration, the demand for housing, schools, and other services within Brazoria County. As a result of the increased immigration of workers, it is likely that an increase in single-family homes would occur in Brazoria County (within and near the cities of Freeport, Oyster Creek, Quintana, and Surfside Beach) where vacant land is available for such development and is located near such available industrial sites.

During the proposed project construction, the City of Freeport, Quintana, Surfside Beach, and Brazoria County would have an increase in employment and local purchases of construction materials. As construction dollars are spent locally, there would be a beneficial effect on local employment in the area. The proposed project would not result in potentially significant impacts.

4.18.2.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

4.18.3 Economics

4.18.3.1 Alternative 1: No-Action

Without the proposed action, the Freeport area would continue on its present course of economic development and diversification, of moderate population, and commercial, residential, and industrial land development. The Port of Freeport would continue to function as an important port for its industrial facilities and international commerce. However, the Port of Freeport would also continue to develop its industrial properties but at a slower rate than it would with the proposed action. Crude petroleum imports have increased in the U.S. in response to both increases in demand and decreases in domestic production. Petroleum imports are and have been the major form of waterborne commerce at the Port of Freeport (USACE, 2002). The maximum dimensions for the very large crude carriers (VLCC) are 900–1,500 ft

length all over (LOA), 160–250 ft beam, and drafts of 60–80 ft. The shuttle tankers are typically 800 ft LOA, 140 ft beam, and maximum drafts exceeding 46 ft. Typically, it takes three partially loaded shuttle tanker runs to transport the oil from the VLCC because of the 45-ft draft limitation. The trend is towards larger vessels and without the proposed project the Port of Freeport may lose income due to time delays and added costs of having to use shuttle tankers.

The No-Action alternative would have a negligible effect on the local economy within the project area and within Brazoria County. Because no property would be removed from the tax rolls, the tax base would not be affected. It would not change the number of employed persons nor industry trends. This alternative would not result in potentially significant impacts.

4.18.3.2 Alternative 2: Proposed Action with Placement at Quintana

As the channel is widened from 400 to 600 ft, two-way traffic will be allowed on the channel, which will reduce vessel delay times for all vessels and barges transiting the Freeport Ship Channel. As a result, vessels will no longer be restricted to 120,000 DWT. The resulting total annual NED economic benefits of the proposed widening due to time savings would be $487,415 (Martin Associates, 2006).

As previously discussed, the primary economic bases of the county include chemical manufacturing, petroleum processing, offshore production maintenance services, biochemical and electronic industries, commercial fishing, and agriculture. As a result of the proposed project, the positive economic effects to the Brazoria County economy could be substantial.

4.18.3.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

4.18.4 Environmental Justice

4.18.4.1 Alternative 1: No-Action

The No-Action alternative would result in negligible effects to the City of Freeport, Quintana, Surfside Beach, and Brazoria County. Similarly, no particular social group would be affected. The effects of this alternative on minority and low-income persons living within the project area are negligible.

4.18.4.2 Alternative 2: Proposed Action with Placement at Quintana

The population living within the vicinity of the proposed alternative was predominately white with the exception of the City of Freeport, with only 33% of the population being white. In general, the effects of this alternative on minority or other identifiable groups living within the project area are expected to be negligible because there would be no physical changes to the environment or land use.

Because there would be no physical changes to the environment or land use, minority and low-income populations living within the project area would experience no adverse changes to the demographic,

economic, or community cohesion characteristics within their neighborhoods as a result of the proposed project. Generally speaking, the population living within these block groups would benefit from the proposed project. These benefits would include minimal short-term local employment in which a portion of the project wages would find their way into the local economy, benefiting local populations. Therefore, the proposed project would not result in disproportionately high and adverse impacts on minority and low-income persons living within the project area.

4.18.4.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

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5.0 CUMULATIVE IMPACTS

5.1 INTRODUCTION

Cumulative impact has been defined by the President's Council on Environmental Quality (CEQ) 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 persons undertakes such action." Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Impacts include both direct effects, which are caused by an action and occur at the same time and place as the action, and indirect effects, which are also caused by the action and occur later in time and are farther removed in distance, but which are still reasonably foreseeable. Ecological effects refer to effects on natural resources and on the components, structures, and functioning of affected ecosystems, whether direct, indirect, or cumulative.

In assessing cumulative impact, consideration is given to (1) the degree to which the proposed action affects public health or safety, (2) unique characteristics of the geographic area, (3) the degree to which the effects on the quality of the human environment are likely to be highly controversial, (4) the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks, and (5) whether the action is related to other actions with individually insignificant, but cumulatively significant impacts, on the environment.

Cumulative effects can result from many different activities including the addition of materials to the environment from multiple sources, repeated removal of materials or organisms from the environment, and repeated environmental changes over large areas and long periods. More complicated cumulative effects occur when stresses of different types combine to produce a single effect or suite of effects. For example, large, contiguous habitats can be fragmented, making it difficult for organisms to locate and maintain populations between disjunctive habitat fragments. Cumulative impacts may also occur when the timings of perturbations are so close that the effects of one are not dissipated before the next occurs, or when the timings of perturbations are so close in space that their effects overlap.

Relative to cumulative impacts, 11 parameters were addressed for 8 past, present, and reasonably foreseeable future projects viewed as pertinent to the future condition of the Project Area and the surrounding area. Parameters to be addressed include ecological, physical, chemical, socioeconomic, and cultural attributes.

5.1.1 Cumulative Impact Assessment Methodology

This discussion describes the application of the cumulative impact assessment methodology to the proposed alternative. Projects evaluated in the cumulative impact assessment include the following:

Reasonably foreseeable future actions:

- Freeport Harbor Channel Improvement Project (Federal project);
- Freeport LNG Project, Phases I and II;
- Center Point Energy, Inc. (associated with supplying electricity for the Freeport LNG Project);
- Port Freeport Modifications;
- Strategic Oil Reserve (Stratton Ridge underground storage); and
- Teppco-Seaway Crude Pipeline Company (potential modifications or relocation of facilities resulting from improvements to the Freeport Harbor Channel project).

Past or present actions:

- The GIWW, which crosses the existing Freeport Harbor Channel project near mile 1.5;
- Freeport Hurricane Flood Protection Levees;
- Strategic Oil Reserve (Bryan Mound); and
- Freeport Harbor 45-ft Project.

Direct impacts that could be quantified in acreage were considered for habitat assessment when information was available. Habitats for cumulative impact assessment were identified from reports developed for the above proposed projects and include the types of information included in Table 5.1-1.

TABLE 5.1-1

CUMULATIVE ECOLOGICAL/ECONOMIC IMPACTS

Ecological Environment	Physical/Chemical Environments	Socioeconomic Assets
Wetlands (coastal marshes)	Air Quality Noise Impacts	Cultural Resources
Benthos	Turbidity	Commercial Fisheries
Essential Fish Habitat	Contaminated Sediments (vicinity of DOW Chemical)	Recreational Fisheries
Threatened/Endangered Species	Shoreline/Bank Erosion (Quintana Island, Surfside and inner reaches of channel alignment route)	

5.1.2 Evaluation Criteria

Cumulative effects were determined by reviewing impacts as described in the project documents and determined from recent habitat information obtained from Section 3.0. Acreage of each habitat in the study was determined from this assessment, if available.

5.1.2.1 Individual Project Evaluation

Individual project documents were reviewed for impacts to selected habitats based on the evaluation criteria described above. No attempts were made to verify or update published documents, nor were the disposal practices proposed in reviewed documents verified for current ongoing projects. In addition, no field data were collected to verify project impacts described in reviewed documents. Mitigation outlined in individual project documents may be in place or proposed. This analysis recognizes that some of the projects assessed are undergoing revisions that may alter their environmental impact. This analysis relied only on existing published documents. If acreage was available, it was summed for each habitat to obtain a cumulative acreage impact for each project. It should be noted that because of the diverse mix of documents that were reviewed for cumulative impacts and because of the fact that not all documents used the same definitions or even the same categories of resources, it was sometimes necessary to lump or modify categories so that the quantities in this section may not be exactly comparable with those presented in sections 3 and 4 of this EIS. However, every attempt has been made to make this section internally consistent, so that all projects included in Cumulative Impacts are evaluated comparably.

5.1.2.2 Resource Impact Evaluation

Biological/ecological, physical/chemical, and cultural/socioeconomic resource impacts were evaluated based on individual project reviews. In Table 5.1-2, a quantitative assessment of biological/ecological resources is presented. A qualitative discussion of biological/ecological, physical/chemical resources, and cultural/socioeconomic resources is presented below, using information published in reviewed documents. The following is a brief description of the evaluated projects.

5.2 REASONABLY FORESEEABLE FUTURE ACTIONS

5.2.1 Freeport Harbor Channel Improvement Project

The USACE has completed preliminary economic and an alternatives screening for improvements along the Freeport Harbor Channel that include deepening and widening portions of the channel. The BRHND of Brazoria County, Texas (Port Freeport) is the non-Federal sponsor for the project. Proposed improvements include widening the Entrance and Jetty Channel, widening and deepening to the Upper Turning Basin, and improving the Stauffer Channel. The proposed dredge and fill activities constitutes a major Federal action and an EIS is being prepared.

The proposed project begins at Channel Station -427+00 at the Entrance Channel extension and continues to Station +225+00 at the Stauffer Turning Basin along the existing Freeport Harbor Channel in Brazoria County, Texas. The Freeport Harbor Channel is currently maintained by the USACE to a depth of -47 ft MLT offshore and -45 ft MLT inshore at a width of 400 ft. The existing channel is approximately 6.3 miles in length. The proposed project (-60 ft MLT and 600-ft width) may also include widening and deepening the Lower Turning Basin, Brazosport Turning Basin and Upper Turning Basin, as well as improving the channel to the Stauffer Turning Basin.

TABLE 5.1-2
CUMULATIVE IMPACTS

Project	Freeport Harbor Channel Widening Project	Freeport LNG Project	Port Freeport Modifications	Stratton Ridge Underground Storage	GIWW	Freeport Hurricane Flood Protection Levees	Bryan Mound Oil Reserve	Freeport Harbor 45-ft Project	Total
RESOURCE									
Wetlands impacted (acres)	NI	57	2.08	538	NI	NI	NI	40	637.1
Wetlands created (acres)	NI	NA	15.7	NA	NA	NI	NA	NA	15.7
Benthos	NI	NI	NA	NI	NI	NI	NI	NI	NI
Threatened/Endangered Species	NI	NI	NA	Potential impact to bald eagle habitat	NI	NI	NI	NI	POTENTIAL IMPACT TO BALD EAGLE
Salt Marsh	NI	NA	NA	NA	NI	NI	NI	NA	NI
Flats	NI	NA	NA	NA	NI	NI	NI	NA	NI
Shallow Bay Bottom Habitat (0 to –12 MLT)	NI	13.9 ac created	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Submerged Aquatic Vegetation (SAV)	NI	NA	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Essential Fish Habitat (subtotal of salt marsh, flats, shallow bay bottom habitat, and SAV)	NI	NI	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Air Quality	NA	NI	NA	NI	NI	NI	NI	NI	NI
Noise	NI	NI*	NA	Minor	NI	NI	NI	NI	MINOR
Water Quality	NI	NI	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Sediment quality	NI	NI	NA	NI	NI	NI	NI	NI	NI
Shoreline/Bank Erosion	Beach placement	NI	NA	NI	NI	NI	NI	0.85 mile beach plcmt	Net positive effect from placement

TABLE 5.1-2 (Concluded)

Project	Freeport Harbor Channel Widening Project	Freeport LNG Project	Port Freeport Modifications	Stratton Ridge Underground Storage	GIWW	Freeport Hurricane Flood Protection Levees	Bryan Mound Oil Reserve	Freeport Harbor 45-ft Project	Total
Cultural Resources	Possible nautical site impact	Possible loss of historic resources	NA	Possible loss of historic resources	NI	NI	NI	NI	POSSIBLE LOSS OF RESOURCES
Commercial Fishereies	NI	NI	NA	NI	NI	NI	NI	NI	NI
Recreational Fisheries	NI	NI	NA	NI	NI	NI	NI	Created areas	POSITIVE EFFECT

NI = No long-term impacts; NA = Not Available; * = with mitigation.

Note: No impact information was available for the Federal Freeport Harbor Channel Improvement Project, the Center Point Energy Project, or the Teppco-Seaway Crude Pipeline Company Project.

Approximately 27.8 mcy of new work material and 150 mcy of maintenance material over the 50-year period of economic evaluation are expected to be produced by the proposed project. Dredged material may be placed in existing UCPAs, new UCPAs, a dispersive ocean placement site, or BU sites (to be determined).

At the time this document was prepared, the evaluation of potential impacts associated with this project was not complete. Thus, no potential impact information was available.

5.2.2 Freeport LNG Project

The Freeport LNG Development, L.P. (Freeport LNG) LNG Import Terminal Project (Freeport LNG Project) is to develop the necessary infrastructure to deliver natural gas to shippers at the Stratton Ridge Meter Station by 2007. To this end, Freeport LNG is constructing a new LNG facility on Quintana Island, Brazoria County, Texas. The final EIS for Phase I of this project lists the following components for the Freeport LNG Project (FERC, 2004).

- LNG ship docking and unloading facilities with a protected single berth equipped with mooring and breasting dolphins, three liquid unloading arms, and one vapor return arm;
- reconfiguration of a storm protection levee and a permanent access road;
- two 26-inch-diameter (32-inch outside diameter) LNG transfer lines, one 16-inch-diameter vapor return line, and service lines (instrument air, nitrogen, potable water, and firewater);
- two double-walled LNG storage tanks each with a usable volume of 1,006,000 barrels (3.5 billion cubic ft of gas equivalent);
- six 3,240 gallon-per-minute (gpm) in-tank pumps;
- seven 2.315 gpm high-pressure LNG booster pumps;
- three boil-offgas compressors and a condensing system;
- six high-pressure LNG vaporizers using a primary closed circuit water/glycol solution heated with twelve water/glycol boilers during cold weather and a set of intermediate heat exchangers using a secondary circulating water system heated by an air tower during warm weather, and circulation pumps for both systems;
- two natural gas superheaters and two fuel gas heaters;
- ancillary utilities, buildings, and service facilities at the LNG terminal; and
- 9.6 miles of 36-inch-diameter natural gas pipeline extending from the LNG import terminal to a proposed Stratton Ridge Meter Station.

Phase II of the project includes construction of an additional LNG ship berth and associated unloading facilities with the capacity to unload up to 200 LNG ships per year, additional vaporizers and associated systems, including an air tower, and an additional LNG storage tank and associated systems (FERC, 2006). The second berth would be located adjacent to the Phase I berth and would be dredged to a depth of -46.5 ft. Approximately 144,000 cy of surface materials would be removed for construction of the dock

and used as fill material elsewhere on the site. Approximately 754,000 cy of dredged material would be pumped to an existing DMPA that is currently being used by the Port and has been authorized by the USACE. Two LNG transfer lines (each 0.99 mile long) would extend across the LNG site boundary.

Impacts associated with both phases of the project include the permanent loss of approximately 57 acres of wetlands and the conversion of approximately 13.9 acres of upland to open-bay bottom.

5.2.3 Center Point Energy, Inc

Construction and operation of the Freeport LNG Project would require that new, dedicated electrical service be brought to the LNG Terminal site. Freeport LNG has requested Center Point Energy to provide a new 69-kV electric transmission line to the Freeport LNG substation, which is to be located on the site of the proposed storage and vaporization facility on Quintana Island. The new line would connect to an existing Center Point Energy substation on the mainland. No information regarding potential impacts associated with this project was available.

5.2.4 Port Freeport Modifications

Several projects were identified by Port Freeport as reasonably foreseeable projects in the Freeport area. These include the expansion of public docks (Dock 5), a cool storage facility, construction of berth 7, the Gulf Coast Regional Spaceport, and park upgrades and a new marina. Additionally, upgrades or additions are planned at two facilities currently operating at the Port, BASF, and RCI. Because many of these projects are still in the conceptual planning stages, there is very little information available regarding their potential impacts. However, a brief description of each follows.

5.2.4.1 Expansion of Dock 5

Development of Parcel No. 25/Berth 5 property will further augment the Port's warehousing and rail facilities. Transit Shed 6 adjacent to Dock 5 will be a 125,000-square ft facility with rail access (BRHND, 2004). According to Port Freeport's Environmental Coordinator, potential impacts associated with the Dock 5 expansion will include minimum to no wetland impacts for the initial phase and dredging activities with placement of dredged material in the Port's UCPAs (Personal communication with Lisa McMichael, August 23, 2006).

5.2.4.2 Cool Storage Facility

A 38,000- to 40,000-square-ft new waterfront cold storage facility is under construction to serve needs of fruit importers Dole Fresh Fruit Co. and Chiquita Brands Inc. The facility will handle palletized fruit and other temperature-sensitive commodities (BRHND, 2004). Construction of the facility involves conversion of a transit shed and does not involve construction of undeveloped land. It will contain four cubicles for fresh fruit storage that can be off-loaded as breakbulk cargo for ships or trucks (Personal communication with Lisa McMichael, August 23, 2006).

5.2.4.3 Construction of Berth 7

This would be a new 800-ft-long berth with 20 acres of stabilized backlands for new containerized and/or breakbulk cargo activity. The facility will ultimately be 1,200 ft long and is designed to handle new generation gantry cranes and vessels up to 48-ft draft (BRHND, 2004). According to Port Freeport's Environmental Coordinator, the project is expected to impact approximately 2.08 acres of jurisdictional Waters of the U.S. The Port is mitigating for that loss with the creation of 15.7 acres of wetlands. Specifically, 8.5 acres of new wetland would be created and 7.2 acres of existing wetlands in the Peach Point Wildlife Management Area would be enhanced (Personal communication with Lisa McMichael, August 23, 2006).

5.2.4.4 Gulf Coast Regional Spaceport

The Gulf Coast Regional Spaceport Development Corporation has proposed the construction of a Gulf Coast Regional Spaceport in Brazoria County. The action would require the Federal Aviation Administration (FAA) to issue a launch site operator license to support the launches of suborbital rockets in Brazoria County. The preferred location for the spaceport is south of Big Slough Road, several miles north of Port Freeport in Brazoria County. Construction would include a ½-mile access road and a 40-ft by 40-ft launch pad. The spaceport would support up to eight launches per year of suborbital rockets, with each launch lasting 15 minutes or less. Issuing a launch license is considered a major Federal action and is subject to the NEPA process (Gulf Coast Regional Spaceport Development Corporation, 2006). A public scoping meeting for preparation of an Environmental Assessment was held July 11, 2006 at the Lake Jackson Civic Center. No potential impact information was available for review at the time this document was prepared.

5.2.4.5 Park Upgrades and Marina

Improvements are anticipated for Freeport's Memorial Park and Bryan Beach Park. Improvements at Memorial Park include electrical upgrades and repairs, such as in-ground halogen light fixtures, accent flood lights, and a sound system that includes 40 weather-resistant speakers and four amplifiers. The goals of the project are to provide security lighting, landscape and American flag lighting, powering the fountains and making public address with the sound system (*The Alliance*, 2006i). At Bryan Beach Park, there are plans for a parking lot and a 2.9-mile crushed oyster shell trail. Restroom facilities may also be constructed at the park (*The Alliance*, 2006g).

The Port has proposed a marina on the Old Brazos River that would market to large high-end boats. Additionally, a marina is being planned in Surfside off the Highway 332 Bridge. The marina would have a 400-slip dry-dock facility with a restaurant, retail shops, showers and a laundry facility. It would cater to sporting craft rather than larger boats (*The Alliance*, 2006c).

5.2.4.6 BASF Polycaprolactam Facility

A polycaprolactam plant is currently under construction at the BASF facilities in Port Freeport. The project is scheduled for completion in mid-2007 (Real Estate Center, 2006). The plant will build on the existing nylon polymer operations and will produce nylon polymers for engineering plastics used in automotive parts, electronics, and sporting goods, as well as other products (*The Alliance*, 2005a). According to the Texas Hub Environmental Team Leader for BASF, projected air emissions for the project have been permitted and process wastewater will be treated onsite under their existing Texas Pollution Discharge Elimination System (TPDES) wastewater discharge permit. No increased water emissions are associated with the project (Personal communication with Michael Baxter July 17, 2006).

5.2.4.7 RCI

American Rice Inc. (ARI) has plans for an expansion of its on-port facilities. Proposed facilities include:

- a 151,165-square ft, fully automated warehouse on 4.3 acres for storage of finished goods;
- 8 steel storage bins encompassing 45,225 square ft on 1.3 acres for holding rice brought by barge and truck;
- A 36,206-square ft instant rice plant on 1 acre for producing instant and microwavable products;
- A 116,736-square ft olive oil bottling plant on 3.4 acres; and
- A cookie-baking facility.

These improvements are expected to employ approximately 335 people in the Freeport area. In addition, RCI plans to relocate their North American operation headquarters to Freeport (*The Alliance*, 2006j). No information regarding potential environmental impacts was available at the time this document was prepared.

5.2.5 Proposed Stratton Ridge Strategic Oil Reserve

In 2006, the U.S. Department of Energy (DOE) issued a draft EIS for expansion of the Strategic Petroleum Reserve (SPR) system. The alternatives considered in the DEIS were expansion of two or three existing facilities and development of one or two new facilities. Potential new sites addressed in the EIS were at Richton and Bruinsburg, Mississippi, Stratton Ridge, Texas, and Clovelly and Chachoula, Louisiana, and expansion was proposed at Big Hill, Texas, and Bayou Choctaw and West Hackberry, Louisiana. Bryan Mound was not mentioned in the DEIS and, therefore, the DOE apparently has no plans for expansion or alteration of the Bryan Mound facility. The proposed new Stratton Ridge facility is ~5 miles northwest of Freeport and a brine disposal line is proposed to pass less than 4 miles northwest of the Freeport Harbor Channel. The Stratton Ridge site would encompass about 269 acres plus an additional 102-acre security area around the site. According to the DEIS (DOE, 2006), the Stratton Ridge facility would provide an additional 160 million barrels of crude oil storage in 16 caverns, would use the GIWW as a water source, would include a new brine diffuser in the Gulf of Mexico, and would require

approximately 61 miles of ROW for new pipelines, roads, and power lines. Potential impacts associated with the proposed facility include the construction of new ROW through the Brazoria NWR, and the loss of 538 acres of wetlands from fill, conversion at the site, and ROW easements. The alternative could affect potential foraging, roosting, and nesting habitat for the Federally threatened bald eagle. Additionally, increased salinity in the Gulf (up to 4.7 ppt), resulting from brine diffusion, would affect EFH, although the increase would be within the normal salinity concentration range for the Gulf. Brine disposal pipeline construction would disturb 320,000 square ft of sediment that is EFH (DOE, 2006).

5.2.6 Teppco-Seaway Crude Pipeline Company

Construction of the proposed Federal Freeport Harbor Channel Improvement Project may result in the relocation of facilities associated with the Teppco-Seaway Crude Pipeline Company. Additional information regarding the potential relocation and associated impacts was not available at the time this report was prepared.

5.3 PAST OR PRESENT ACTIONS

5.3.1 GIWW

Routine maintenance dredging will continue to occur along the GIWW in the vicinity of Freeport Harbor. According to the USACE FEIS for maintenance dredging of the GIWW (USACE, 1975), the portion of the GIWW from Chocolate Bayou to Freeport Harbor is dredged at approximately 36-month intervals and the estimated annual maintenance material is 750,000 cy. The portion from Freeport Harbor to Cedar Lakes is maintained every 24 months with an estimated annual maintenance material of 1,000,000 cy. Dredged material from the GIWW in the vicinity of the project area is placed in UCPAs designated for GIWW maintenance dredging. The proposed widening of the Freeport Channel will not affect the continuing maintenance dredging of the GIWW.

5.3.2 Freeport Hurricane Flood Protection Levees

According to a 2006 report (Edge et al., 2006), the Freeport Harbor levee system is projected to be able to protect the City and Port from a 100-year hurricane, which is more extreme than any hurricane to hit the Freeport area since records have been kept. Therefore, it is not likely that any additional construction would be required for the levee system.

5.3.3 Bryan Mound Strategic Oil Reserve

The Bryan Mound SPR Storage Site is part of the Nation's emergency oil stockpile and has a total storage capacity of 226 million barrels of oil. The system comprises more than twenty 10-million gallon chambers in a salt dome. The top of the dome is 1,200 ft below ground level and reaches a depth of 50,000 ft. The Bryan Mound site is close to port and terminal facilities at Freeport and to the Phillips Petroleum tank farm 3 miles to the east. Two principal crude oil pipelines extend from Bryan Mound—a

4-mile, 30-inch-diameter line to the Phillips terminal and docks, and a 46-inch line to the ARCO Pipeline Company terminal in Texas City, Texas.

5.3.4 Freeport Harbor 45-Ft Project

This is the existing project, which was constructed in 1978. The Freeport Harbor Jetty and Entrance Channels are currently maintained by the USACE to a depth of -47 ft MLT. The remainder of the channel is authorized at -45 ft MSL. The existing channels are approximately 6.3 miles in length and approximately 400 ft in width. The only on-going activity is the routine maintenance, which requires the removal of an average of 1.72 mcy/cycle (8.2 months), which equals 2.57 mcy/year of material for placement in UCPSs or the maintenance ODMDS.

5.4 RESULTS

5.4.1 Wetlands

The Freeport Widening Project would not impact any wetlands. Negative impacts (totaling 598.5 acres) are expected to occur to wetland habitat from the Freeport LNG project Phase I and II, (57 acres), Port Freeport modifications (3.5 acres), and the Strategic Oil Reserve project (538 acres). Based on available information, a total of 15.7 acres of wetland would be created through mitigation for the Port Freeport modifications. However, several of the projects evaluated had not yet identified wetland mitigation plans. It is reasonably foreseeable that permitting associated with the other projects would result in additional wetland construction and/or enhancement in the Freeport area.

Past and on-going projects have also affected wetlands in the study area. Based on the information available, the Freeport Harbor 45-ft project resulted in the loss of 40 acres of wetlands.

As noted in Section 3.12 of the EIS, there are approximately 31,400 acres of estuarine marsh wetlands, 38 acres of estuarine shrubland, 1,150 acres of freshwater marshes, 1,218 acres of freshwater shrub-scrub wetland, and 4,697 acres of forested wetlands in the study area. Major factors affecting wetlands in the study area are relative sea-level rise, subsidence, the diversion of the Brazos River, and conversion to upland habitat (White et al., 2004). However, as noted in Section 3.4, subsidence has diminished or stopped as groundwater, oil, and gas pumping has ceased.

Overall, cumulative impacts to wetlands in the study area are not expected to be significant, assuming mitigation for the Strategic Oil Reserve project.

5.4.2 Benthos

Organisms present on open-bay bottom will be temporarily affected by the Project due to excavation and placement of dredged materials. Temporary impacts to benthic communities will also result from other potential projects in the area, including the Freeport LNG project, Stratton Oil Reserve project, and Port Freeport modifications. Past projects also temporarily impacted the benthos and ongoing dredging

maintenance activities on the GIWW will continue to have temporary impacts on the benthos in the GIWW. The Strategic Oil Reserve project would result in an increase in salinity of about 4.7 ppt and the Freeport LNG project (Phase II) would result in the creation of approximately 13.9 acres of bay bottom habitat (DOE, 2006).

As noted in Section 4.14.2, excavation of open-water bottom buries and removes organisms, but organisms can rapidly recolonize, whereas disposal of dredged material in the open-water smothers or buries existing benthic communities. Although benthic communities recover fairly rapidly, the communities present in early successional stages of recovery are not necessarily the same as those buried by the dredged material. Additionally, repeated dredging in one place may prevent benthic organisms from fully developing (Dankers and Zuidema, 1995), resulting in a shift in community structure (Montagna et al., 1998). However, the new assemblages would still provide an adequate food source for the aquatic community.

Overall cumulative impacts to the benthos in the study area are not expected to be significant. Dredging and use of ODMDSs would temporarily disrupt the benthic communities and a slight increase in salinity from the Stratton Ridge project could also result in localized shifts in the benthos. However, additional open-bay bottom would be created by the Freeport LNG project and the temporary impacts associated with dredging occur over a very small portion of the total open water in the area.

5.4.3 Essential Fish Habitat

The proposed widening of the Freeport Entrance and Jetty Channels, the Freeport LNG Project, some of the Port Freeport modifications, the construction of the brine diffusion portion of the Stratton Ridge facility, and maintenance of the GIWW and Freeport Channels would result in placement of dredged material. Some of the material would be placed in UPCAs, thus not affecting EFH. However, placement of dredged material in open water placement sites could affect food sources in EFH, increase turbidity in the study area, and release contaminants.

Initial placement of dredged material would cover benthic organisms resulting in a loss of food source. As previously noted, recovery of some benthic organisms would likely occur relatively quickly, although the assemblage in the dredged material might differ from the assemblage that existed at the PA prior to construction. As noted in Section 4.9.1.1.1, turbidity is the most obvious impact of dredged material placement. Impacts to EFH from turbidity associated with ocean placement are not significant. If the material to be dredged is not contaminated, there would be no contamination issues with respect to EFH. Placement of dredged material associated with the projects included in this analysis would occur over time and would be subject to USACE and EPA permitting. Thus, it is reasonable to expect that dredged material associated with these projects that would be placed in open water placement sites would not contain contaminants.

Accidental spills have the potential to impact EFH, and larval and juvenile finfish could be affected significantly should a spill occur. Larval and juvenile finfish are less mobile and tend to be more

susceptible to spills than adults. However, because of increased safety with the wider channel, as in the proposed alternative, there should be a slight decrease in the likelihood of oil spill chances.

5.4.4 Threatened and Endangered Species

Most of the proposed projects included in this analysis are not expected to significantly impact Federally protected species. The Stratton Ridge underground storage facility could impact the bald eagle and dredging activities associated with some of the projects could affect sea turtles. A BA and BO are being prepared for the Stratton Ridge project and conditions of the BO would reduce and mitigate for adverse impacts associated with the project. Additionally, project sponsors for projects requiring dredging activities would have to coordinate with FWS and NMFS in regards to potential impacts to sea turtles. The likelihood of direct sea turtle mortality can be reduced by restricting the use of hopper dredges to between December 1 and March 31, whenever possible. Any dredging activities outside of this timeframe (i.e., between April 1 and November 30) should be with pipeline dredges, where feasible, which turtles can more easily avoid. Preceding the hopper dredges with a trawler to capture turtles and relocate them can also reduce dredging impacts on sea turtles. This could be required in dredging contracts, and is required for present maintenance dredging. There could be minor impacts to seat turtles from potential mortality resulting from dredging activities.

5.4.5 Submerged Aquatic Vegetation

SAV could be impacted by potential increases in salinity associated with the Stratton Ridge facility. However, the 4.7 ppt salinity increase expected to occur as a result of the project would be sporadic, is not outside of the normal range of fluctuations within the area, and the discharge would be directly to the Gulf, not adjacent estuaries. No cumulative impacts to SAV are expected.

5.4.6 Air Quality

Objectionable odors (mercaptan, hydrogen sulfide) may result from the dredging of maintenance sediments containing high concentrations of organic matter in those reviewed projects requiring dredging. Temporary and intermittent maintenance dredging activities would emit NO_X and CO primarily. During operation, pollutants expected to be emitted include NO_X, CO, particulates, sulfur dioxides, and hydrocarbons. The project area occurs within the HGA, which is a non-attainment area for O_3 (Section 3.1.1.1). Therefore, all projects in the study area with the potential to affect air quality must coordinate with TCEQ in regards to the SIP. This coordination should ensure compliance with the SIP, and thus the NAAQS, resulting in no significant cumulative impact to air quality.

5.4.7 Noise

Noise impacts included in those projects associated with dredging will include operation and maintenance noise. This impact will be temporary, will move up and down the project area depending on the section

being dredged, and is not expected to differ from current maintenance dredging for many of the projects. Additionally, it is unlikely dredging would occur for more than one of the reviewed projects at one time.

5.4.8 Water Quality

For those projects that include dredging activities, dredging and placement operations are expected to temporarily degrade water quality in the project vicinity through increased turbidity and the release of nutrients from the sediment. No projects reviewed cited concerns with sediment contamination or nutrients, including the Widening Project.

Dredging and placement at proposed open water and upland PAs may increase suspended solids, release contaminants and bound nutrients, and deplete oxygen. This impact is temporary and, except for turbidity, insignificant. If temporary degradation occurs, the study area should rapidly return to ambient conditions upon completion of dredging.

The Stratton Ridge project may increase salinity in some areas by 4.7 ppt. However, according to their analysis (DOE, 2006), this is within the current range of natural fluctuations and should not substantially impact water quality.

Although increased ship traffic in the study area could increase the risk of a toxic spill, that risk is offset by the increased safety in the channel expected from the proposed widening project, the Federal channel improvement project, and increased safety measures associated with the transport of products to the LNG facility.

5.4.9 Sediment Quality

None of the projects reviewed are expected to impact sediment quality or disturb contaminated sediment. Although increased ship traffic in the study area could increase the risk of a spill that could eventually contaminate sediments, that risk is offset by the increased safety in the channel expected from the proposed widening project, the Federal channel improvement project, and increased safety measures associated with the transport of products to the LNG facility. Thus, no significant cumulative impacts to sediment quality are expected.

5.4.10 Shoreline/Bank Erosion

As noted in Section 3.3.1, the shoreline in the study area has been fluctuating since 1852. None of the projects reviewed are expected to alter the ongoing pattern. The proposed channel widening project would place approximately 300,000 cy of silty sand material on Quintana Beach in front of the Seaway PA or on Surfside beaches. The placement of this material, along with other placement projects that may occur in the area, may help to delay beach erosion. However, current overall erosion patterns would continue.

5.4.11 Cultural Resources

Activities associated with any of the reviewed projects have the potential to adversely impact unknown cultural resources by altering the integrity of location, design, setting, materials, construction, or association that contributes to a resource's significance in accordance with the National Register criteria. Possible cultural resources that could be impacted by the reviewed projects were identified for the Freeport LNG facility and the Stratton Ridge facility. A barn located within the Freeport LNG project area would be removed during construction. The eligibility for NRHP of this barn is unknown. Several potential historic resources are located along the ROWs associated with the Stratton Ridge project. Both of these projects are considered Federal actions and are, therefore, required to coordinate with the SHPO for Section 106 compliance. Thus, any potential impacts to cultural resources associated with these projects would be avoided or mitigated for appropriately. In addition, the proposed widening project would impact six anomalies that lie within the project footprint. Prior to construction, these anomalies would need to be diver verified and the appropriate coordination with SHPO would occur.

5.4.12 Commercial Fisheries

None of the projects reviewed would impact commercial fisheries in the study area.

5.4.13 Recreational Fisheries

None of the projects reviewed would impact recreational fisheries in the area. It should be noted that when the Freeport Harbor 45-ft project was implemented, additional recreational fishing areas were created (USACE, 1978).

5.5 CONCLUSIONS

Cumulative impacts due to past, existing, and reasonably foreseeable future projects, along with the proposed alternative, are not expected to have significant adverse effects in the study area. Many of the projects occurring in the general vicinity of the Freeport Harbor Channel are part of the continued urbanization and industrialization of Brazoria County. The majority of impacts associated with these projects would be minor and/or temporary and some result in positive impacts for the area. Existing governmental regulations, in conjunction with the goals and coordination of community planning efforts, address the issues that influence local and ecosystem-level conditions. Resources in the area are provided some protection through the coordination of the numerous stakeholder groups, local organizations, and State and Federal regulatory agencies, and through regulations such as the TCMP, the CWA, and the CAA. This coordination and regulation of resources should prevent or minimize negative impacts that could threaten the general health and sustainability of the region.

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6.0 PERMITS AND APPROVALS REQUIRED

A list of permits and approvals that may be required for the proposed project is presented in Table 6.0-1. This EIS was initiated as a result of Port Freeport's application to the USACE for a Section 10/404 permit for dredge and fill activities. This application also initiates the permitting process for Clean Water Act Section 401 Water Quality Certification by the TCEQ and a TCMP Consistency Determination (described below).

The Coastal Zone Management Program (CZM) was created by the Coastal Zone Management Act of 1972. The TCMP is a State entity that participates in the Federal CZM. The TCMP coordinates local, State, and Federal programs for the management of Texas coastal resources. The Coastal Coordination Council (CCC), composed of several State agencies and local officials, administers the TCMP. The TCMP reviews all Federal actions that may affect any natural resource in the coastal zone for consistency with the Federal goals and objectives of the Federal CZM. Federal actions include direct Federal actions (i.e., performed by or for a Federal agency) and indirect Federal actions (i.e., activities requiring Federal permits, approval, or financial assistance). The responsibility for these reviews belongs to the lead agency—the GLO. A Section 404 or Section 10 permit application will automatically trigger a review by the GLO for consistency with TCMP. As part of the original permit application to the USACE, the permittee would submit a TCMP consistency statement. Any concerns expressed by the GLO would be addressed before the permit is granted. Additional information regarding the TCMP for the proposed Freeport Harbor Channel widening project is provided in Appendix H.

EPA is charged with developing ocean dumping criteria to be used in evaluating permit applications under Section 102(a) of the Marine Protection and Sanctuaries Act (MPRSA). EPA also is responsible for designating recommended sites for ocean dumping under Section 102(c) of the MPRSA. Modeling indicates the existing maintenance material ODMDS is large enough to accommodate maintenance material from the widened channel (see Appendix C). Therefore, redesignation by EPA of the ODMDS would not be required for placement of maintenance dredged material from the widened channel since no modification to the ODMDS would be required. Additionally, future maintenance material is expected to have the same properties as existing maintenance material (see Appendix C).

Section 103 of the MPRSA authorizes the USACE to permit the placement of dredged material within an ODMDS, subject to EPA concurrence and use of EPA's dumping criteria. USACE would need to issue a Section 103 permit to allow for the placement of new work (virgin) dredged material at the one-time use ODMDS. This ODMDS was a one-time use site for placement of new work material for the 45-ft project. The site would be redesignated by USACE under Section 103 for one-time placement of new work material associated with the proposed channel widening.

TABLE 6.0-1

PERMITS/APPROVALS POSSIBLY REQUIRED

Activity Permitted	Permitting Authority	Name of Permit or Filing	When Required
AIR			
Air emissions for activities subject to USACE jurisdiction	USACE (consultation w/ TCEQ & EPA)	Conformity ruling as part of USACE permit	Prior to issuance of USACE permit
WATER			
Placement of fill or dredged material in waters of U.S.	USACE	Section 404 permit of CWA	Pre-construction
Navigable waters	USACE	Section 10	Pre-construction
Construction and operation in waters of U.S.	TCEQ	Section 401 certification (to show compliance with TX surface water quality standards)	Prior to issuance of USACE permit
Placement of dredged material in ODMDS	USACE	Section 103 MPRSA Permit	Concurrent with issuance of USACE permit
OTHER COMPLIANCE			
Section 7 of Endangered Species Act	FWS/NMFS	Biological Assessment/Biological Opinion	Prior to issuance of USACE permit
Designation ODMDS Redesignation	EPA	Section 102 MPRSA	Prior to issuance of USACE permit

7.0 PUBLIC INVOLVEMENT, REVIEW, AND CONSULTATION

7.1 PUBLIC INVOLVEMENT PROGRAM

The USACE and Port Freeport involved the public through public meetings, and other outreach throughout the history of this project. A proactive approach was taken to inform and involve the public, resource agencies, industry, local government, and other interested parties about the project and to identify any public concerns.

On November 29, 2005, a public scoping meeting was held at the Freeport Community House, Freeport, Texas. The purpose of he meeting was to introduce the proposed project to the public, explain the NEPA process, and solicit public comment regarding the project. The meeting included an open house prior to the formal meeting, which included a presentation from USACE, the Port, and PBS&J. Oral and written comments were collected at the meeting and written comments were collected throughout the scoping comment period, which ended December 29, 2005. Other various forms of outreach utilized during this project included early regulatory agency coordination, DMMP Workgroup meetings, individual contacts, press releases, and comment forms.

7.2 REQUIRED COORDINATION

The Draft EIS is being circulated to all known Federal, State, and local agencies. Interested organizations and individuals are also being sent an electronic copy.

7.3 STATEMENT RECIPIENTS

Section 9.0 of this DEIS provides a list that includes those who are being sent a copy of this document, along with a request to review and provide comments on the documents.

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8.0 LIST OF PREPARERS

The USACE Project Manager for the Port Freeport Entrance and Jetty Channels Widening Project EIS is Sam Watson. Prior to Sam Watson's involvement in the project, it was managed by Bryan Herczeg. The Port's Project Manager is David Knuckey.

The Port and Port consultants that reviewed and assisted in preparation of the document are listed below.

Name	Title/Specialty
Port Freeport	
David Knuckey, P.E.	Director of Engineering/Construction/ Project Coordination and Document review
Lisa McMichael	Environmental Coordinator/ Project Coordination and Document Review
HDR/Shiner Moseley and Associates, Inc.	
Joe Moseley, P.E., PhD	Project Coordination and Document Review
Scott Wagner, P.E.	Project Manager, Maritime Consultant/ Project Coordination and Document Review
Collin Fagan	Maritime Consultant/Project Coordination and Document Review
Neil McLellan, P.E.	Technical Support
Maurer Advisory & Consulting Services, Inc.	
Herbie Maurer, P.E., R.P.L.S.	President/Project Coordination and Document Review

USACE and PBS&J key personnel responsible for preparation of the document are listed below:

Name	Title/Specialty
U.S. Army Corps of Engineers, Galveston District	
Sam Watson	Project Manager/Regulatory Specialist
Bryan Herczeg	Project Manager
Terry Roberts	Environmental Lead

Topic/Area of Responsibility	Name/Title	Experience
PBS&J:		
Project Manager Water and Sediment Quality Document Review, ODMDS Appendix	Martin Arhelger Vice President, Project Director	30 years, Environmental Assessment and Impact Analysis
Assistant Project Manager, Document Review, Cumulative Impact Analysis	Angela Bulger Senior Scientist	8 years, NEPA Document Preparation Management and Impact Analysis

Topic/Area of Responsibility	Name/Title	Experience
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Sea Turtle Analysis	Derek Green Biologist, Wildlife Specialist	23 years, Environmental Assessment and Impact Analysis
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Air Quality	Lara Lam Engineer II, Air Quality Specialist	4 years, Air Quality Analysis
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Geology, Bathymetry, Topography	James Killian Senior Scientist	22 years, Geologic Sciences
Noise	Thomas Ademski Senior Environmental Planner	8 years, Environmental Planning and Noise Analysis
Aquatic Ecology and Essential Fish Habitats, TCMP	Lisa Vitale Senior Scientist	13 years, Marine/Aquatic Biology
Shoreline Erosion and Navigation	Paul Jensen Principal Technical Professional	40 years, Commercial Navigation, Environmental Engineering
Shoreline Erosion and Navigation	Ka-Leung Lee Senior Water Resources Engineer	10 years, Water Quality, Hydrologic and Hydraulic Analyses and Modeling
Technical Support	Thomas Dixon Environmental Scientist II	5 years, Wildlife Ecology BA Preparation
Technical Support	Eric Monshaugen GIS Analyst II	2 years, GIS
Technical Support	David Kimmerling CAD/Graphics Specialist	21 years, Graphics
Technical Support	Chris Vidrick Word Processor	30 years, Word Processing

9.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE DRAFT STATEMENT ARE SENT

Federal Government Agencies

U.S. Army Corps of Engineers
U.S. Coast Guard, Lisa Taylor
Environmental Protection Agency, Barbara Keeler
U.S. Fish & Wildlife Service, Moni Belton
National Marine Fisheries Service, Miles Croom
National Marine Fisheries Service, Rusty Swafford

Native American Groups

Alabama-Coushatta Tribe of Texas, Debbie Thomas
Caddo Nation of Oklahoma, LeRue Martin Parker

Federal Representatives and Senators

Congressional District 14, Congressman Ron Paul

State Representatives and Senators

Senate District 17, Senator Kyle Janek
House District 25, Representative Dennis Bonnen

State Government Agencies

Texas Department of Transportation, Raul Cantu
Texas General Land Office, Ray Newby
Texas General Land Office, Garry McMahan
Texas Commission on Environmental Quality, L'Oreal W. Stepney, Director Water Quality Division
Texas Commission on Environmental Quality, Brandy Bergthold
Texas Commission on Environmental Quality, Ken Gathright (Just Draft GCD)
Texas Parks and Wildlife Department, Cherie O'Brien
Texas Historical Commission
Texas Water Development Board

County and Municipal Government Agencies

County Judge of Brazoria County
Donald Payne, Commissioner, Brazoria County Precinct 1
Brazoria County, Kelli Smith

City of Freeport

City of Freeport, Ron Bottoms, Mayor
City of Freeport, Doug Caffey

Village of Surfside Beach

Lary Davison, Mayor, Village of Surfside

Town of Quintana

Stephen Alongis, Building Inspector, Town of Quintana
Tonya McCaghren, City Secretary, Town of Quintana

Seaway

Jimmy Nealy

City of Oyster Creek

City of Clute

Libraries

Brazoria County Library System
Brazoria Library
Clute Library
Freeport Library
Lake Jackson Library

Media

Alvin Sun & Advertiser
The Brazosport Facts, Val Horvath
The Bulletin of Brazoria County
The Source Weekly
Westlake Picayune, Dane Anderson

Companies and Organizations

Port of Freeport, David Knuckey
Dow Chemical, James Prazak
Cradle of Texas Conservancy
Surfrider Foundation, Texas Chapter, Ellis Pickett, Chairman
Freeport LNG, Bill Henry
Galveston Bay Foundation, Sharron Stewart
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Save our Beach Association, Robert Eastman, President
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Appendix A

Permit Application

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

April 14, 2005

J200.40142

Mr. Dolan Dunn
USACE – Galveston District
P. O. Box 1229
Galveston, Texas 77553-1229

RE: PERMIT APPLICATION TO WIDEN PORTIONS OF FREEPORT HARBOR JETTY AND ENTRANCE CHANNEL USING NON-FEDERAL FUNDS

Dear Mr. Dunn:

I. EXECUTIVE SUMMARY

- **The Brazos River Harbor Navigation District of Brazoria County, Texas (also known as Port Freeport) is seeking a USACE Section 10/404 permit to widen portions of the Entrance and Jetty Channel of the Freeport Harbor Channel by up to 200 feet (from 400 feet up to 600 feet). The project depth will remain the same at 45 feet in the Jetty Channel and 47 feet in the Entrance Channel.**
- **The PURPOSE of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight operations only for larger vessels, and (c) restrictions that do not allow the larger vessels requiring waivers to enter port when winds exceed 20 knots or cross-currents exceed 0.5 knots.**
- **The project NEED is the elimination of the operational constraints to allow vessels to avoid delays, thereby reducing shipping costs and logistical problems.**
- **The goal is to have the widening complete during 2007.**
- **The applicant intends to seek federal assumption of maintenance if permitted and constructed as a non-federal improvement.**
- **The widening will generate approximately 2 million CY of uncontaminated material, predominantly clay/silty clay and sand/sandy silt. The material will be used for two beneficial purposes: (a) creation of an offshore berm to provide a topographic high with hard substance; and (b) beach nourishment.**
- **All work will be done in compliance with design standards applicable to federal projects in order to be consistent with any results from the ongoing, congressionally authorized federal feasibility study for widening and deepening all major segments of the Freeport Harbor Channel.**
- **Preliminary analyses of key issues have not identified any significant negative impacts or serious concerns. These include jetty stability, cultural resources, dredging, sediment quality, dredged material placement, water quality, endangered species, etc.**

Corporate Office: 555 N. Carancahua, Suite 1650 Corpus Christi, Texas 78478 Phone (361) 857-2211 Fax (361) 857-7234 E-mail: mail@shinermoseley.com

II. EXISTING CONDITIONS

II.1 Existing Project Dimensions

The existing Freeport Harbor Channel consists of the following authorized components:

Entrance Channel	47 ft x 400 ft
Jetty Channel	47 ft x 400 ft
Lower Turning Basin	45 ft x 750 ft
Inside Channel	45 ft x width varies
Brazosport Turning Basin	45 ft x 1,000 ft
Upper Turning Basin	45 ft x 1,200 ft
Brazos Harbor Channel	36 ft x 200 ft
Brazos Harbor Turning Basin	36 ft x 750 ft

These channel reaches normally have an advance maintenance component and an overdredge allowance in addition to the authorized depths. The proposed widening will affect only the Entrance Channel and the Jetty Channel.

II.2 Operational Constraints Resulting from Existing Channel Dimensions

The widening will allow deep draft vessels to enter port under a broader range of environmental conditions than is possible in the 400-foot channel. At present, all deep draft vessels are limited to one-way traffic in the Freeport Channel. Vessels over 750 feet long or over 107 feet wide – which includes most crude oil and chemical tankers, the largest segment of Freeport traffic – are also limited to daylight transits. Vessels with beams over 145 feet are further limited and require waivers to enter port.

Port entry is further restricted by the effects of along-shore cross-currents, which vary in direction and velocity up to 3 knots. Depending on the ship's speed and the current's velocity, the Harbor Pilot must apply as much as 14 degrees of rudder "leeway" to counter the cross-current effects. That "crabbing" approach has the ship at an angle to the centerline of the channel as it approaches the jetties, which makes its effective width in the channel greater than the vessel's beam. A cross-current strong enough to restrict entrance for deep-draft vessels occurs approximately five percent of the time. For the largest vessels, entrance could be restricted as much as 25 to 30 percent of the time. The cross-current affects maneuverability as the vessel starts into the jetties and the effects are no longer uniform. Widening the channel would reduce the effects of cross-current by allowing for a wider beam aspect approaching the jetties and providing more room to maneuver in the Jetty Channel. Widening the channel would also allow longer vessels to enter Port Freeport, since the vessel's beam aspect is influenced by length as well as width and amount of leeway being held.

For the most part, the largest tankers currently able to call at the Seaway and ConocoPhillips terminals are AFRAMAX size – 75,000 to 110,000 deadweight tons

(DWT), with the largest on the order of 800 feet long and 138 feet wide. The terminal operators would like to be able to accommodate the larger SUEZMAX tankers – 110,000 to 150,000 DWT, with typical dimensions on the order of 900 feet long and 148 feet wide. Under current conditions, those larger vessels can enter the port only under ideal weather and sea conditions after undergoing the Port's waiver process. Widening the channel would substantially increase the operating window for those larger tankers. For many of the smaller deep draft vessels, widening would also allow for relaxation of the existing requirements for one-way traffic and daylight transits.

These substantial benefits for widening are reflected in the USACE's "Freeport Harbor, Texas, Navigation Improvement Reconnaissance Report Section 905(b) Analysis (October 2002)". That report states that widening will result in direct transportation cost savings for existing and future vessel and terminal operators in several ways. One of benefits of widening is decreased vessel downtime associated with the 'daylight hours only' transit restriction for vessels in excess of 750 feet in length. Another is decreased vessel downtime associated with one-way traffic restrictions for deep draft vessels – deep draft crude carriers represent the majority of the 3,000+ vessels calling annually. Reducing constraints based on the effects of along-shore cross-currents is another significant benefit stated in the report. Widening will also improve the potential for much larger vessels to enter port. The study notes that waivers have been granted for vessels up to 900 feet long and 160 feet wide, when wind is below 15 knots and cross-current is not more than one-half knot, and that numerous requests have been denied for ships 920 to 950 feet long.

Some benefits will also be achieved in the form of improved navigation safety as a result of the increased maneuvering room, especially between the jetties. Also, a widened channel will be less restrictive for other traffic during maintenance dredging and when the other improvements are initiated in the future.

II.3 Activity and Trends at Port Freeport

Total tonnage through the Port has steadily and consistently increased over the past ten years as indicated below. Crude oil represented approximately two-thirds of the total tonnage in 2003. Trends for 2004 and 2005 are consistent with the pattern shown by these statistics.

Cargo Through Port Freeport (thousand short tons)			
Year	Total	Year	Total
1994	17,450	1999	28,076
1995	19,662	2000	28,966
1996	24,571	2001	30,143
1997	26,281	2002	27,164
1998	29,014	2003	30,537

Given national and international trends, the growth over the last decade is expected to continue in the future. In addition to the growth in existing cargos, there are several

recent new initiatives in the area that will contribute to even more growth. These include the following:

- ***Container / General Cargo Diversification.*** The Port has initiated a major diversification effort aimed at a wide range of new cargos. This has included (a) a master planning project to assess potential uses for the Port's 8,000± acres, (b) permitting and design of the first phase of a modern container terminal, and (c) other initiatives.
- ***LNG Terminal.*** Freeport LNG recently received Federal Energy Regulatory Commission (FERC) and USACE approvals for an LNG terminal at Quintana. As currently permitted, the terminal will have one berth and a throughput capacity of 1.5 bcfd and will generate one ship call every 3 days. While no application for expansion has been filed, Freeport LNG has notified FERC that the plans for expansion include a second berth and additional storage.

Increased ship traffic resulting both from growth of existing business and from new business will increase the operational congestion on the existing system. The proposed widening of the Entrance Channel and Jetty Channel up to 600 feet will significantly lessen the congestion by removing most of the operational constraints.

II.4 Ongoing Federal Feasibility Study

The USACE, under the authority of Section 216 of the Flood Control Act of 1970 (P.L. 91-611), is currently conducting a feasibility study for widening and deepening the Freeport Harbor Channel. This study will evaluate the incremental widening and deepening of the project up to dimensions of 600 feet by 60 feet. The $5.4 million study is being jointly funded by the USACE and Port Freeport.

The timing of the feasibility study and subsequent authorization and appropriations are dependent upon the federal budget process. A current optimistic view indicates that the federal project could be online in the 2012 timeframe.

Local interests hope to have the widening permitted and constructed by late 2007. All design features of the improvements will be done in strict compliance with USACE design standards for federal projects to ensure compatibility.

III. THE CASE FOR CHANNEL EXPANSION

III.1 Introduction

There is a widely recognized need to expand the Freeport Harbor Channel. The 2002 USACE Reconnaissance Study (Freeport Harbor, Texas Navigation Improvement Reconnaissance Report, Section 905(b) Analysis) stated the need to improve the existing conditions.

> *"The existing conditions that give rise to the need for channel enlargements at Freeport Harbor are the existing channel dimensions, which are inadequate for the length and draft of many of the crude petroleum and chemical tankers operating at Freeport. As a result of channel constrictions, operational practices have been instituted that result in light loading and additional transit times at Freeport Harbor."*

The Port is keenly aware of the need to both widen and deepen the channel, which is being evaluated in the ongoing federal feasibility study. The Port, in cooperation with Port Users, has opted to pursue obtaining a permit to widen the Jetty Channel and Entrance Channel from 400 feet up to 600 feet in order to expedite the substantial benefits of widening, with a target completion date in 2007. This permit action should allow the widened channel to be in operation at least 5 years earlier than the proposed federal improvements.

The decision to expeditiously pursue the widening alone in lieu of the deepening is based on several factors; namely, widening will (a) relieve serious operational constraints, (b) benefit the largest number of shippers, and (c) be substantially less costly.

III.2 Purpose and Need

The purpose and need for the widening can be succinctly stated.

- The purpose of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight transit only of the larger vessels, and (c) restrictions that do not allow large ships requiring waivers to operate when winds exceed 20 knots or cross-currents exceed 0.5 knots.
- The project need is the elimination of the operational constraints, allowing vessels to avoid delays, thereby reduce shipping costs and logistical problems.

IV. RELATED ISSUES

Preliminary coordination with the USACE and resource agencies, prior studies of channel expansion, and discussions with users have identified a number of issues that merit attention when considering channel widening. Following is a brief discussion of the primary issues. In some cases, the applicant did a detailed study of the specific topic. These are available as appendices.

IV.1 Jetty Stability

There was concern that widening the channel by up to 200 feet might undermine the jetties and make them unstable. A study was commissioned that included obtaining additional soil borings and conducting a detailed engineering study of the jetty's stability for a widened channel. The study showed that the jetty stability would not be jeopardized by the proposed widening. That portion of the jetty channel beyond the beach that has a

full jetty can be widened to 600 feet without any risk to the jetty's stability. The inner portion that consists of a heavy revetment along the shoreline can be widened to 550 feet without any risk. Thus, that portion of the channel from station 0+00 to station 43+00 will be widened to 600 feet. Station 43+00 to station 38+00 will be a transition zone with the remaining distance to the Lower Turning Basin (station 38+00 to station 51+84) being widened to 550 feet (Geotechnical Study of Jetty Stability and Channel Widening Project, Freeport Ship Channel, Freeport, Texas; Fugro Consulting, April 2005).

IV.2 Beneficial Use of Dredged Material

The channel widening to 600 feet will generate approximately 2.8 million CY of new material. This is all virgin cut material and consists of 1.2 million CY of clay/silty clay and 0.8 million CY of sand/silty sand (Geotechnical Study of Jetty Stability and Channel Widening Project, Freeport Ship Channel, Freeport, Texas; Fugro Consulting, April 2005). These findings are consistent with prior USACE geotechnical investigations.

The primary beneficial use of the dredged material is to create a topographic high in the form of a berm. It will be built approximately 2.5 miles off the Quintana Beach in 40± feet of water. There is adequate dredged material to build a berm approximately 8,000 feet long by 2,000± feet wide including slopes, to a height of 15 feet.

The primary benefit of the berm will be to fisheries in the form of a topographic high and relatively hard substrate in an area that is very flat and has very soft bottom conditions. A second, and relatively minor, benefit is that the berm may offer some storm protection to a portion of the eroding Quintana Beach during a moderate hurricane.

The dredging is expected to produce approximately 300,000± CY of material that can be used for beach nourishment. To the extent that it can be economically recovered, it will be placed on the beach at Quintana. While not ideal for beach nourishment, approximately 300,000 CY of comparable virgin cut beach quality material was placed on Surfside Beach during the Freeport Harbor 45-Foot Project in the early 1990s with broad public acceptance.

Dredging will be done by pipeline dredge or a mix of pipeline and hopper dredges. Given the current status of the U.S. dredging industry, this flexibility is needed to get the best bid prices. It is likely that a pipeline dredge will be used in the Jetty Reach and a hopper dredge in the Entrance Reach; however, dredging contractors have indicated that a pipeline dredge might be used for both reaches.

IV.3 Cultural Resources

The primary area of potential concern is the 200-foot increment that the channel will be widened. A marine archeological investigation is currently underway. It has been coordinated with USACE archaeologists and is being done to meet applicable USACE standards. The results will be provided to the Galveston District when they are available.

IV.4 Threatened and Endangered Species

The primary endangered species of concern is sea turtles. Dredging protocols have been developed and agreed to for all USACE hopper dredging projects within the Freeport Channel. These same protocols will be applied to the non-federal widening.

IV.5 Water Quality

Sediment samples from borings were subjected to a range of chemical testing to applicable USACE and EPA protocols. The results were then reviewed against the applicable criteria with the results being that no contamination was found that exceeded screening criteria. Consequently, the material meets all criteria for open water placement or for beach nourishment. (Letter Report; PBS&J, Martin E. Arhelger, April 2005)

All reasonable efforts will be made to control sediment dispersion during construction of the berm. This will include (a) control of the dredging operations to maximize generation of clay balls and minimize liquid content, (b) placement of an outfall pipe with deflectors near the bottom, and (c) use of submerged silt curtains around the discharge location.

IV.6 Air Quality

The dredging and placement of approximately 2 million CY will be done over a 4-5 month period. Based on current technology, this will probably generate over 25 tons of NO_X and VOC, thus requiring a Conformity Analysis Review under the Clean Air Act. Once completed, the widening will eliminate significant ship waiting time and associated emissions.

An analysis is currently underway to determine the emissions during dredging and verify that a Conformity Analysis will be required. The same effort is also assessing the potential reduction in ship-related emissions that will result from a decrease in waiting time.

IV.7 Recreation

The Freeport Harbor Channel is widely recognized as a valuable recreational asset that provides small boat access to the Gulf, fishing from the jetties and shoreline, and the opportunity to watch ships from up close. The proposed widening should not negatively impact any of these uses. Potential recreational benefits include improved fishing on the offshore berm and expansion of eroding beaches due to beach nourishment.

IV.8 Cumulative Impacts

The proposed widening is not expected to generate an increase in total ship traffic calling at Freeport. Rather, the widening will remove existing operating constraints, thereby

increasing the efficiency of existing operations. Thus, the widening should have no cumulative impacts.

V. CLOSING

Attached you will find a completed application (USACE form 4345), permit drawings (eight sheets), and supporting information.

We are submitting this application on behalf of the applicant, the Brazos River Harbor Navigation District of Brazoria County, Texas, as authorized on page 1 of the application form.

We are requesting that you review this application package as expeditiously as practical. Please contact the undersigned if you need any clarification or additional information.

Sincerely,

SHINER MOSELEY AND ASSOCIATES, INC.

Thomas B. Rodino

Captain Thomas B. Rodino (USCG Retired)
Senior Maritime Consultant

Joe C. Moseley

Joe C. Moseley, Ph.D., P.E.
Principal

JCM/dd

Enclosures

cc with Enclosures: Brazos River Harbor Navigation District (David Knuckey, P.E.)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT *(33 CFR 325)*	OMB APPROVAL NO. 0710-0003 Expires December 31, 2004

The public reporting burden for this collection of information is estimated to average 10 hours per response, although the majority of applications should require 5 hours or less. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington DC 20503. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies. Submission of requested information is voluntary, however, if information is not provided, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME Brazos River Harbor Navigation District	8. AUTHORIZED AGENT'S NAME AND TITLE *(an agent is not required)* Joe C. Moseley, Ph.D., P.E., Vice President
6. APPLICANT'S ADDRESS P.O. Box 615 Freeport, TX 77542-0615	9. AGENT'S ADDRESS Shiner Moseley and Associates, Inc 555 N. Carancahua, Suite 1650 Corpus Christi, Texas 78478
7. APPLICANT'S PHONE NUMBERS WITH AREA CODE a. Residence b. Business 979-233-2667, ext. 4257	10. AGENT'S PHONE NUMBERS WITH AREA CODE a. Residence b. Business 361-857-2211

11. **STATEMENT OF AUTHORIZATION**

I hereby authorize Shiner Moseley and Associates, Inc. to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE **(David M. Knuckey, P.E.)** — DATE 4/14/05

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE *(see instructions)*
Widening of the Freeport Ship Harbor Jetty and Entrance Channel

13. NAME OF WATERBODY, IF KNOWN *(if applicable)* Gulf of Mexico	14. PROJECT STREET ADDRESS *(if applicable)* N/A
15. LOCATION OF PROJECT Brazoria (COUNTY) — Texas (STATE)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN *(see instructions)*

N/A

17. DIRECTIONS TO THE SITE

Proceed south from Lake Jackson on SH 332; cross the Gulf Intracoastal Waterway. Turn right at stop light and proceed to end of street that dead-ends at the Ship Channel.

18. Nature of Activity *(Description of project, include all features)*

- Dredge channel to a maximum bottom width of 600 ft from the Lower Turning Basin to the -51 ft contour, a distance of approximately 4.8 miles.
- Dredging will be performed primarily with pipeline dredge; with the possible use of some hopper dredge.

19. Project Purpose *(Describe the reason of purpose of the project, see instructions)*

The purpose of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight operations only for larger vessels, and (c) restrictions that do not allow large vessels requiring waivers to enter port when winds exceed 20 knots or cross-currents exceed 0.5 knots.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Provide beneficial uses: (a) create a berm to provide a topographic high and hard substrate (for habitat and beach protection) and (b) put sand on beach for beach nourishment.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

Clay / silty clay ..... 1,200,000 CY
Sand / sandy silt ..... 800,000 CY
Total ..... 2,000,000 CY

22. Surface Area in Acres of Wetlands or Other Waters Filled *(see instructions)*

(a) Offshore berm ..... < 370 acres (including slopes)
(b) Beach nourishment..... < 10 acres of new beach area at initial equilibrium

23. Is Any Portion of the Work Already Complete? Yes ☐ No ☒ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

See Sheet 8 of attached permit drawings.

25. List of Other Certifications or Approvals/Denials Received from other Federal, State, or Local Agencies for Work Described in This Application

AGENCY	TYPE APPROVAL *	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building and flood plain permits

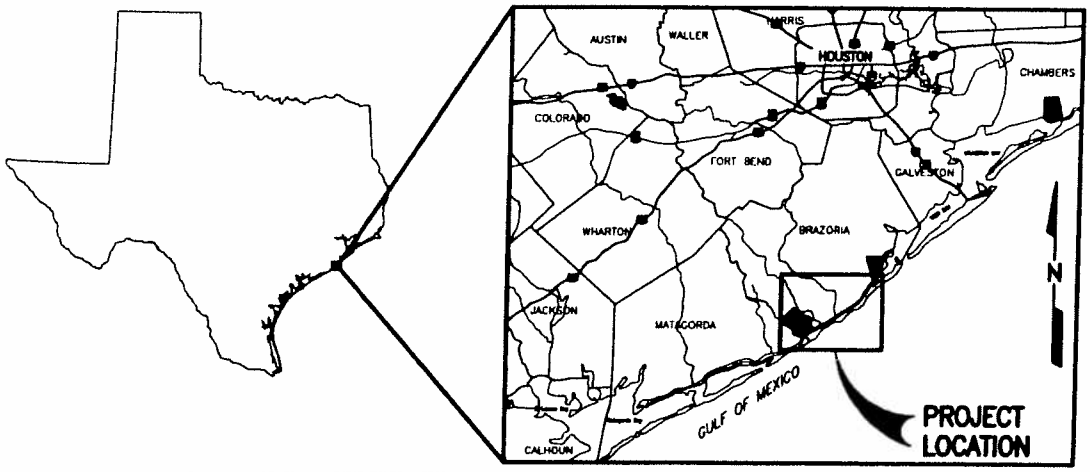
26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

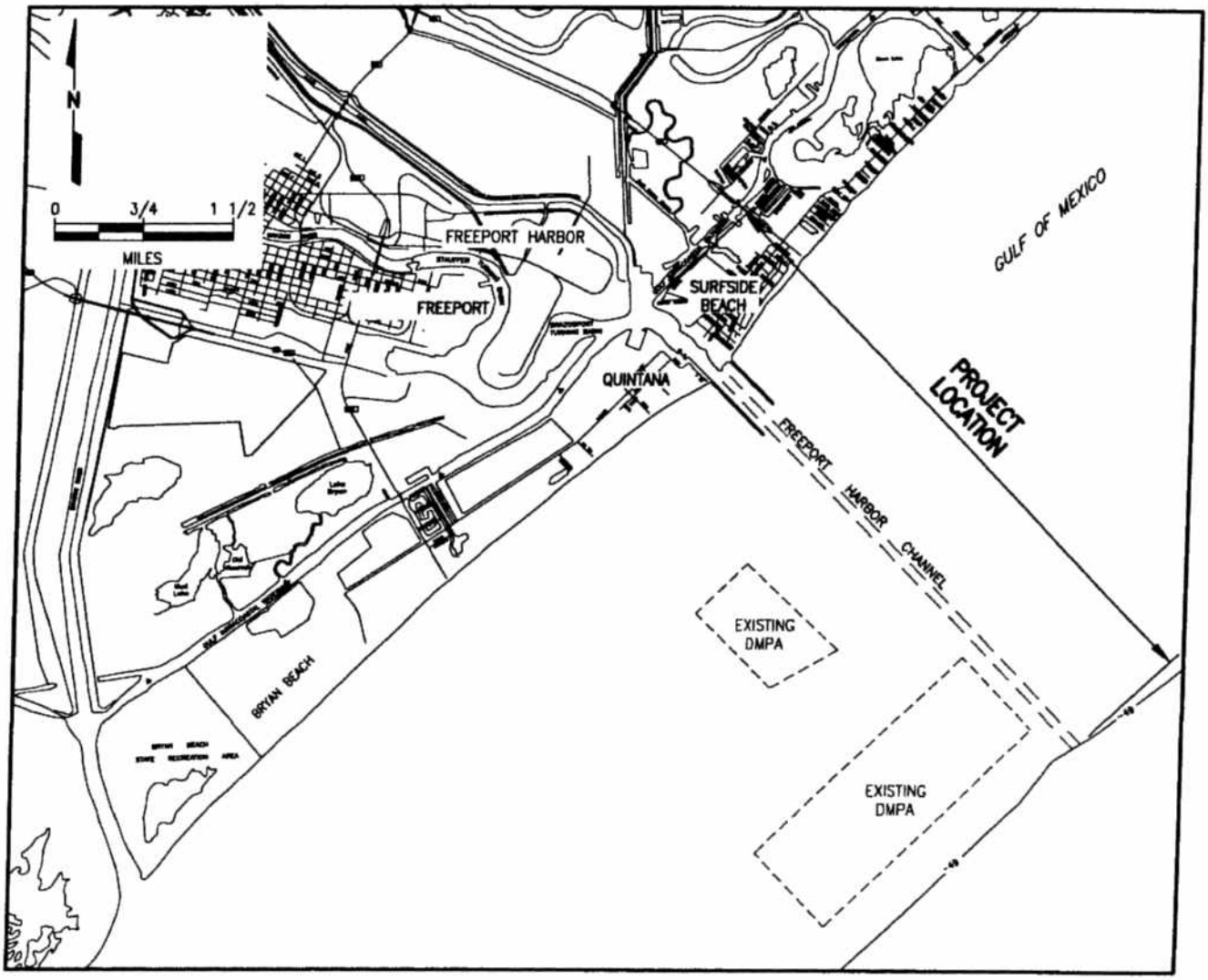
N/A	N/A	Joe C Moseley	4/14/05
SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT – Shiner Moseley	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in Block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States, knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a materiel fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

PROJECT LOCATION





P • O • R • T
FREEPORT

FOR COE USE ONLY

Permit Application No.: _____

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 1 of 8

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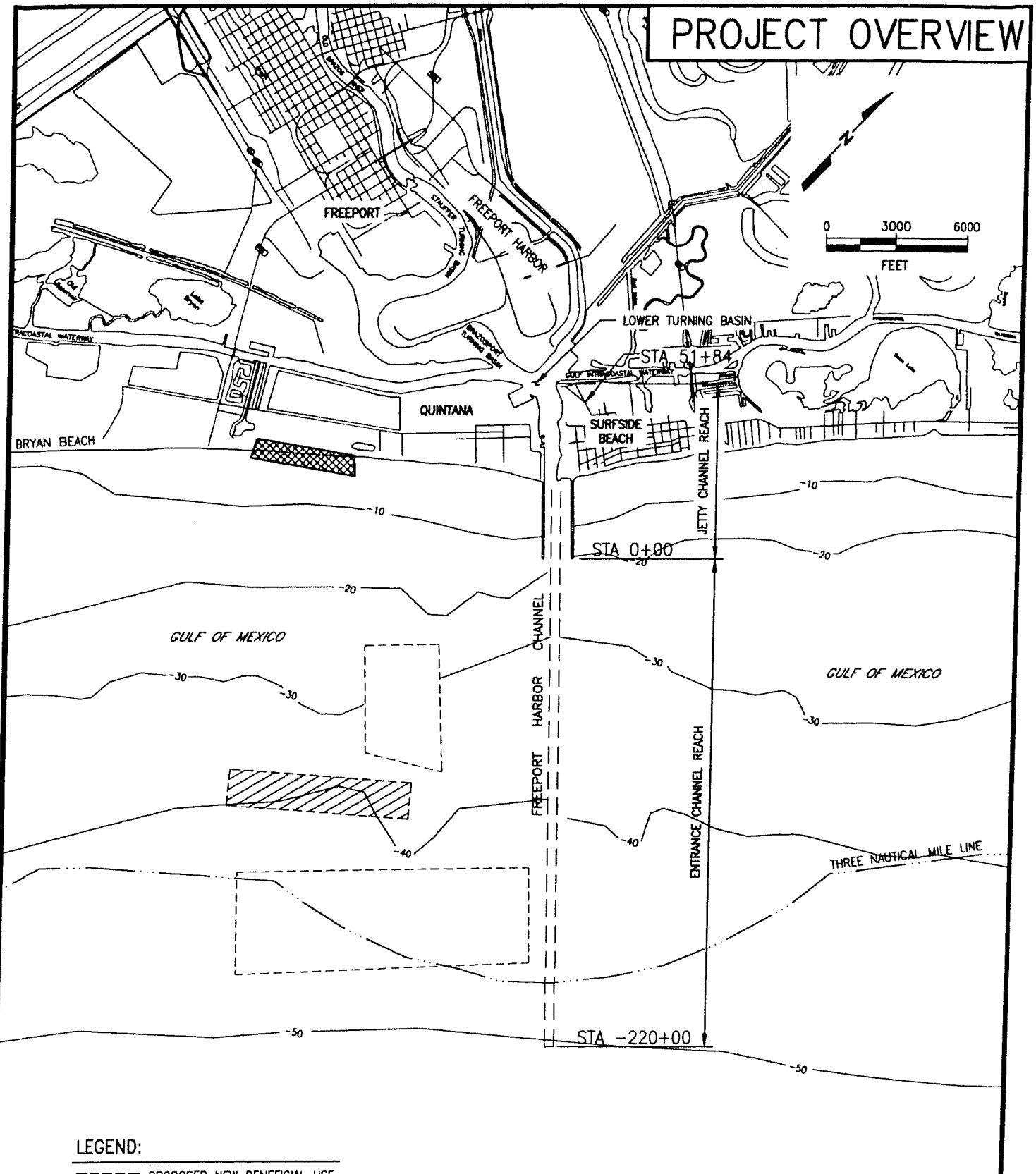
PROJECT OVERVIEW



LEGEND:

- PROPOSED NEW BENEFICIAL USE AREA: BERM FOR HABITAT
- PROPOSED BEACH NOURISHMENT AS BENEFICIAL USE
- EXISTING USACE DMPA

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.: _____

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA		
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00 / SHEET 2 of 8

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

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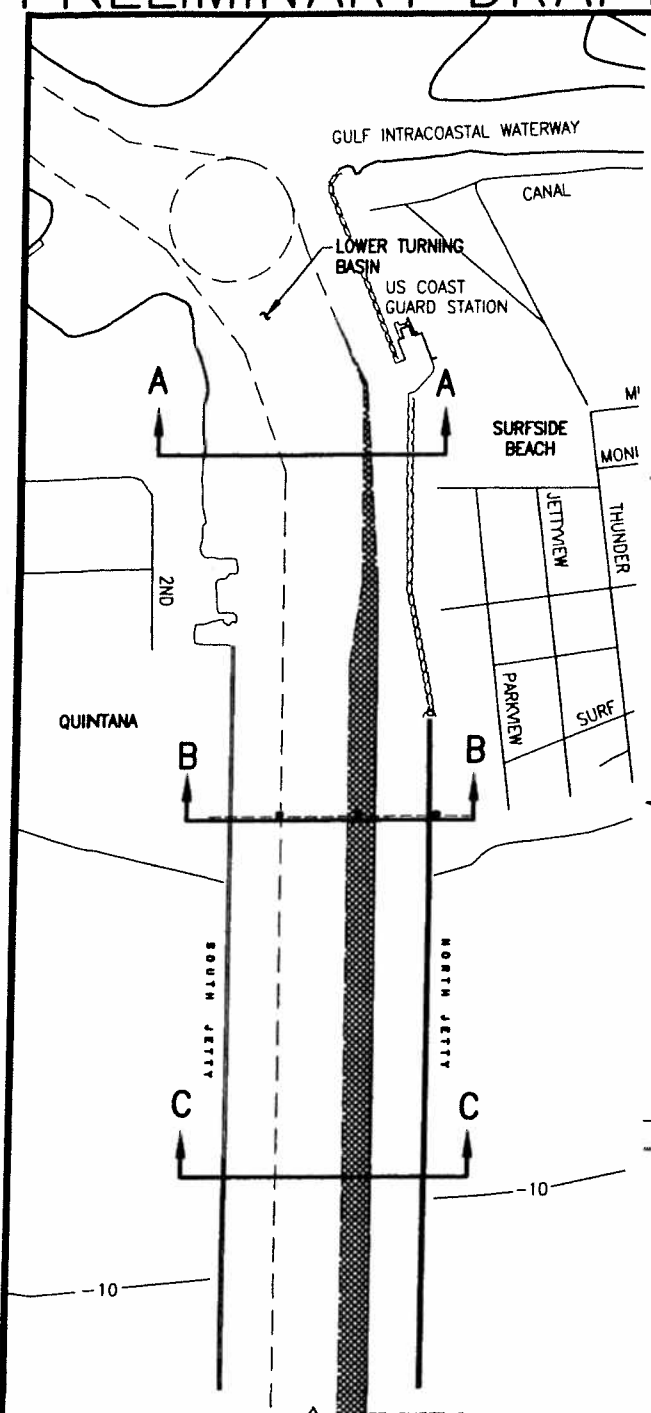
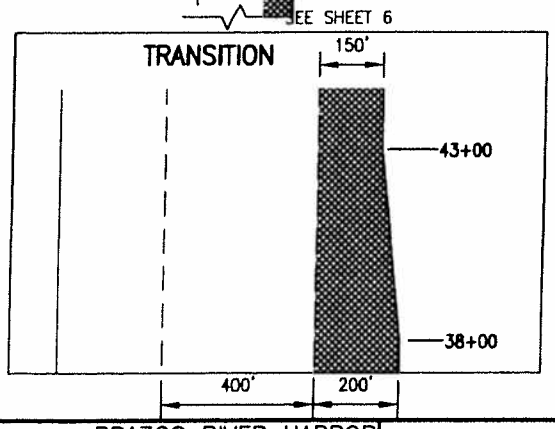
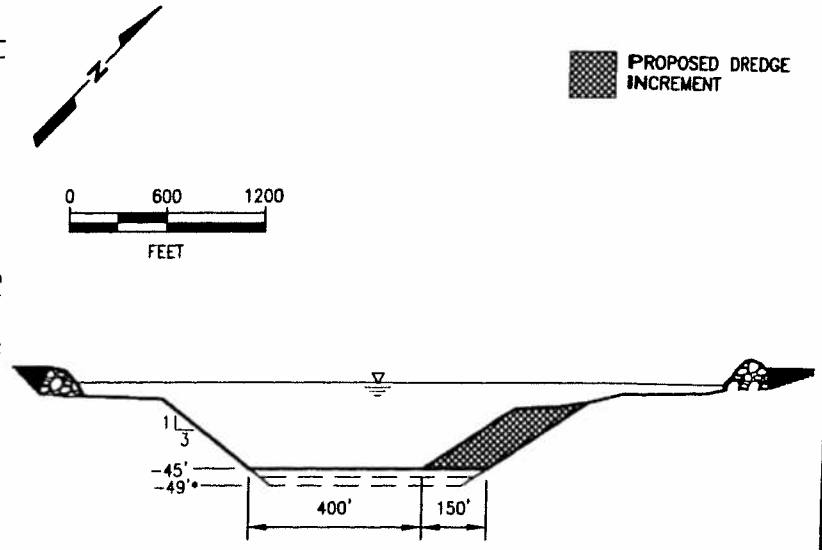
PRELIMINARY DRAFT

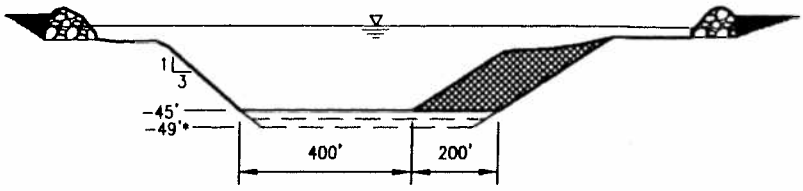
JETTY CHANNEL REACH



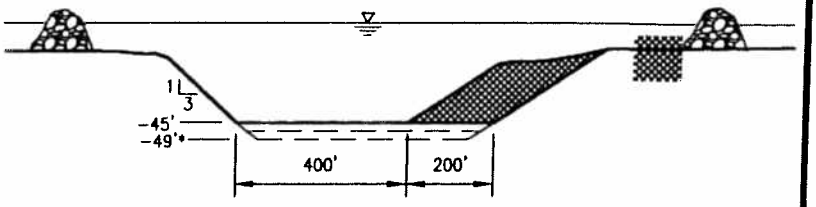




SECTION A–A



SECTION B–B



SECTION C–C

NOTES:

* INCLUDES 2' OF MAINTENANCE PLUS 2' OF OVERDREDGE

P O R T FREEPORT

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Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA		
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00 / SHEET 3 of 8

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

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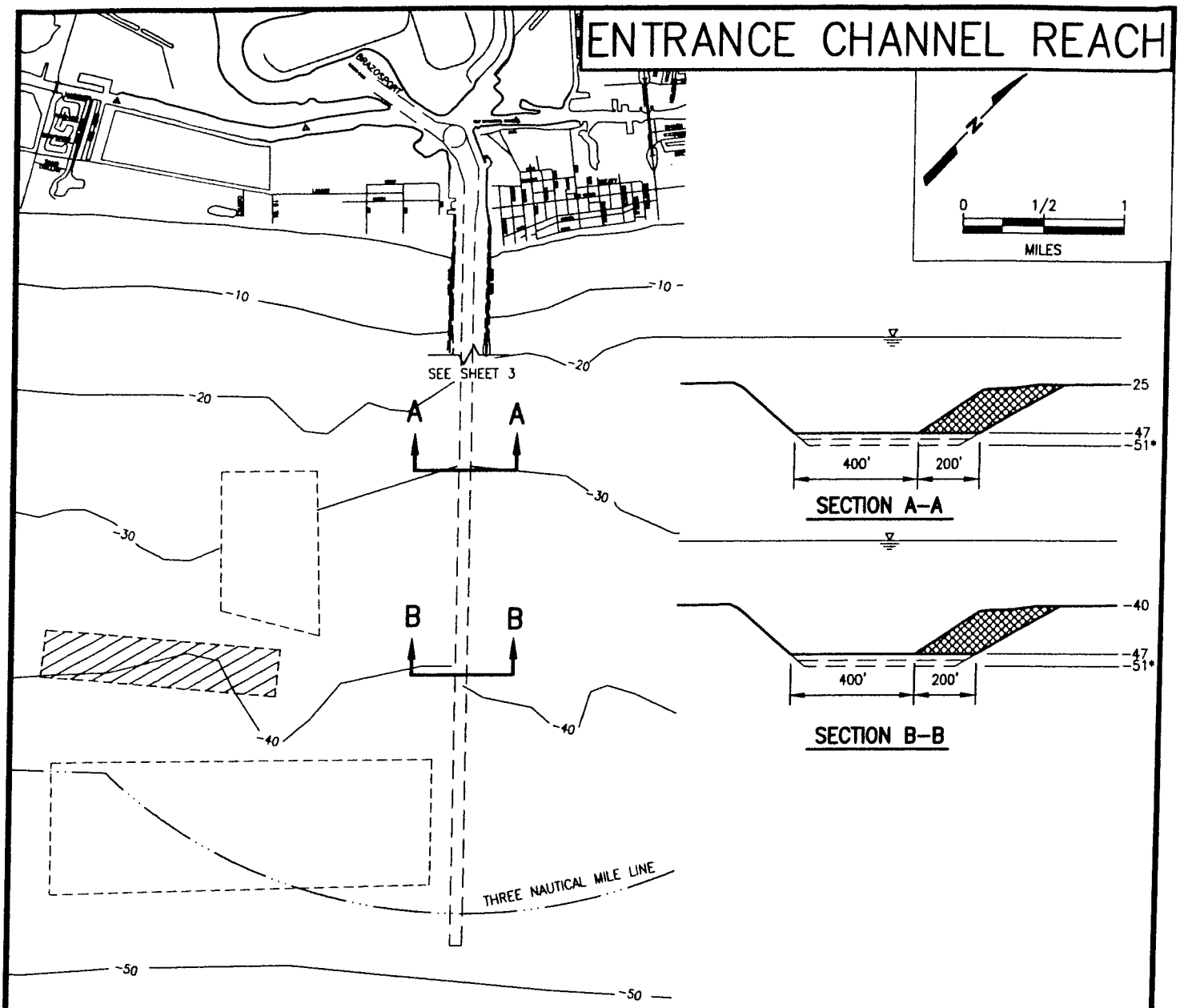
ENTRANCE CHANNEL REACH



NOTES:

* INCLUDES 2' OF MAINTENANCE PLUS 2' OF OVERDREDGE

LEGEND:

- PROPOSED DREDGE INCREMENT
- PROPOSED NEW BENEFICIAL USE AREA: BERM FOR HABITAT
- PROPOSED BEACH NOURISHMENT AS BENEFICIAL USE (SEE SHEET 7)
- EXISTING USACE DMPA

PORT FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA		SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00 / SHEET 4 of 8

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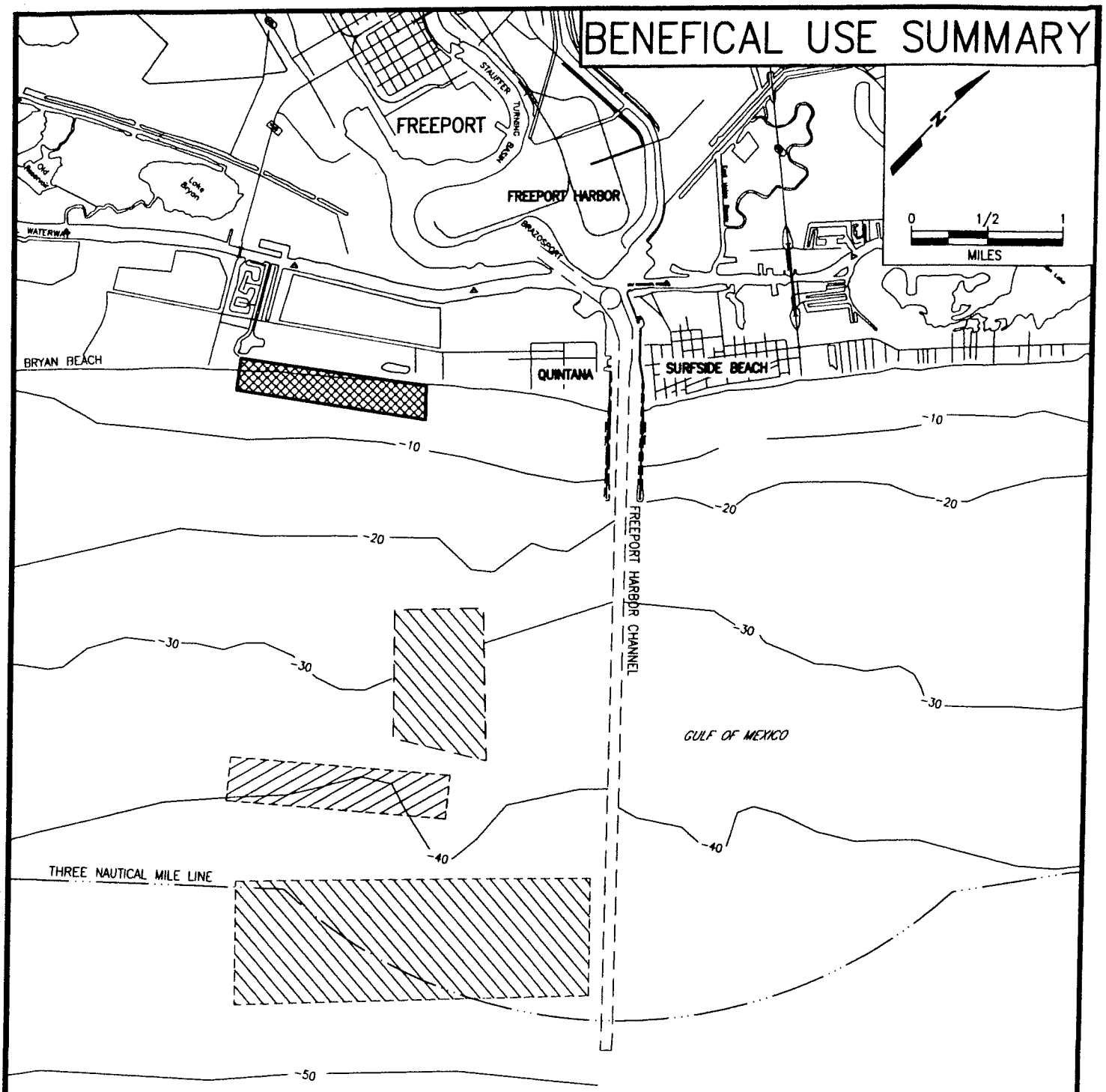
BENEFICAL USE SUMMARY



NOTES:

OFFSHORE BENEFICIAL USE AREA. CONSTRUCT A BERM OF TO PROVIDE HARD SUBSTRATE AND TO OFFER LIMITED BEACH PROTECTION. SEE SHEET 6 OF 8.

BEACH QUALITY MATERIAL, IF FOUND IN ECONOMICALLY RECOVERABLE QUANTITIES, WILL BE USED AS BEACH NOURISHMENT FOR SURFSIDE BEACH. SEE SHEET 7

EXISTING USACE DMPA

P • O • R • T
FREEPORT

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Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

PROJECT No: 200.40142.00 | SHEET 5 of 8

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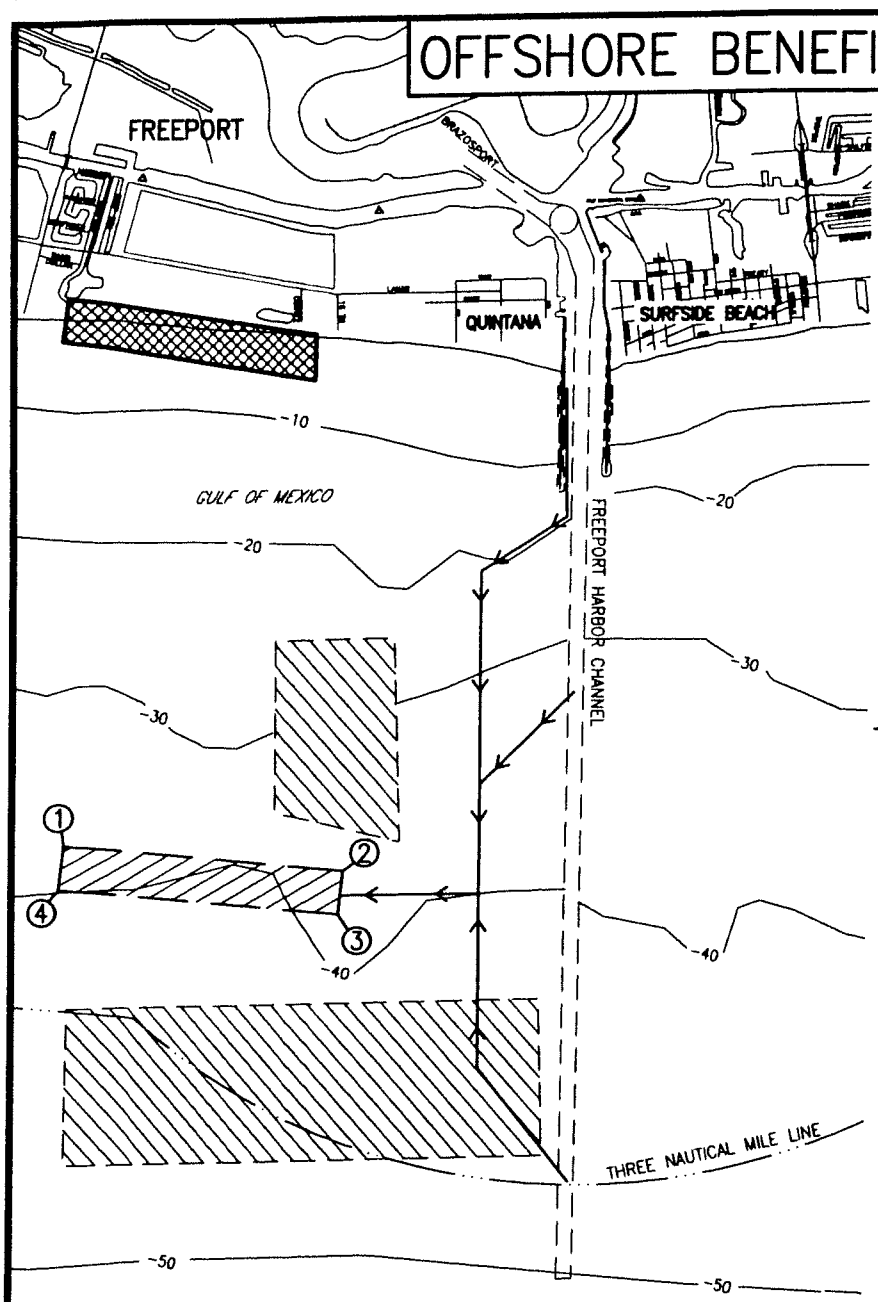
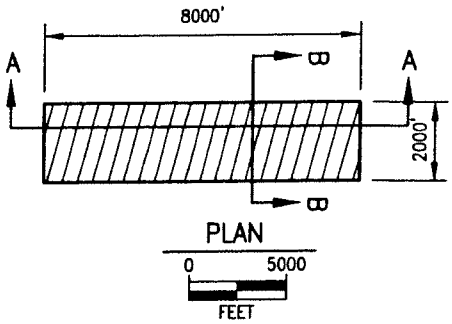
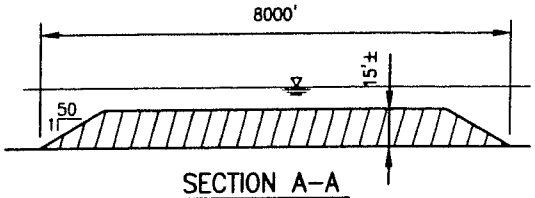
OFFSHORE BENEFICAL USE AREA–BERM

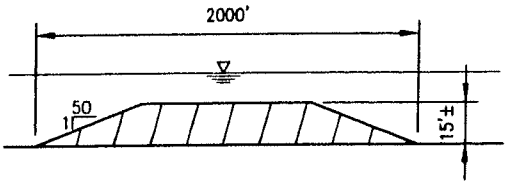






SECTION A–A

SCALE: NONE



SECTION B–B

SCALE: NONE

NOTES:

LEGEND

- PROPSED BEACH NOURISHMENT
- PROPOSED OFFSHORE BENEFICIAL USE AREA
- ① N28°53'05" W95°15'12"
- ② N28°53'54" W95°17'01"
- ③ N28°53'37" W95°16'48"
- ④ N28°52'48" W95°17'59"
- EXISTING USACE OFFSHORE PLACEMENT AREAS
- PIPELINE ROUTING (TYPICAL)

N

0 1/2 1

MILES

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT

COUNTY: BRAZORIA

PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL

DATE: 4/15/05 | REV. DATE: | DATUM: USACE MLT

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

PROJECT No: 200.40142.00 | SHEET 6 of 8

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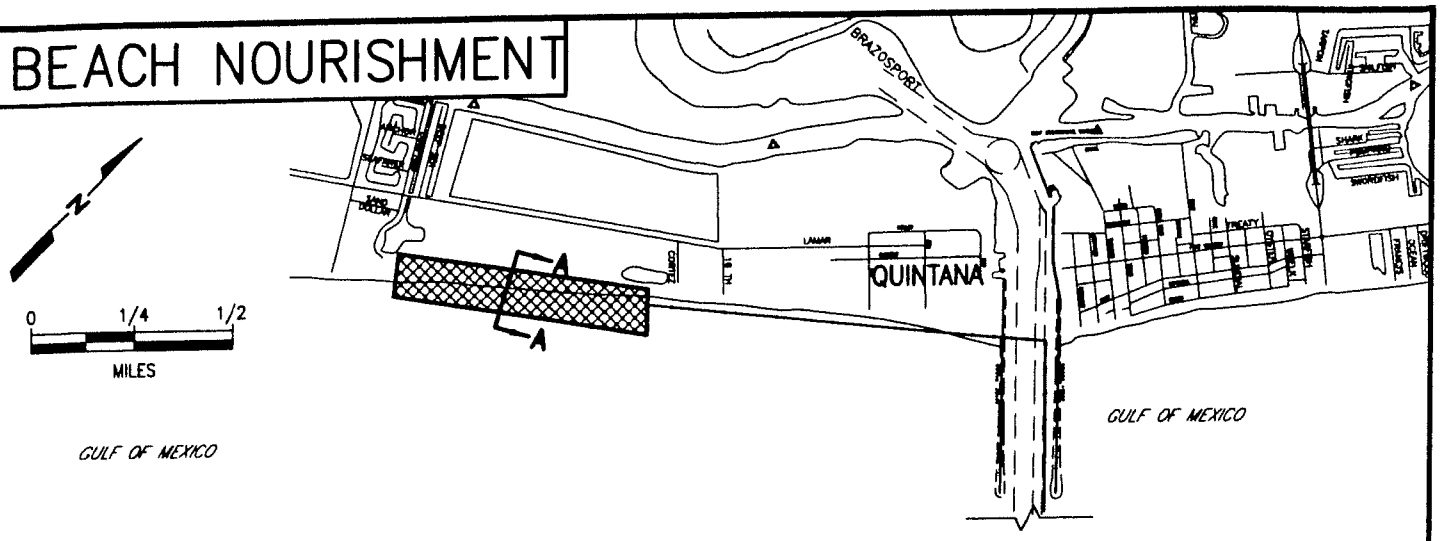
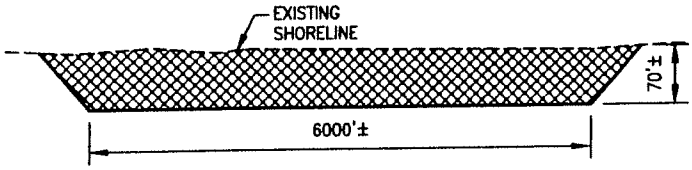
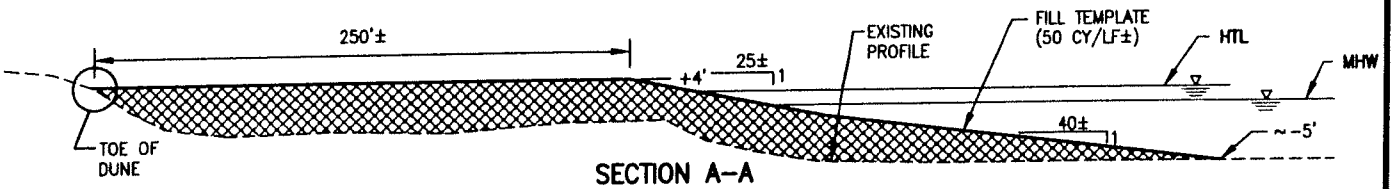
BEACH NOURISHMENT



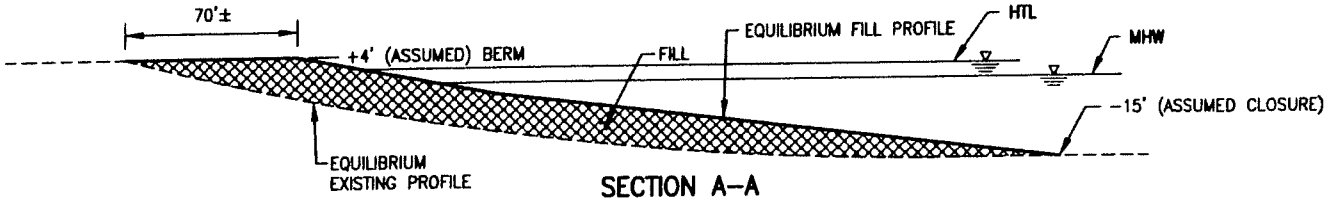


PLAN VIEW AT INITIAL EQUILIBRIUM

(MATERIAL MAY BE PLACED AT ONE OR BOTH LOCATIONS)



SECTION A–A
INITIAL PLACEMENT



SECTION A–A
AT INITIAL EQUILIBRIUM

NOTES:

1. MHW = 3.28 MLT; HTL = 5.01 MLT
2. BEACH FILL LENGTH WILL DEPEND ON THE AMOUNT OF RECOVERABLE BEACH QUALITY MATERIAL; 300,000 CY WOULD CONSTRUCT APPROXIMATELY 6000 LF OF BEACH AT A FILL TEMPLATE OF 50 CY/LF. THIS WOULD CREATE APPROXIMATELY 9± ACRES OF BEACH AREA AT INITIAL EQUILIBRIUM.

LEGEND

PROPOSED BEACH NOURISHMENT

PIPELINE ROUTING (TYPICAL)

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS, 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 7 of 8

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ATTACHMENT E

Adjacent Property Owners

Because of the large number of adjacent property owners, their names and addresses are being obtained from the Brazoria County Tax Appraisal District and are being supplied in electronic format under separate cover.

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

June 7, 2005 J200.40142

Mr. Bryan Herczeg
U.S. Army Corps of Engineers
Galveston District
P. O. Box 1229
Galveston, Texas 77553-1229

RE: PERMIT APPLICATION NO. 23752 (FREEPORT HARBOR CHANNEL WIDENING)

Dear Mr. Herczeg:

We have reviewed your letter dated May 6, 2005 concerning additional information on the above permit application and the discussion with you and others on the USACE staff at the May 24 meeting; and have prepared this response.

The amendments to the permit application form and the revised permit application drawings are attached (Attachments A and B).

The remainder of this letter is a point by point response to the items raised in your May 6 letter.

a. Complete and return the enclosed Consistency with Texas Coastal Management Program Form to the Galveston District.

   Completed TCMP Form attached. (Attachment C)

b. Submit coordinates for each corner of the beach nourishment site for historic property review.

   Sheet 7 modified to show coordinates.

c. Submit correct coordinates for the BU site. The coordinates of the proposed offshore BU site do not match the coordinates identified in the Scope of Work for the remote sensing survey for historic properties investigations.

   Sheet 6 modified to show proper coordinates.

d. Revise drawings on Sheet 3 of 8 as needed. The transition view shown does not match the plan view above. It also does not match the narrative found in section IV.1 Jetty Stability (page 6) of the project summary. The cross hatching on the upper slopes in the cut sections is not defined.

Corporate Office: 555 N. Carancahua, Suite 1650 Corpus Christi, Texas 78478 Phone (361) 857-2211 Fax (361) 857-7234 E-mail: mail@shinermoseley.com
Houston: 3300 South Gessner, Suite 111 Houston, Texas 77063 Phone (713) 975-0033 Fax (713) 975-9515 E-mail: nmclellan@shinermoseley.com

Sheet 3 modified to reflect the appropriate stations.

e. Sheet 3 of 8, Section C-C shows a dredging area next to the jetty. Please explain.

Sheet 3 modified to delete.

f. Sheet 3 of 8, match line should refer to sheet 4 not sheet 6.

Sheet 3 modified to renumber the match line.

g. Sheet 4 of 8, legend shows proposed beach nourishment symbol but location of beach nourishment site is not identified on the plans.

Sheet 4 modified to show beach nourishment location.

h. Sheet 6 of 8 of project plans, the use of pipelines for dredged material disposal 2 to 3 miles offshore is questioned.

Although not common in the Galveston District, large pipeline dredges can effectively operate in the Gulf. For example, in Florida, pipeline dredges are frequently used up to 5 miles offshore for beach nourishment. In our discussions with dredging contractors concerning this project, the contractors raised the possibility of using pipeline dredges. In order to get the best price, we would like to maintain the flexibility of using either technology.

i. Provide the correct channel stations in both the project summary and plans including transition area, cross-sections and work limits. The description of the changes in channel dimensions found in section IV.1 Jetty Stability (fist paragraph on page 6 of project summary) is unclear. Station 51+84 is identified as being at the Lower Turning Basin. This station is over 1000 feet seaward of the Coast Guard Station, not at the turning basin.

- *The proposed widening in the Jetty Channel is as follows:*

STATION	WIDEN TO
0+00 to 40+00	600 ft
40+00 to 45+00	Transition from 600 ft to 550 ft
45+00 to 63.35 (outer limits of turning basin)	550 ft

- *Sheet 3 has been modified to properly reflect the above.*
- *The Entrance Channel will be widened from 0+00 to -220+00*

j. Identify the correct volume of dredged material. The volume of 2.8 MCY of dredged material in Section IV.2 Beneficial Use of Dredged Material (page 6 of the project summary) does not agree with the figure of 2.0 MCY found in the section I. Executive Summary (page 1) or under in the permit application (item 21).

The total volume of dredged material that will be generated is 3.2 million CY. This includes widening the Jetty Channel at project depth of 45 feet and the Entrance Channel at project depth of 47 feet, both with 2 feet of advance maintenance and 2 feet of overdepth.

k. The most important engineering concern is that of jetty stability. Even if adequate stability is shown, it is noted that the top of cut will be approaching distances of 100 feet or less from the jetty toe and these areas will need to be monitored for possible undermining in the years to come.

The routine cross sections obtained by the USACE to determine channel siltation will provide an indication of how the shelf between the top of the slope and the toe of the jetty may be changing due to erosion. We believe this should be adequate to detect any potential undermining. If the USACE believes additional monitoring will be required, it can be discussed as a possible permit condition.

l. the project summary and permit application state that a secondary benefit of the offshore berm (BU site) is to provide protection for the beach. To verify this, the hydrodynamic model must be reviewed. Submit the model and results for USACE review.

A scoping level analysis of the potential reduction in wave energy on the Quintana Beach has been completed. That analysis concludes: "The berm is not likely to effectively reduce wave energy at the shoreline." Consequently, energy reduction will not be identified as a secondary benefit. A copy of the technical memo is included as Attachment D.

m. Although the permit application states the offshore berm (BU site) will primarily benefit fish, it does not indicate that biological monitoring will be conducted to demonstrate the intended purpose of the BU site.

The applicant does not propose to do any biological monitoring of the offshore berm. Initial discussions with the resource agencies (NMFS and USFWS) indicated that they recognize the benefits. Also other Gulf studies (Mobile, Houston) have indicated the positive biological effect of berms. If this comes up during the public comment period, it can be discussed as a possible condition.

n. Address plans for future channel maintenance and identify where maintenance material will be placed.

The Port intends to seek federal assumption of the maintenance of the non-federal widened increment. Until this occurs (if at all) the maintenance dredged material from the widening increment will be placed in the same offshore DMPA as the construction material.

o. Regarding impacts to sea turtles identify the dredging protocols to be used that are referred to in Section IV.4 of the Project Summary.

The recognized protocols in effect at the time the dredging is performed, will be followed.

p. Submit the adjacent property owner addresses along the channel.

See Attachment E.

q. The application is unclear whether or not the 300,000 CY of sandy material is in fact "economically recoverable". Determine if the sandy material is recoverable and if beach nourishment will be conducted if the project is authorized.

At this point it is not possible to definitely determine whether or not the potential beach quality material will be "economically recoverable", since the specific dredging method is not established. In order to get the best price on the dredging, it is the applicant's intent to not specify the type of dredging equipment to be used. Thus, a contractor may bid the job based on using hopper dredge, pipeline dredge, mechanical methods or some combination thereof. The specific method used will determine the incremental cost of placing sand on the beach, which will establish its "economic feasibility", and this is not known at this time.

r. Regarding the Preliminary Geotechnical Study of Jetty Stability Report prepared by Fugro Consulting, April 2005:

1. The soil parameters summarized on page 5-4 are not consistent with the parameter included in the slope stability analysis presented in Appendix B.
2. Paragraph 5.5.3 on page 5-4 discusses the basis of how drained strength shear values were developed; however, this discussion does not address the presence of slickensided surfaces within the clays as noted on the drilling logs and how the presence of slickensided surfaces influence the selection of shear strength values.
3. The selection of drained strength shear values is not consistent with Corps guidelines as provided in Section 2-2 of EM 1110-2-1902. These guidelines minimize the contribution of cohesion in the Mohr-Coulomb failure envelope for drained strength.
4. Computed factors of safety in Table 5-2 on page 5-5 are uncharacteristically large for channel slopes cut in clay.

5. It is unclear what data was reviewed to evaluate the stability of existing channel slopes as noted on page 5-6. The Corps has an extensive history of cross section surveys taken through this reach. The data should be reviewed to further validate the appropriateness of 3:1 slopes.

These issues were discussed in detail at the last meeting. They will be addressed in the final Jetty Stability Report.

If we can provide any additional information, please contact us at any time.

Sincerely,

SHINER MOSELEY AND ASSOCIATES, INC.

Captain Thomas B. Rodino (USCG Retired)
Senior Maritime Consultant

Joe C. Moseley, Ph.D., P.E.
Principal

TBR/JCM/dd

Attachments: A. Application Amendments
B. Revised Drawings
C. Consistency with TCMP Form
D. Potential Wave Energy Reduction Analysis
E. List of Adjacent Property Owners

cc: (w/ attachments) David Knuckey, P.E.
Captain Kurt Hallier

ATTACHMENT A

Modify the information in the ENG Form 4345 to read as follows:

18. Nature of Activity (Description of project, include all features)

- Dredge channel to a maximum bottom width of 600 ft from the Lower Turning Basin to the -51 ft contour, a distance of approximately 4.8 miles.
- Dredging will be performed primarily with pipeline dredge; a hopper dredge, mechanical methods, or some combination thereof.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

Clay / silty clay	2,400,000 CY
Sand / sandy silt	800,000 CY
Total	3,200,000 CY

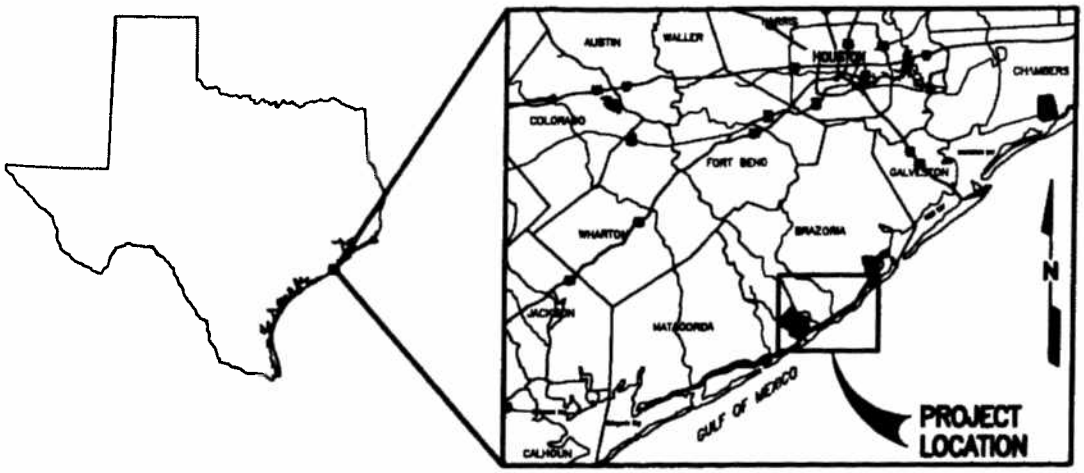
24. Addresses of Adjoining Property Owners, Lessees, etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list.)

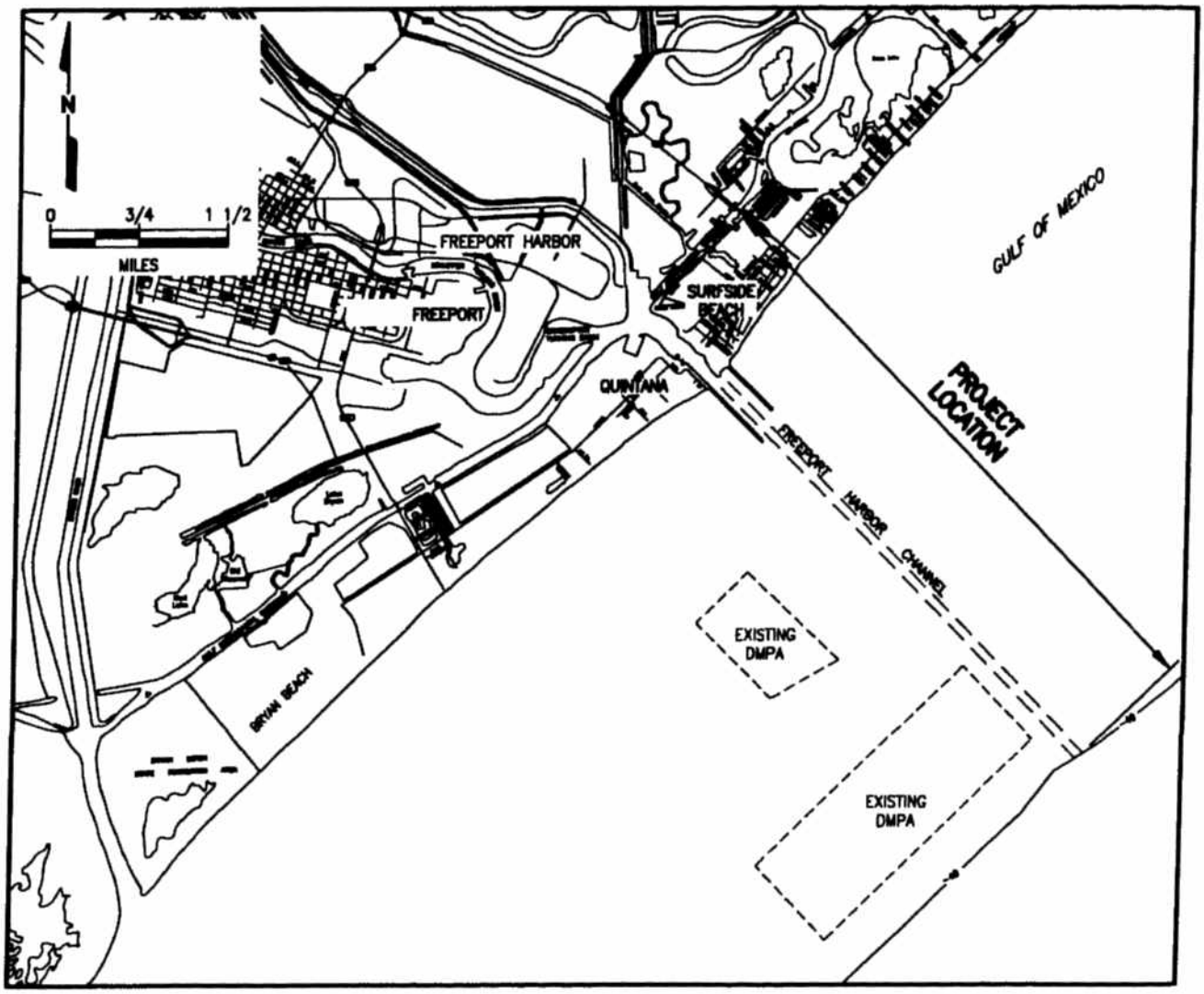
See attached list (Attachment D)

ATTACHMENT B

Revised Permit Drawings

PROJECT LOCATION





P O R T
FREEPORT

FOR COE USE ONLY

Permit Application No.: _____

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA		
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 6/07/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00 / SHEET 1

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

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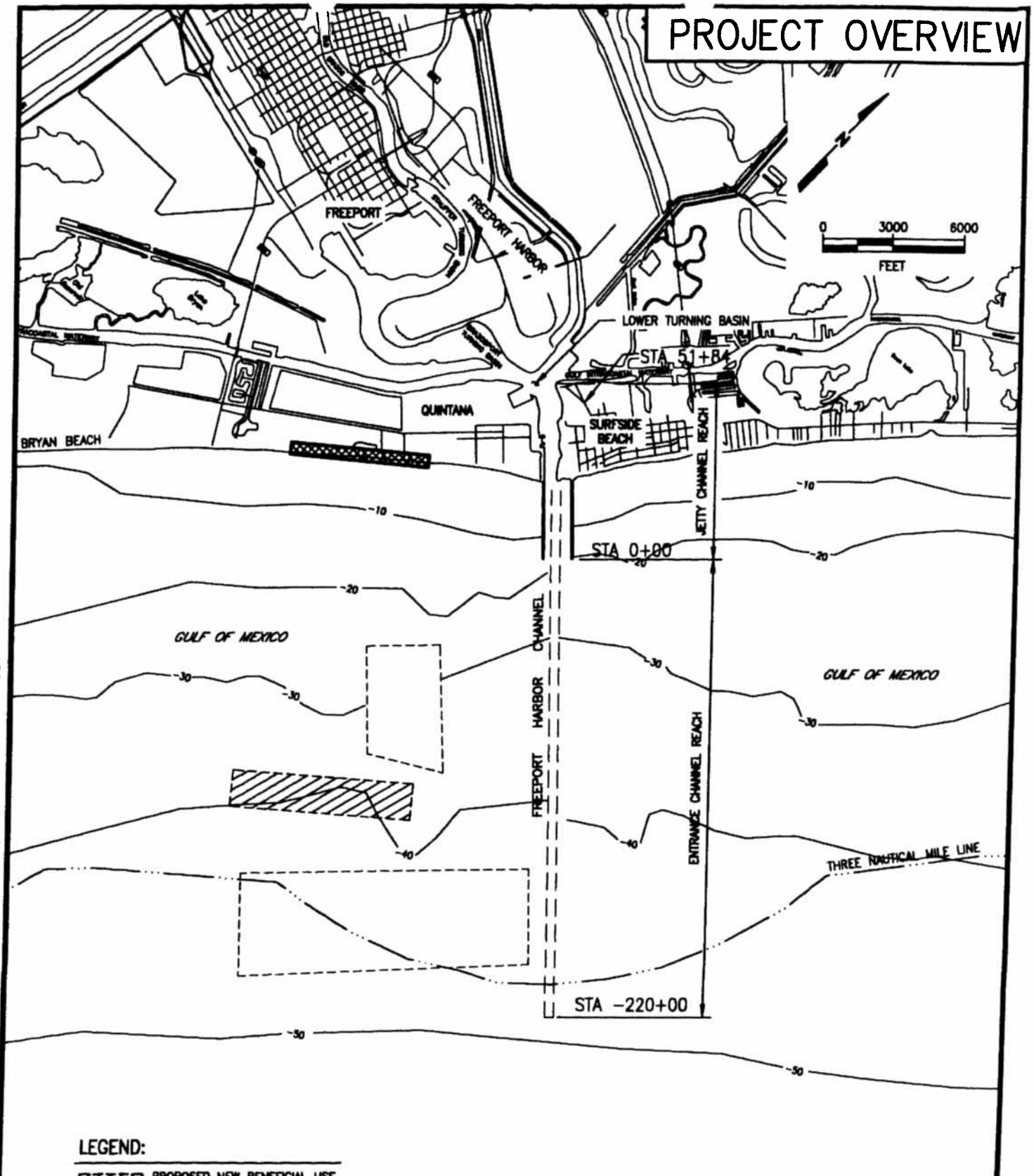
PROJECT OVERVIEW



LEGEND:

- PROPOSED NEW BENEFICIAL USE AREA: BERM FOR HABITAT
- PROPOSED BEACH NOURISHMENT AS BENEFICIAL USE
- EXISTING USACE DMPA

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.: _____

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA		SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 6/07/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00 / SHEET 2

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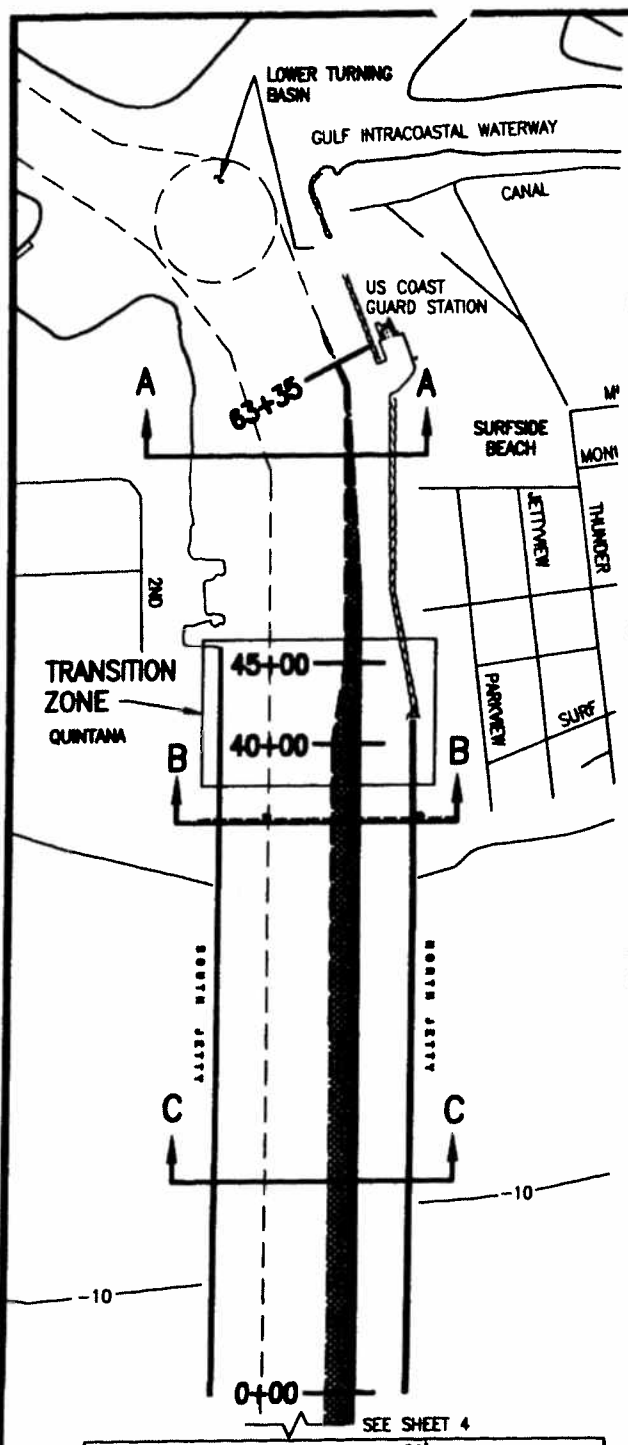
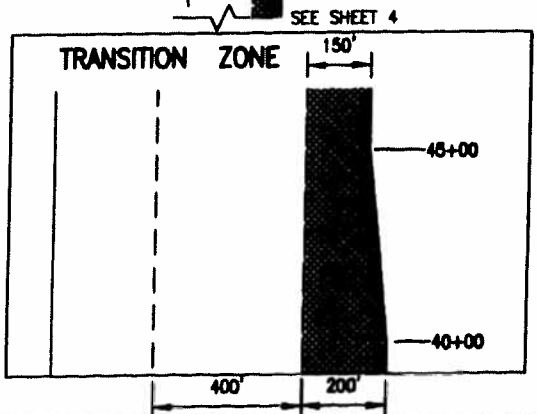
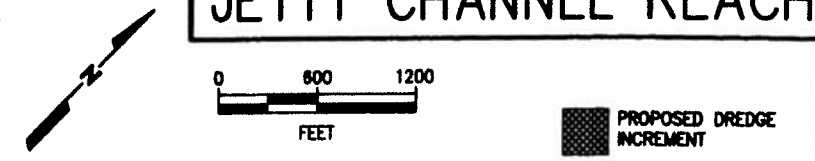
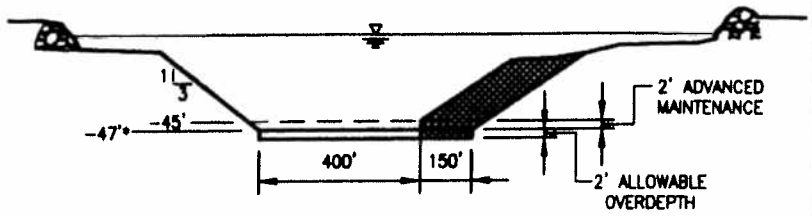
JETTY CHANNEL REACH

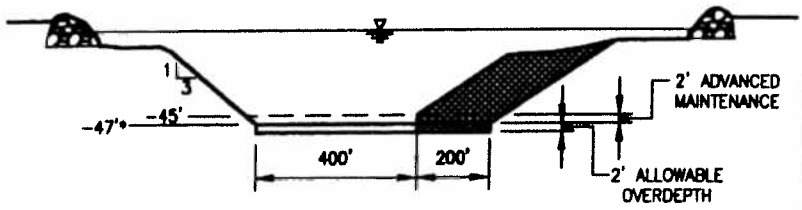




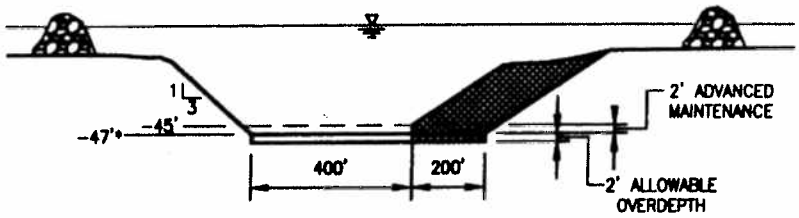




SECTION A–A



SECTION B–B



SECTION C–C

* BASED ON –45' PLUS 2' ADVANCED MAINTENANCE

JETTY CHANNEL WIDENING SUMMARY	
REACH	WIDEN TO
0+00 TO 40+00	600 FT.
40+00 TO 45+00	TRANSITION FROM 600 FT. TO 550 FT.
45+00 TO 63+35	550 FT.

PORT FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT

COUNTY: BRAZORIA

PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL

DATE: 6/07/05 | REV. DATE: | DATUM: USACE MLT

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

PROJECT No: 200.40142.00

SHEET 3

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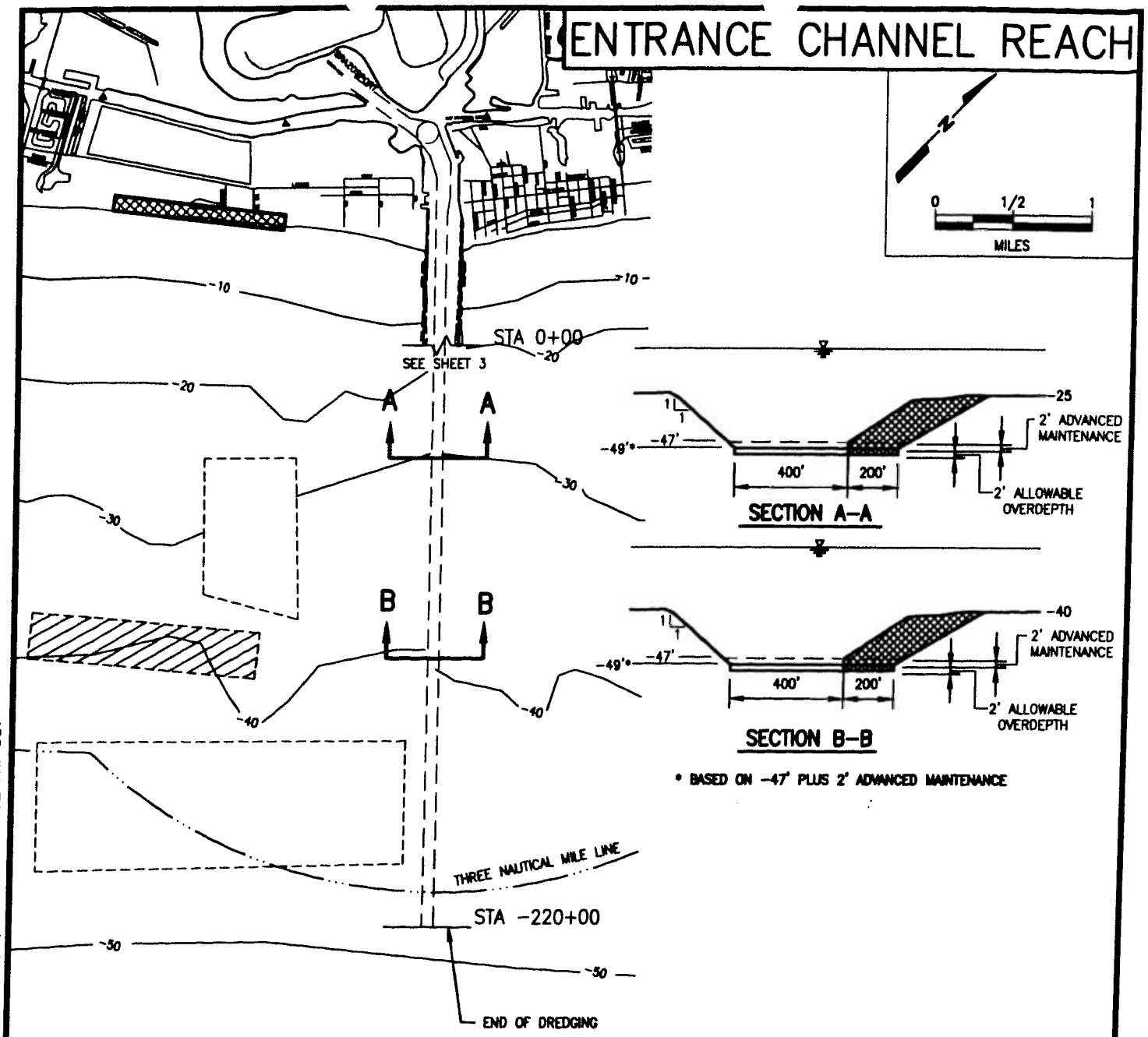
ENTRANCE CHANNEL REACH



NOTES:

* INCLUDES 2' OF ADVANCED MAINTENANCE PLUS 2' OF ALLOWABLE OVERDEPTH

LEGEND:

- PROPOSED DREDGE INCREMENT
- PROPOSED NEW BENEFICIAL USE AREA: BERM FOR HABITAT (SEE SHEET 6)
- PROPOSED BEACH NOURISHMENT AS BENEFICIAL USE (SEE SHEET 7)
- EXISTING USACE DMPA

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT | COUNTY: BRAZORIA

PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL

SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

DATE: 6/07/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 4

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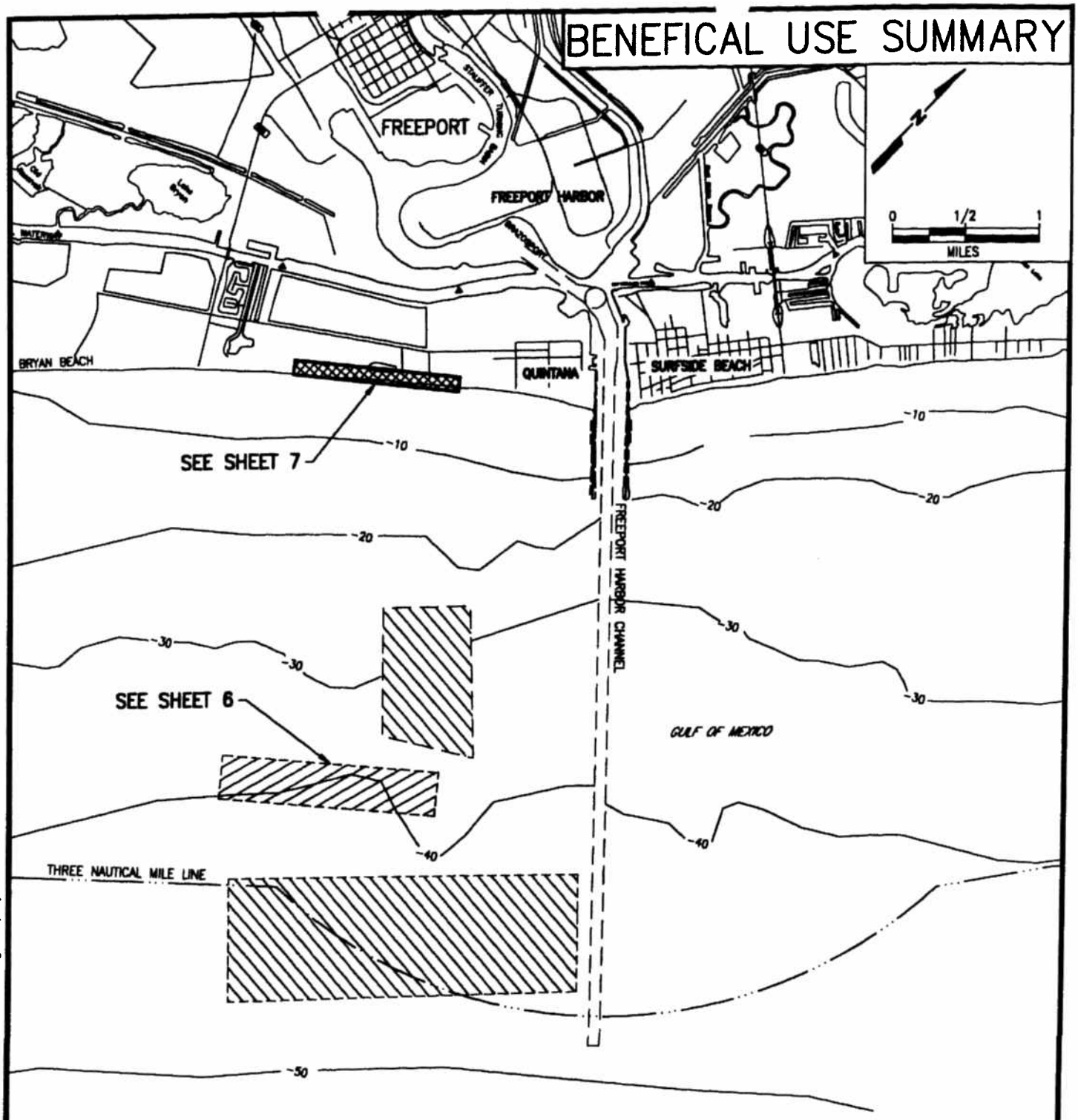
BENEFICAL USE SUMMARY



NOTES:

OFFSHORE BENEFICIAL USE AREA. CONSTRUCT A BERM OF TO PROVIDE HARD SUBSTRATE AND TO OFFER LIMITED BEACH PROTECTION. SEE SHEET 6.

BEACH QUALITY MATERIAL, IF FOUND IN ECONOMICALLY RECOVERABLE QUANTITIES, WILL BE USED AS BEACH NOURISHMENT FOR QUINTANA BEACH. SEE SHEET 7

EXISTING USACE DMPA

PORT FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		
DATE: 6/07/05	REV. DATE:	DATUM: USACE MLT

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

PROJECT No: 200.40142.00 | SHEET 5

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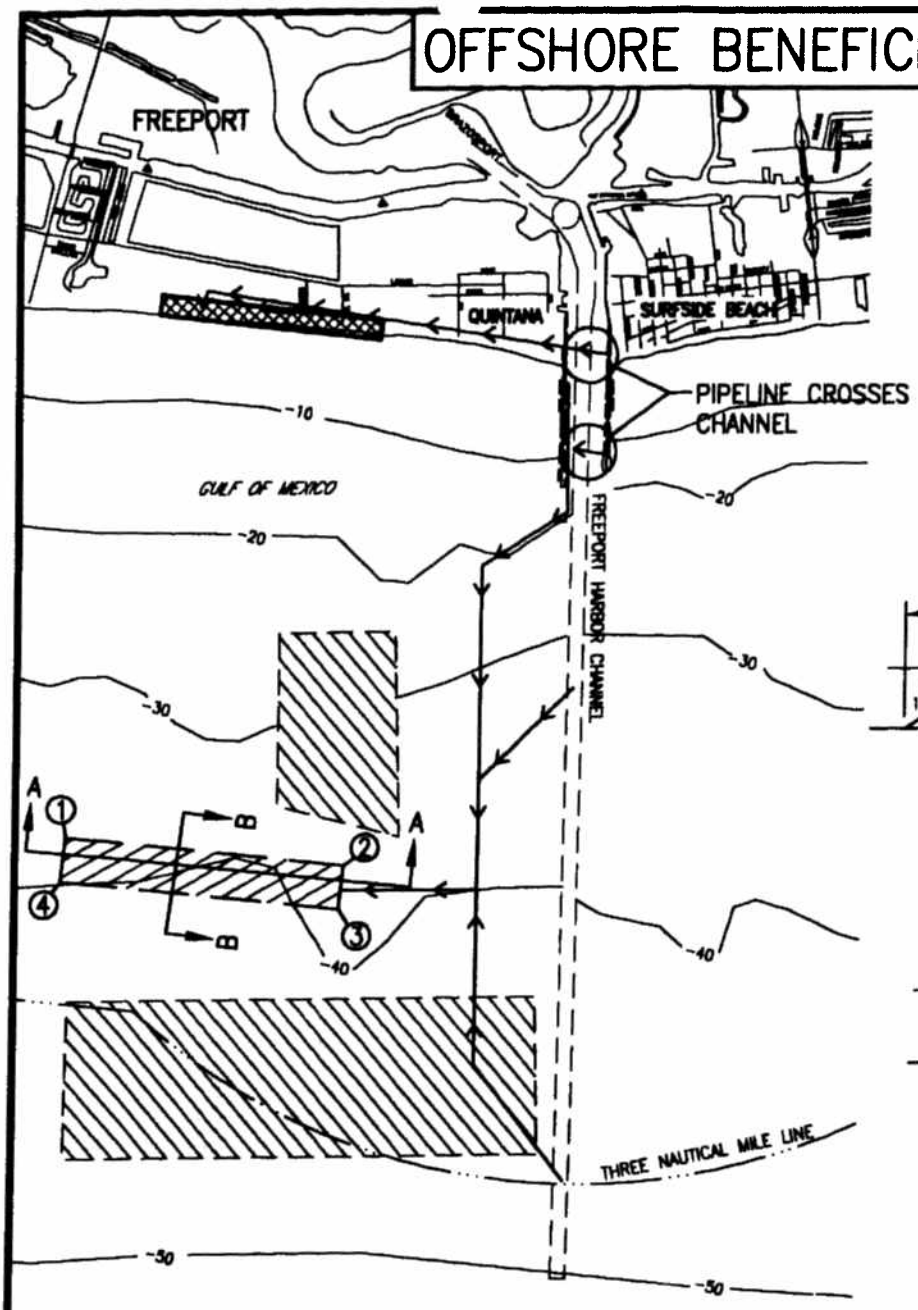
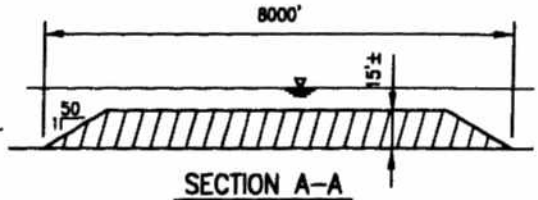
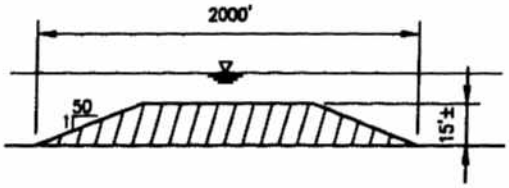
OFFSHORE BENEFICIAL USE AREA–BERM





SECTION A–A

SCALE: NONE



SECTION B–B

SCALE: NONE

NOTES:

PIPELINE ROUTE OUTSIDE JETTY IS TO SHOW CONCEPT. IT WILL VARY IN LOCATION AS REQUIRED FOR EFFICIENT DREDGING.

N

0 1/2 1

MILES

LEGEND

- PROPOSED BEACH NOURISHMENT
- PROPOSED OFFSHORE BENEFICIAL USE AREA
- ① N 28.52899967 W 95.18200007
- ② N 28.53800000 W 95.16900000
- ③ N 28.53600000 W 95.16700000
- ④ N 28.52700000 W 95.18000000
- EXISTING USACE OFFSHORE PLACEMENT AREAS
- PIPELINE ROUTING (TYPICAL)

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS	
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478	
DATE: 6/07/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 6

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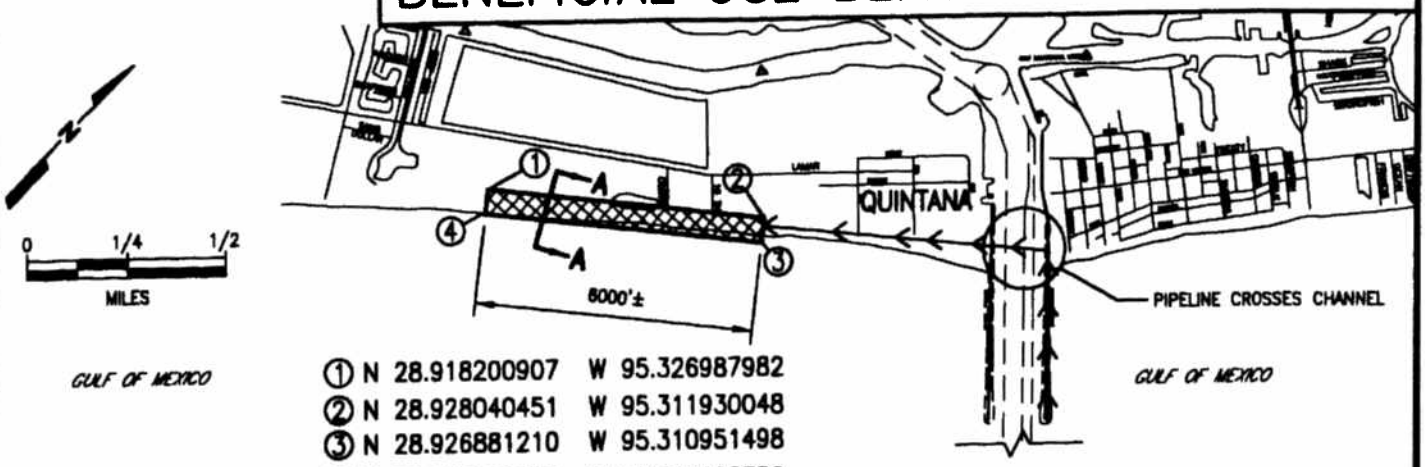
BENEFICIAL USE BEACH NOURISHMENT



① N 28.918200907 W 95.326987982
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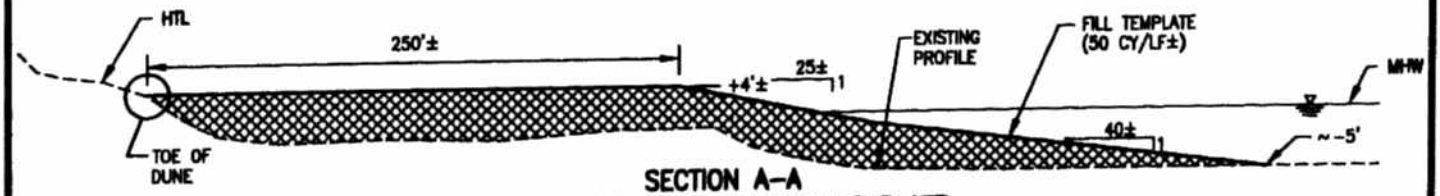
③ N 28.926881210 W 95.310951498
④ N 28.917041777 W 95.326009356



SECTION A–A
BEACH FILL CONSTRUCTION TEMPLATE

NOTES:

1. MHW = APPROX. +3.3' MLT; HTL = APPROX. +5.0' MLT
2. BEACH FILL LENGTH WILL DEPEND ON THE AMOUNT OF RECOVERABLE BEACH QUALITY MATERIAL THAT MIGHT BE AVAILABLE; IF 300,000 CY IS AVAILABLE, IT WOULD CONSTRUCT APPROXIMATELY 6000 LF OF BEACH AT A FILL TEMPLATE OF 50 CY/LF. THIS WOULD CREATE APPROXIMATELY 9± ACRES OF BEACH AREA AT INITIAL EQUILIBRIUM.

LEGEND

PROPOSED BEACH NOURISHMENT

PIPELINE ROUTING (TYPICAL)

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478	
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 6/07/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 7

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ATTACHMENT C

CONSISTENCY WITH THE TEXAS COASTAL MANAGEMENT PROGRAM

The applicant should sign this statement and return with application packet to:

U.S. Army Corps of Engineers (USACE)
Regulatory Branch
P.O. Box 1229
Galveston, Texas 77553-1229
Fax: 409-766-3931

For USACE use:

Permit #: _____

Project Mgr: _____

Applicant's Name and Address (please print):

Brazos River Harbor Navigation District

The Texas Coastal management Program (CMP) coordinates state, local, and federal programs for the management of Texas coastal resources. Activities within the CMP boundary must comply with the enforceable policies of the Texas Coastal Management Program and be conducted in a manner consistent with those policies. The boundary definition and policies are contained in the CMP rules (31 TAC §503.1 and §501.14, respectively). To determine whether your proposed activity lies within the CMP boundary, please see http://www.glo.state.tx.us/coastalpermits/locator.html. To determine whether your proposed activity meets the CMP consistency requirements, please see the applicable policies at http://www.glo.state.tx.us/coastal/cccrules.html.

The proposed activity must not adversely affect coastal resource areas (CNRAs). CNRAs include: coastal barriers, coastal historic areas, coastal preserves, coastal shore areas, coastal wetlands, critical dune areas, critical erosion areas, gulf beaches, hard substrate reefs, oyster reefs, special hazard areas, submerged lands, submerged aquatic vegetation, tidal sand or mud flats, waters of the open Gulf of Mexico, and waters under tidal influence. These are more fully described at 31 TAC §501.3(b), available at http://www.glo.state.tx.us/coastal/cccrules.html. Tools for locating CNRAs may be found at http://www.glo.state.tx.us/gisdata.html. The Coastal Management Program Permit Service Center is available to answer questions regarding compliance with the CMP policies.

The applicant affirms that the proposed activity, its associated facilities, and their probable effects comply with the relevant enforceable policies of the Texas Coastal Management Program (see 31 TAC §501.14), and that the proposed activity will be conducted in a manner consistent with such policies for the following reasons (use additional pages if necessary):

1. The proposed widening is of an existing ship channel and is being done to more efficiently handle both existing and future ship traffic.
2. The dredging and material placement is being done in a manner to eliminate or minimize any adverse impact. In fact, the dredged material will be devoted to beneficial use purposes. The primary beneficial use will be to construct an offshore berm to provide hard substrate for aquatic species. To the extent that suitable beach quality material is found in economically recoverable quantities, it will be used for nourishment of nearby eroding beaches.

Date: June 7, 2005 Signature: Joe C Moseley

Any questions regarding the Texas Coastal Management Program should be referred to:

Gwen Spriggs
Texas General Land Office
Coastal Coordination Council
1700 North Congress Avenue, Room 620
Austin, Texas 78701-1495
Phone: 512-475-3514
Fax: 512-475-0680
Toll Free: 1-800-998-4GLO
gwen.spriggs@glo.state.tx.us

Permitting Assistance Coordinator
Permit Service Center
6300 Ocean Drive
TAMU-CC Natural Resource Center, Suite 2800
Corpus Christi, Texas 78412-5599
Phone: 361-825-3050
Fax: 361-825-3465
Toll Free: 1-866-894-3578
permitting.assistance@glo.state.tx.us

ATTACHMENT D

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

MEMORANDUM

6/7/2005 J200.40142

TO: **FILE**

FROM: **JOE C. MOSELEY, PH.D., P.E.**
JOEL DARNELL JTD

RE: **FREEPORT CHANNEL WIDENING**

Executive Summary

- A scoping level investigation was performed to assess the potential for the offshore berm to reduce wave energy (and thereby erosion) on the beach at Quintana. This analysis was based on the berm location and size shown in the permit application (No. 23752, Sheet 6).
- The analysis used idealized data on bathymetry, wave conditions, and berm geometry that were obtained from multiple government sources (USACE, NOAA).
- Three wave cases were analyzed: ambient (H=3.5 ft), moderate storm (H=13.0 ft), and hurricane (H=20.0 ft).
- Due to the water depth and height of the berm, most waves will propagate over the berm with an insignificant change in height. Therefore, the berm is not likely to effectively reduce wave energy at the shoreline.

Introduction

This memo summarizes a scoping level investigation to assess the impacts of the proposed offshore dredged material berm located in the vicinity of the Freeport Channel, Freeport, TX. This work was performed in four phases: wave climate study, bathymetric grid creation, REFDIF wave modeling, and data analysis and interpretation. Given the proposed berm geometry and location in relatively deep water, the results of this investigation suggest that waves at the site are unlikely to be significantly effected, even for moderate storm conditions. It is important to note that the results of this investigation are based on idealized bathymetry, wave conditions, and berm geometry and thus should be considered a qualitative assessment. A more detailed and extensive modeling effort may provide better insight into the wave and shoreline processes at the site.

Corporate Office: 555 N. Carancahua, Suite 1650, Corpus Christi, Texas 78478 Phone (361) 857-2211 Fax (361) 857-7234 Email: mail@shinermoseley.com

Wave Climate Study

To establish representative wave conditions at the site, a 20-year record of hindcast wave data distributed by the USACE Coastal and Hydraulics Laboratory Wave Information Study (WIS) was compiled. These hindcast data were supplemented with limited study of offshore wave buoy data available from the National Data Buoy Center (NDBC). From these sources, nearshore wave height, period, and direction were established for ambient conditions at the site. Compiled WIS hindcast data were used to estimate representative wave conditions during moderate storms, as well as mild tropical storms and hurricanes. To quantify the relative occurrence of extreme events, a simple return period analysis was also performed for wave height, based on WIS monthly maximum hindcast wave conditions. Table 1 provides the three wave cases and associated wave conditions used in the wave modeling. Wave direction is reported using the meteorological convention (direction from which the wave propagates).

Table 1. Summary of wave conditions.

Case	H_{mo} (ft)	T_p (s)	Direction
Ambient	3.5	5.5	146°
Moderate Storm	13.0	10.0	165°
Tropical Storm/Hurricane	20.0	20.0	136°

Bathymetric Grid Creation

Since waves in the nearshore respond to changes in bathymetry, a representative bathymetric grid of the Freeport Channel and vicinity was generated. Lacking detailed hydrographic survey information, this idealized bathymetric grid was generated primarily from NOAA Navigation Chart 11321. Some of the features from this chart were adjusted to make the beach slope more uniform across the modeling domain. For reference, NGDC Coastal Relief Model soundings appear to contain anomalous data in the immediate vicinity of the Freeport Channel, particularly in offshore areas south of the jetties.

The idealized dredged material berm was represented as a three dimensional trapezoid with base length of 8200 ft, width of 1950 ft, and height of 7 ft. The berm was oriented roughly parallel to the shoreline contours in a water depth of about 40 ft. Side slopes of the berm were set at 50:1. The widened Freeport Channel and existing jetties were also built into the bathymetric grid, though these features did not play an important role in the modeling exercise.

Two bathymetric grids were generated, one with idealized bathymetry only, and the other including both the idealized bathymetry and berm geometry described above. Each grid covered 21,300 ft alongshore, with an offshore extent of 20,000 ft, and grid resolution of 50 ft.

REF/DIF Wave Modeling

REF/DIF 1 was applied to model wave transformation for the three wave cases and two bathymetric grids described above. REF/DIF is a weakly non-linear numerical model for propagation of monochromatic water waves over complex bathymetry and includes important nearshore wave processes such as shoaling, refraction, diffraction, and energy dissipation. REF/DIF has been applied to numerous modeling projects near jetties and entrance channels and can account for complex features such as emergent breakwaters or submerged mounds. Water level for all model runs was selected to represent mean sea level at the site.

Analysis and Interpretation

The model output included wave height and direction, which were compared between wave cases with and without the offshore berm in place. Due to the water depth and height of the berm relative to wave length, most waves can be expected to propagate over the offshore berm with an insignificant change in height. The modeling suggests that the primary effect of the berm may be diffractive scattering and focusing of waves on either end of the berm. For the monochromatic waves used in this investigation, this diffractive pattern was the most pronounced difference between cases with and without the berm in place. Still, these differences appeared small and would be even less pronounced considering the reality of ocean waves, which occur in a range of frequencies, directions, and wave heights at any given time. Furthermore, the relatively sharp gradients of the idealized berm shape generate more pronounced focusing and scattering effects than would be observed in the field for an actual offshore berm. For the results described above, adding storm surge to the model would only lessen the impacts of the offshore berm, by increasing the water depth. Therefore, the effect of storm surge was not analyzed in detail.

Conclusion and Recommendations

Based on the interpretation of model results discussed here, an offshore berm with relatively small height in deep water is not likely to effectively reduce wave energy at the shoreline, even for moderate storm conditions. More extensive wave modeling that accounts for wave spectra and wave reflection may provide additional insight into potential offshore berm effects on wave energy. Modeling should also investigate the effects of different berm geometries and locations, other than the single idealized case considered here.

Appendix B

DMMP and Site Habitat Report

PORT FREEPORT℠

THE COAST IS CLEAR

Freeport Channel Widening Permitting

J200.50170

HDR | SHINER MOSELEY AND ASSOCIATES, INC.

EXECUTIVE SUMMARY

The widening of the Freeport channel seaway of the Outer Turning Basin will generate 3.2 mcy of dredged material, including 2.9 mcy of clay and 300,000 cy of silty sand. The silty sand is suitable for certain beneficial uses in the area; however, no suitable beneficial uses for the 2.9 mcy of clay were identified through the process described below.

A DMMP Working Group was formed consisting of participants from U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Environmental Protection Agency (USEPA), Texas Parks and Wildlife Department (TPWD), Texas General Land Office (TGLO), Texas Commission on Environmental Quality (TCEQ) and the National Oceanographic and Air Administration (NOAA), Third Party EIS Contractor (PBS&J), and the Ports Consultant HDR|Shiner Moseley and Associates, Inc. (HDR|SMA). to identify regulatory issues related to the project and to identify and evaluate potential beneficial uses for the dredged material produced during the project.

There are a total of 17 alternative disposal sites, including confined placement areas, Offshore Dredged Material Disposal Sites (ODMDS), and two types of beneficial uses: habitat restoration and beach nourishment. A preliminary screening reduced the potential candidates to 6 options: three habitat restoration sites, two beach nourishment sites, and, as a last resort, an ODMDS.

Further analysis eliminated two of the beneficial use habitat restoration sites, Swan Lake and Bryan Lake, leaving the SH332 Beneficial Use site. The limited suitable material (300,000 cy) would support only one BU site, either habitat restoration or beach nourishment. Detailed cost estimates indicate that the cost of the SH 332 site restoration would exceed the cost of beach nourishment by approximately $527,750.

The recommended Dredge Material Management Plan contains the following key features:

- Use a mix of dredging methods:
    - pipeline dredge to remove the 300,000 cy of silty sand
    - mechanical excavation to deepen the project area to provide hopper dredge access
    - hopper dredge for the remaining 2.9 mcy of clay
- Place the 300,000 cy of sand on Quintana Beach in front of the Seaway Placement Area to:
    - provide accessible public beach
    - protect the containment levee.
- Place the 2.9 mcy of clay in the ODMDS, the permitting of which should begin immediately.

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I. INTRODUCTION

1. Project Description and Area Setting

The existing Federal channel is approximately 5.2 miles in length and is approximately 400 ft in width at the bottom. Water depths in the Freeport Ship Channel are currently maintained by the USACE to a depth of -47 ft from Mean Low Tide (MLT). The proposed project entails widening the Freeport Ship Channel from the Outer Turning Basin to the -49 ft contour. The widening increment will be at the same depth as the existing Federal Channel. Portions of the Jetty Channel and all of the Entrance Channel will be widened to a total bottom width of 600 feet. Exhibit A is a copy of the original U.S. Army Corps of Engineers (USACE) Permit Application #23752 that covers the proposed widening. The Brazos River Harbor Navigation District (Port Freeport or Port) is the permit applicant.

The purpose of the project is to permit the use of non-Federal funds to widen the existing Federal Channel. The need is to eliminate operational constraints preventing the transit of larger ships into the Port of Freeport. The constraints are threefold: (a) limits on large vessels when the wind exceeds 20 knots or currents exceed 2 knots, (b) limitations on nighttime transit, and (c) restriction on two way traffic. Elimination of these operational constraints will increase port efficiency and reduce shipping costs due to delays.

Construction of the project will generate approximately 3.2 mcy of uncontaminated dredged material that consists of 2.9 mcy of clay and 300,000 cy of silty sand.

The Freeport area is unique in that it does not have barrier islands or extensive bays. The primary tributaries, the Brazos River and the San Bernard River, drain directly into the Gulf of Mexico from the mainland rather than via bays between the mainland and barrier islands and do not provide freshwater inflow at the Port.

The Freeport Ship Channel follows the lower portion of what is called the "Old River." In 1929 the lower 6.8 miles of the Brazos River were diverted via a new man-made channel into the Gulf approximately 6 miles west of the Old River. The overall effect of this relocation was the elimination of significant currents in the port area, the elimination of riverine flood flows through the port, and the direct discharge of the sediment laden river water into the Gulf. Benefits to the port include less maintenance dredging, fewer operational interruptions due to high water, and increased navigation safety.

The beachfront on both sides of the Ship Channel is developed. On the north lies the community of Surfside, population 763. It is predominately a single family residential area, with some beach related commercial development. On the south lies the community of Quintana, population 38, which is single family residential. A dominant feature of Quintana is the Freeport LNG terminal, which is under construction. Two large dredged material disposal areas and Bryan Beach State Park are also in Quintana.

2. Beneficial Uses Concept

Federal policy suggests that dredged material be used for beneficial purposes if deemed practical. Typically, beneficial uses may include a wide spectrum of purposes:

- Habitat creation or restoration.
- Shoreline restoration.
- Beach nourishment.
- Dune reconstruction.

In making the decision as to whether or not a beneficial use is feasible, a number of factors may be considered:

- Likelihood of success or failure.
- Environmental effects.
- Construction costs.
- Sustainability.
- Type and extent of benefits.

3. Approach

The following steps outline the steps taken during the planning and permitting process. Beneficial uses have been considered throughout the process.

Step 1 – Conducted Regulatory Assessment

Meetings were held with the regulatory and resource agencies (U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Environmental Protection Agency (USEPA), Texas Parks and Wildlife Department (TPWD), Texas General Land Office (TGLO), Texas Commission on Environmental Quality (TCEQ) and the National Oceanographic and Air Administration (NOAA)) to get opinions and comments regarding the proposed project. Beneficial uses were proposed during these meetings, primarily wetland restoration and an offshore habitat berm.

Step 2 – Drafted Initial Application

An initial draft permit application was prepared and submitted to the USACE on April 14, 2005 and assigned permit application number 23752. Three beneficial use possibilities were identified and included in the initial permit application: beach nourishment, offshore habitat berm, and onshore wetlands enhancement.

Step 3 – Participated in Joint Evaluation Meeting (JEM)

A Joint Evaluation Meeting was held with the Port, USACE, TXGLO, TCEQ, TPWD, USEPA, USFWS, NMFS, and HDR|SMA to discuss the project concept and details of various beneficial uses that were identified. The agencies participating in the JEM generally acknowledged their support for the concept and provided comments.

Step 4 – Scoping Meeting and NEPA Process

The NEPA compliance process formally started with the Scoping Meeting on November 25, 2005. The idea of beneficial use of dredged material was presented to state and federal agency representatives and the public, including the formation of a DMMP Work Group. The Work Group consisted of representatives from the following: U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Environmental Protection Agency (USEPA), Texas Parks and Wildlife Department (TPWD), Texas General Land Office (TGLO), Texas Commission on Environmental Quality (TCEQ), Port, Third Party EIS Contractor (PBS&J), and the Ports Consultant HDR|Shiner Moseley and Associates, Inc. (HDR|SMA).

Step 5 - Operations of Work Group

Between early December 2005, and late February 2006, the Work Group met four times and completed the following steps:

- Step 5-A - Decided on an approach to identify and evaluate alternatives.
- Step 5-B - Identified a total of 17 disposal sites of which 9 sites were beneficial use alternatives.
- Step 5-C - Used available information to screen the 9 potential beneficial uses down to 3 sites meriting further scrutiny.
- Step 5-D - Visited the remaining candidate sites and collected additional site specific information and prepared summary documents.
- Step 5-E - Reviewed results with the DMMP Work Group and made recommendations for an overall Dredged Material Management Plan.
- Step 5-F - Compiled the results into a plan for incorporation in the EIS and other appropriate NEPA compliance documents.

Section II of this document describes the alternatives analyzed and how the process was used to arrive at the recommended DMMP. Section III of this document presents the findings and results of the process.

II. ALTERNATIVES IDENTIFICATION AND EVALUATION

1. Introduction

For preliminary screening purposes, potential onshore placement sites within approximately 5 miles of the project site were considered. Offshore placement was also considered. The potential placement areas included both potential beneficial use sites as well as conventional disposal sites. A total of 17 placement areas were identified in 4 major categories. Of the 17 alternatives below, 9 can be considered beneficial uses (denoted with an asterisk):

Marsh Restoration and Creation/GIWW Bank Stabilization

- Swan Lake *
- Bryan Lake *
- Highway 332 Marsh *
- GIWW Bank Stabilization *

Upland Confined Placement Area (UCPA)

- DMPA "Seaway"
- DMPA "85"
- DMPA "2/3"
- DMPA "86/87"
- DMPA "88"
- DMPA "7"
- DMPA "1"

Offshore Placement

- Offshore Berm – Fish Habitat *
- Offshore Berm – Wave Protection *
- Nearshore Berm – Beach Feeder and Surf Break *
- ODMDS Placement

Beach Nourishment

- Surfside *
- Quintana *

Table II.1 is a matrix that assesses the suitability of each site according to the following criteria:

- Dredge Method
- Potential Capacity – Silty Sand
- Potential Capacity – Clay
- Beneficial Use
- Containment Requirements
- Regulatory Requirements
- Issues
- Viable Alternatives

All confined placement areas were eliminated due to two reasons: resource agencies require that dredged material be used beneficially, if possible, and the existing confined placement areas have very limited available capacity. The preliminary screening reflected in Table II.1 identifies five potential beneficial uses for the 300,000 cy of silty-sand material that merited further attention:

- Marsh restoration at Swan Lake
- Marsh restoration at Highway 332
- Marsh restoration at Bryan Lake
- Beach nourishment at Quintana Beach – adjacent to Seaway DMPA
- Beach nourishment at Surfside Beach

Other potential beneficial use sites were eliminated for the following reasons:

- Gulf Intracoastal Waterways (GIWW) Bank Stabilization was determined to be unsuitable due to inadequate capacity and difficulty of containment.
- Offshore Berm – Fish Habitat. These merits are debatable and similar benefits would result from placement in a designated disposal area.
- Offshore Berm – Shoreline Protection. A cursory analysis indicated that the benefits were negligible.

- Offshore Berm – Beach Feeder. Benefits would be very minimal and most (90%) of the dredged material is not suitable for beach nourishment.

The three potential habitat restoration sites, refer to Figure 1, are each briefly discussed below. A habitat assessment with photos is included as Exhibit B.

Swan Lake Beneficial Use Site

This potential beneficial use site is located approximately two miles east of the Freeport Jetty Channel. The overall area identified as a potential beneficial use site is roughly 578 acres, which includes open water, tidal streams, wetlands, and potentially some uplands. It is bounded on the north by the GIWW, on the west by a canal connected to the GIWW, and on the east and south by developed properties and roadways. As a potential beneficial use site for the placement of dredged materials, the focus of the initial investigation was on the open water portions for wetland restoration and/or creation. Two distinct bodies of open water were identified by examining an aerial photograph of the area. The western body is roughly 85 acres in size and the eastern body is approximately 225 acres in size, refer to Figure 2. In aggregate, the two bodies of open water encompass approximately 310 acres.

Ownership of these two areas was not confirmed during the initial investigation. However, based on the nature of the bodies of water, it is assumed they are state owned land.

The initial investigation also compared a 2005 aerial photograph against historic photographs available on the Texas General Land Office web site. An aerial photograph from 1944 was used for comparison purposes. Although a significant portion of the 225 acre area was not covered in the 1944 photograph, the nature of both areas appears to be quite similar, with the exception of the western-most portion of the 85 acre site that appears to encompass a larger area that is now the open water. In general, the comparison indicates that over the past 61 years there has been no substantial loss of wetland acreage in this area, beyond that described above for the 85 acre site.

A site visit was performed on 12/20/05 to supplement the initial investigation efforts. Photographs obtained during that visit are provided in Exhibit 2 of Exhibit B.

The following pertinent observations were made during the site visit:

- There is evidence of oyster beds and fishing activities (i.e., presence of traps) in the 225 acre eastern body of open water.
- There is evidence of oyster beds in the 85 acre western body of open water.
- No evidence of sea grass presence was found; however, the visit was limited to an investigation along a portion of the shorelines and not the full bodies of water.

Bryan Lake Beneficial Use Site

This potential beneficial use site is located approximately three miles west of the Freeport Jetty Channel, refer to Exhibit 3 of Exhibit B. The overall area identified as a potential beneficial use site is roughly 913 acres, which includes open water, tidal streams, wetlands, and potentially some uplands. It is bounded on the south by the Gulf Intracoastal Waterway (GIWW), on the west by the Bryan Mound Strategic Petroleum Reserve (SPR) facility, on the north by a levee with roadway, and on the east by a developed roadway. As a potential beneficial use site for the placement of dredged materials, the focus of the desktop investigation was on the open water portions for wetland restoration and/or creation. Three distinct bodies of open water were identified by examining aerial photographs of the area. The east body is approximately 50 acres in size, the west body is approximately 100 acres in size, and the central area is approximately 30 acres in size, refer to Figure 3. In aggregate, the three bodies of open water encompass approximately 180 acres.

Ownership of these three areas was not confirmed during the desktop investigation. However, based on the nature of the bodies of water it is assumed they are state owned land.

The initial desktop investigation also compared a recent aerial photograph against historic photographs available on the Texas General Land Office web site. An aerial photograph from 1944 was used for comparison purposes. Based on the comparison it is evident that all three bodies of water have been in existence since 1944. Both the western 100 acre area and the central 30 acre area appear to be similar in both photographs. The eastern 50 acre area appears to be smaller in size today as compared to 61 years ago, which may indicate accretion in the area. In general, the comparison indicates that there has been no substantial conversion of wetlands or uplands to open water in this area over the past 61 years.

A site visit was performed on 12/20/05 to supplement the desktop investigation efforts. Photographs obtained during that visit are provided as in Exhibit 2 of Exhibit B. During that site visit discussions were held with Mr. Jimmy Salinas, Environmental Safety and Health Coordinator for the Bryan Mound SPR facility to obtain his input on potential beneficial use projects adjacent to the facility. The following pertinent observations were made during the site visit and discussions with Mr. Salinas:

- There is evidence of oyster beds in the 100 acre western body of open water.
- Mr. Salinas indicated that the SPR facility would likely have strong reservations about marsh creation in the 100 acre and 30 acre areas because of security concerns. Specifically, the growth of marsh grasses would restrict perimeter security vision in this area.
- There was no obvious evidence of oyster beds in the 50 acre area and SPR did not have any specific concerns with potential beneficial use for marsh creation in this area.
- No evidence of sea grass presence was found; however, the visit was limited to an investigation along a portion of the shorelines and not the full bodies of water.

SH 332 Bridge Beneficial Use Site

This potential beneficial use site is located approximately one mile northeast of the Freeport Jetty Channel, refer to Exhibit 1 of Exhibit B. The overall area identified as a potential beneficial use site is roughly 328 acres, which includes open water, tidal streams, wetlands, and potentially some uplands. It is bounded on the north and west by canals, on the south by developed land and roadways, and on the east by undeveloped land. State Highway (SH) 332 runs through the center of this area in a general north-south direction. As a potential beneficial use site for the placement of dredged materials, the focus of the desktop investigation was on the open water portions for wetland restoration and/or creation. Four distinct bodies of open water were identified by examining aerial photographs of the area. Two areas, 42 acres and 12 acres in size respectively, are located west of SH 332 and two areas, each 4 acres in size are located east of SH 332, refer to Figure 4. In aggregate, the four areas of open water encompass approximately 62 acres.

Ownership of these four areas was not confirmed during the desktop investigation. However, based on the nature of the 42 acre body of water, it is assumed that it is state owned land.

The desktop investigation also compared a recent aerial photograph against historic photographs available on the Texas General Land Office web site. Aerial photographs from 1944 and 1965 were used for comparison purposes. Although the 1944 photograph of the area is not very clear, the 1965 photograph indicates that the two 4 acre areas were bodies of water 40 years ago, with stronger evidence of this on the northernmost 4 acre area. Furthermore, the comparison with the 1965 photograph indicates that the areas west of SH 332 were wetlands and have broken up over the past 40 years to become predominantly open water.

A site visit was performed on 12/20/05 to supplement the desktop investigation efforts. Photographs obtained during that visit area provided in Exhibit 2 of Exhibit B for informational purposes. The following pertinent observations were made during the site visit:

- No evidence of oyster beds in any of the areas was found; however, the visit was limited to an investigation along a portion of the shorelines and not the full bodies of water.
- No evidence of sea grass presence was found; however, the visit was limited to an investigation along a portion of the shorelines and not the full bodies of water.
- The two 4 acre areas and the 12 acre area appear to be functional wetlands with tidal conveyances.
- The 42 acre site appears to be broken up marsh area with a predominance of open water.

For the reasons discussed above, the only viable marsh restoration project is at the SH 332 bridge area. The other alternative beneficial use is placement of the material on the beach to counter shoreline erosion. The 300,000 cy of silty sand from the Jetty Channel is available and suitable for either beneficial use.

A cost comparison of using the silty sand for the SH 332 marsh creation and beach nourishment was completed. The two alternatives are discussed below:

Marsh Restoration.
Dredged material produced during this project consists of silty sand and stiff clays. Stiff clays are not suitable for proper vegetation growth and wildlife habitat and therefore not suitable for marsh restoration uses. Approximately 300,000 cy of the silty sand material located in the Jetty Channel is available to be placed in the SH 332 Bridge Beneficial Use location. Roughly 200,000 cy would be used to properly fill one of the two areas to an elevation that would allow growth of low marsh habitat for marsh restoration. The remaining 100,000 cy would be used to properly fill in the other area to an elevation that would allow growth of low marsh habitat for marsh restoration.

Assumptions used in the analysis are as follows:

- A single 20" to 24" hydraulic dredge unit will be mobilized and used for the placement of materials in both the SH 332 Bridge Beneficial Use locations.
- The average pumping distance for the SH 332 Bridge Beneficial Use areas is approximately 1.7 nautical miles. The pipeline will cross the GIWW. The high volume of barge traffic associated with the GIWW will require significant operational interruptions. The pipeline will have to be outfitted with a diffuser or baffle at the discharge end to allow for a better control of the discharged dredged material into the marsh area.

Beach Nourishment. Approximately 300,000 cy of the silty sand material, located in the Jetty Channel is available to be placed on either the Surfside or the Quintana Beach, but not a combination thereof due to the relatively small amount of material available. Assumptions include:

- A single 20" to 24" hydraulic dredge unit will be mobilized and used for the placement of the materials on one or the other beach, but not split between the two.
- The average pumping distance for beach placement is approximately 2.0 nautical miles. No crossing of the ship channel is assumed here; however, one will be required if the material goes to Quintana Beach.

The costs of the two alternatives are as follows:

ITEM DESCRIPTION	QUANTITY		UNIT COST	TOTAL	EXTENDED TOTALS
	NUMBER	UNIT			
Beach Nourishment					**$1,066,000**
Mob/Demob (2)	1	LS	$2,000.00	$2,000	
300 hp bulldozer	360	HR	$160.00	$57,600	
200 hp bulldozer	360	HR	$120.00	$43,200	
Pipeline	8,500	FT	$12.00	$102,000	
Dredge	360	HR	$1,800.00	$648,000	
25% Contingency				$213,200	
Marsh Placement					**$1,593,750**
Mob/Demob (3)	1	LS	$4,500.00	$4,500	
Dredge (4)	450	HR	$1,800.00	$810,000	
Backhoe/barge					
1. Levee	300	HR	$350.00	$105,000	
2. Discharge	450	HR	$350.00	$157,500	
3. Deconstruct	100	HR	$350.00	$35,000	
Pipeline	9,000	FT	$12.00	$108,000	
Weir	1	LS	$20,000.00	$20,000	
Marsh Buggy	100	HR	$350.00	$35,000	
25% Contingency				$318,750	
Difference					**$527,750**

Notes:

1. Original mob/demob of dredge equipment assumed same for both options at ~$500,000
2. Beach nourishment requires additional mob/demob of two bulldozers
3. Marsh placment requires additional mob/demob of marsh backhoe with barge and marsh buggy
4. Dredge production reduced by 25% due to shallow depths at marsh and need for elevation control

Summary

- The additional cost associated with marsh restoration at SH 332 bridge, relative to beach placement, is approximately $527,750.
- There is a great deal of public support for placement of the silty sand material on either the Quintana or Surfside beach. Removing the littoral zone material and placing it further inland on a marsh is contrary to the evident public desires.
- The nature of the stiff clay material is not optimally suited for either habitat restoration or beach nourishment; consequently, it should go to an Offshore Dredged Material Disposal Site (ODMDS).

III. FINDINGS AND RECOMMENDATIONS [I'D EITHER GET RID OF THIS OR THE EXECUTIVE SUMMARY]

A. New construction material volume and characteristics

1. The initial construction of the widening will generate 3.2 mcy of dredged material, which includes 300,000 cy of silty sand and 2.9 mcy of stiff clay.

2. The 300,000 cy of silty sand can be used for either of two types of beneficial use in the immediate project area: habitat restoration or beach nourishment.

3. The stiff clay is not suitable for the identified beneficial uses.

B. Maintenance Material Volume and Characteristics

1. The average maintenance volume for the widening increment is on the order of 1 mcy per year.

2. It is fine silty clay and is not suitable for any of the available beneficial uses.

C. Dredging Methods

1. Several scenarios are possible depending on the equipment available at the time of dredging. The most likely scenario involves a mix of hopper dredge, pipeline dredge, and mechanical excavation.

2. A pipeline dredge will be used to excavate the silty sand and pump it to the beach nourishment site.

3. Mechanical excavation will be used to deepen the project area to about 25-30 feet, which is the minimum operation depth for a hopper dredge.

4. A hopper dredge will be used to excavate the stiff clay and transport it to the Offshore Dredged Material Disposal Site (ODMDS).

D. Alternative and Recommended Placement Areas

1. A total of 17 potential placement areas were identified (see Table II.1) and divided into four separate categories:

- Upland Confined Upland Placement Area (UCPA).
- Offshore Dredged Material Disposal Sites (ODMDS).
- Beneficial Uses – Habitat Restoration (BU – HR).
- Beneficial Uses – Beach Nourishment (BU-BN).

2. An initial screening reduced the original 17 alternatives to 5 alternatives meriting further attention.

- All existing UCPAs were eliminated due to other commitments and limited capacity. No new UCPAs were proposed due to the scarcity of suitable upland sites.
- To comply with existing Federal guidance, the ODMDS are considered only as a last resort if no other practical options exist.

- Three potential Beneficial Use – Habitat Restoration sites were identified: Swan Lake, Bryan Lake, SH 332 Bridge.
- Two Beneficial Use sites – Beach Nourishment were identified: Quintana and Surfside.

3. The above surviving alternatives were subjected to further evaluation, which included site visits to better characterize existing conditions, placement options, and potential benefits.

- Two of the BU – HR sites, Swan Lake and Bryan Lake, were eliminated due to the presence of oysters and existing good habitat that might be significantly degraded by any restoration attempts.
- The other BU – HR site SH 332 Bridge appears to offer potentially attractive habitat restoration options.
- Both the BU – BN sites offered positive potential. Closer evaluation favors Quintana in front of the Seaway Confined Placement Area for two public purposes:
    - reestablish public access to the public beach in front of the disposal area
    - provide erosion protection for the containment levee of the Seaway Confined Placement Area.
- Because of the limited volume of suitable material (300,000 cy of suitable silty sand) for the beneficial uses, only one project can be done – either the habitat restoration or beach nourishment.
- A more in depth cost comparison of the SH 332 and Quintana Beach was done. Placement at the SH 332 exceeds the cost of placement at Quintana by approximately $527,750.
- Public support is for beach nourishment.

E. Summary of Recommended Placement Areas

- Place the 300,000 cy of silty sand on the Quintana beach in front of Seaway UCPA to provide improved public access and provide erosion protection for the UCPA containment.
- Place the remaining 2.9 mcy of stiff clay in the ODMDS.
- Maintenance material should be placed in the ODMDS.
- Permitting of the ODMDS should be expedited.

Figure 1

Figure 2

Figure 3

Figure 4

Figure II.1
Freeport Entrance & Jetty Channel Widening Project
Dredge Material Management Plan – Placement Evaluation Matrix

Placement Alternative	Dredge Methodology	Potential Capacity Silty-Sand Material[1]	Potential Capacity Clay Material[2]	Beneficial Use	Containment Requirements	Regulatory Requirements (Beyond 404/10 Permit)	Issues	Viable Alternative
Swan Lake Marsh Restoration/Creation	Hydraulic	~ 100K CY (33%)	~ 250K CY (20%)	Yes	ICW Interface	None	▪ Presence of oyster beds ▪ Active fishing area ▪ Freeport Wiggles Sect. 216 study (conflict)	No
Bryan Lake Marsh Restoration/Creation	Hydraulic	~ 60K CY (20%)	~ 0K CY (0%)	Yes	None	None	▪ Presence of oyster beds ▪ Strategic Petroleum Reserve security concerns ▪ Potential future mitigation or development site (Port)	No
332 Bridge Marsh Restoration/Creation	Hydraulic	~ 300K CY (10%)	~ 0 CY (0%)	Yes	Drainage Canal Interface	None	▪ Presence of oyster beds ▪ Active fishing area	Yes
ICW Bank 'Stabilization'	Hydraulic	Not Suitable (0%)	??%[3]	Yes	Yes	None	▪ Construction difficulty (long, narrow placement corridor) ▪ Containment needs along bank a major factor	No
Beach Placement – Quintana or Surfside	Hydraulic	100% (Suitable Mat'l Only)	Not Suitable (0%)	Yes	None	None	▪ Quality of sandy material	Yes
Beach Placement – DMPA "Seaway" Levee Protection	Hydraulic	Not Suitable (0%)	~ 150K CY (12%)	Yes	None	None	▪ Undertaking would most likely preclude driving on this section of beach ▪ Material would be sacrificial in nature, fines would be on beach for a long time	No
Upland Confined Placement DMPA "Seaway"	Hydraulic	Not Considered for Sandy Mat'l	~ 150K CY (12%)	No	Dike Raising Required	None	▪ Freeport LNG borrow pit not large enough to accommodate material without additional dike raising efforts ▪ Port Freeport prefers not to place material in this Port controlled DMPA	No
Upland Confined Placement DMPA "85"	Hydraulic	Not Considered for Sandy Mat'l	~ 0 CY (0%)	No	Dike Raising Required	None	▪ DMPA Capacity has been reached without significant dike raising	No
Upland Confined Placement DMPA "2 / 3"	Hydraulic	Not Considered for Sandy Mat'l	~ 0 CY (0%)	No	In Place	None	▪ Limited existing capacity is already designated for use (Freeport LNG)	No
Upland Confined Placement DMPA "86 / 87"	Hydraulic	Not Considered for Sandy Mat'l	~ 0 CY (0%)	No	In Place	None	▪ DMPA is designated for ICW maintenance material placement	No
Upland Confined Placement DMPA "88"	Hydraulic	Not Considered for Sandy Mat'l	~ 0 CY (0%)	No	In Place	None	▪ DMPA is designated for ICW maintenance material placement	No
Upland Confined Placement DMPA "7"	Hydraulic	Not Considered for Sandy Mat'l	~ 0 CY (0%)	No	In Place	None	▪ DMPA capacity has been reached ▪ Adjacent property restrictions do not allow expansion	No
Upland Confined Placement DMPA "1"	Hydraulic	Not Considered for Sandy Mat'l	~ 0 CY (0%)	No	In Place	None	▪ Limited existing capacity is already designated for use (Freeport LNG and Federal Channel Maintenance)	No

Figure II.1
Freeport Entrance & Jetty Channel Widening Project
Dredge Material Management Plan – Placement Evaluation Matrix

Placement Alternative	Dredge Methodology	Potential Capacity Silty-Sand Material[1]	Potential Capacity Clay Material[2]	Beneficial Use	Containment Requirements	Regulatory Requirements (Beyond 404/10 Permit)	Issues	Viable Alternative
Offshore Berm – Fish Habitat	Mechanical / Hydraulic	100% (Including Entrance Chnl)	100% (Including Entrance Chnl)	Yes (See Issues)	None	102/103	▪ The typical application of this concept is considered a Beneficial Use; however the project's application was not considered a true Beneficial Use through further analysis (i.e., concept is not similar to model concept in Mobile, AL. ▪ The same 'benefit' would occur with placement in the ODMDS, just in a different location (i.e., a location that has been used for dredge material placement in the past.	No
Offshore Berm – Wave Protection	Mechanical / Hydraulic	100% (Including Entrance Chnl)	100% (Including Entrance Chnl)	Yes (See Issues)	None	102/103	▪ The typical application of this concept is considered a Beneficial Use; however the project's application was not considered a Beneficial Use through further analysis.	No
Nearshore Berm – Beach Feeder Berm / Surf Break	Hydraulic	100% (Including Entrance Chnl)	Not Considered for Clayey Mat'l	Yes	None	102/103	▪ Sandy materials better suited for direct beach placement in this project's application.	No
ODMDS Placement	Mechanical / Hopper	100% (Including Entrance Chnl)	100% (Including Entrance Chnl)	No	None	102/103	▪ Designated ODMDS	**Yes**

[1] Based on preliminary analysis of geotechnical information, the quantity of silty-sand materials in the Jetty Channel is assumed to be approximately 300,000 cubic yards.
[2] Based on the overall quantity of material in the Jetty Channel with the aforementioned estimated quantity of silty-sand materials removed, the quantity of clay materials is assumed to be approximately 1,300,000 cubic yards (the remaining 1.6 MCY of material is located in the Entrance Channel.
[3] ICW 'Bank Stabilization' Capacity was not calculated because of the multiple factors that make this alternative non-viable.

Exhibit A-Permit Application

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

April 14, 2005 J200.40142

Mr. Dolan Dunn
USACE – Galveston District
P. O. Box 1229
Galveston, Texas 77553-1229

RE: PERMIT APPLICATION TO WIDEN PORTIONS OF FREEPORT HARBOR JETTY AND ENTRANCE CHANNEL USING NON-FEDERAL FUNDS

Dear Mr. Dunn:

I. EXECUTIVE SUMMARY

- **The Brazos River Harbor Navigation District of Brazoria County, Texas (also known as Port Freeport) is seeking a USACE Section 10/404 permit to widen portions of the Entrance and Jetty Channel of the Freeport Harbor Channel by up to 200 feet (from 400 feet up to 600 feet). The project depth will remain the same at 45 feet in the Jetty Channel and 47 feet in the Entrance Channel.**
- **The PURPOSE of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight operations only for larger vessels, and (c) restrictions that do not allow the larger vessels requiring waivers to enter port when winds exceed 20 knots or cross-currents exceed 0.5 knots.**
- **The project NEED is the elimination of the operational constraints to allow vessels to avoid delays, thereby reducing shipping costs and logistical problems.**
- **The goal is to have the widening complete during 2007.**
- **The applicant intends to seek federal assumption of maintenance if permitted and constructed as a non-federal improvement.**
- **The widening will generate approximately 2 million CY of uncontaminated material, predominantly clay/silty clay and sand/sandy silt. The material will be used for two beneficial purposes: (a) creation of an offshore berm to provide a topographic high with hard substance; and (b) beach nourishment.**
- **All work will be done in compliance with design standards applicable to federal projects in order to be consistent with any results from the ongoing, congressionally authorized federal feasibility study for widening and deepening all major segments of the Freeport Harbor Channel.**
- **Preliminary analyses of key issues have not identified any significant negative impacts or serious concerns. These include jetty stability, cultural resources, dredging, sediment quality, dredged material placement, water quality, endangered species, etc.**

Corporate Office: 555 N. Carancahua, Suite 1650 Corpus Christi, Texas 78478 Phone (361) 857-2211 Fax (361) 857-7234 E-mail: mail@shinermoseley.com
Houston: 3300 South Gessner, Suite 111 Houston, Texas 77063 Phone (713) 975-0033 Fax (713) 975-9515 E-mail: nmclellan@shinermoseley.com

II. EXISTING CONDITIONS

II.1 Existing Project Dimensions

The existing Freeport Harbor Channel consists of the following authorized components:

Entrance Channel	47 ft x 400 ft
Jetty Channel	47 ft x 400 ft
Lower Turning Basin	45 ft x 750 ft
Inside Channel	45 ft x width varies
Brazosport Turning Basin	45 ft x 1,000 ft
Upper Turning Basin	45 ft x 1,200 ft
Brazos Harbor Channel	36 ft x 200 ft
Brazos Harbor Turning Basin	36 ft x 750 ft

These channel reaches normally have an advance maintenance component and an overdredge allowance in addition to the authorized depths. The proposed widening will affect only the Entrance Channel and the Jetty Channel.

II.2 Operational Constraints Resulting from Existing Channel Dimensions

The widening will allow deep draft vessels to enter port under a broader range of environmental conditions than is possible in the 400-foot channel. At present, all deep draft vessels are limited to one-way traffic in the Freeport Channel. Vessels over 750 feet long or over 107 feet wide – which includes most crude oil and chemical tankers, the largest segment of Freeport traffic – are also limited to daylight transits. Vessels with beams over 145 feet are further limited and require waivers to enter port.

Port entry is further restricted by the effects of along-shore cross-currents, which vary in direction and velocity up to 3 knots. Depending on the ship's speed and the current's velocity, the Harbor Pilot must apply as much as 14 degrees of rudder "leeway" to counter the cross-current effects. That "crabbing" approach has the ship at an angle to the centerline of the channel as it approaches the jetties, which makes its effective width in the channel greater than the vessel's beam. A cross-current strong enough to restrict entrance for deep-draft vessels occurs approximately five percent of the time. For the largest vessels, entrance could be restricted as much as 25 to 30 percent of the time. The cross-current affects maneuverability as the vessel starts into the jetties and the effects are no longer uniform. Widening the channel would reduce the effects of cross-current by allowing for a wider beam aspect approaching the jetties and providing more room to maneuver in the Jetty Channel. Widening the channel would also allow longer vessels to enter Port Freeport, since the vessel's beam aspect is influenced by length as well as width and amount of leeway being held.

For the most part, the largest tankers currently able to call at the Seaway and ConocoPhillips terminals are AFRAMAX size – 75,000 to 110,000 deadweight tons

(DWT), with the largest on the order of 800 feet long and 138 feet wide. The terminal operators would like to be able to accommodate the larger SUEZMAX tankers – 110,000 to 150,000 DWT, with typical dimensions on the order of 900 feet long and 148 feet wide. Under current conditions, those larger vessels can enter the port only under ideal weather and sea conditions after undergoing the Port's waiver process. Widening the channel would substantially increase the operating window for those larger tankers. For many of the smaller deep draft vessels, widening would also allow for relaxation of the existing requirements for one-way traffic and daylight transits.

These substantial benefits for widening are reflected in the USACE's "Freeport Harbor, Texas, Navigation Improvement Reconnaissance Report Section 905(b) Analysis (October 2002)". That report states that widening will result in direct transportation cost savings for existing and future vessel and terminal operators in several ways. One of benefits of widening is decreased vessel downtime associated with the 'daylight hours only' transit restriction for vessels in excess of 750 feet in length. Another is decreased vessel downtime associated with one-way traffic restrictions for deep draft vessels – deep draft crude carriers represent the majority of the 3,000+ vessels calling annually. Reducing constraints based on the effects of along-shore cross-currents is another significant benefit stated in the report. Widening will also improve the potential for much larger vessels to enter port. The study notes that waivers have been granted for vessels up to 900 feet long and 160 feet wide, when wind is below 15 knots and cross-current is not more than one-half knot, and that numerous requests have been denied for ships 920 to 950 feet long.

Some benefits will also be achieved in the form of improved navigation safety as a result of the increased maneuvering room, especially between the jetties. Also, a widened channel will be less restrictive for other traffic during maintenance dredging and when the other improvements are initiated in the future.

II.3 Activity and Trends at Port Freeport

Total tonnage through the Port has steadily and consistently increased over the past ten years as indicated below. Crude oil represented approximately two-thirds of the total tonnage in 2003. Trends for 2004 and 2005 are consistent with the pattern shown by these statistics.

Cargo Through Port Freeport (thousand short tons)			
Year	Total	Year	Total
1994	17,450	1999	28,076
1995	19,662	2000	28,966
1996	24,571	2001	30,143
1997	26,281	2002	27,164
1998	29,014	2003	30,537

Given national and international trends, the growth over the last decade is expected to continue in the future. In addition to the growth in existing cargos, there are several

recent new initiatives in the area that will contribute to even more growth. These include the following:

- ***Container / General Cargo Diversification.*** The Port has initiated a major diversification effort aimed at a wide range of new cargos. This has included (a) a master planning project to assess potential uses for the Port's 8,000± acres, (b) permitting and design of the first phase of a modern container terminal, and (c) other initiatives.
- ***LNG Terminal.*** Freeport LNG recently received Federal Energy Regulatory Commission (FERC) and USACE approvals for an LNG terminal at Quintana. As currently permitted, the terminal will have one berth and a throughput capacity of 1.5 bcfd and will generate one ship call every 3 days. While no application for expansion has been filed, Freeport LNG has notified FERC that the plans for expansion include a second berth and additional storage.

Increased ship traffic resulting both from growth of existing business and from new business will increase the operational congestion on the existing system. The proposed widening of the Entrance Channel and Jetty Channel up to 600 feet will significantly lessen the congestion by removing most of the operational constraints.

II.4 Ongoing Federal Feasibility Study

The USACE, under the authority of Section 216 of the Flood Control Act of 1970 (P.L. 91-611), is currently conducting a feasibility study for widening and deepening the Freeport Harbor Channel. This study will evaluate the incremental widening and deepening of the project up to dimensions of 600 feet by 60 feet. The $5.4 million study is being jointly funded by the USACE and Port Freeport.

The timing of the feasibility study and subsequent authorization and appropriations are dependent upon the federal budget process. A current optimistic view indicates that the federal project could be online in the 2012 timeframe.

Local interests hope to have the widening permitted and constructed by late 2007. All design features of the improvements will be done in strict compliance with USACE design standards for federal projects to ensure compatibility.

III. THE CASE FOR CHANNEL EXPANSION

III.1 Introduction

There is a widely recognized need to expand the Freeport Harbor Channel. The 2002 USACE Reconnaissance Study (Freeport Harbor, Texas Navigation Improvement Reconnaissance Report, Section 905(b) Analysis) stated the need to improve the existing conditions.

> *"The existing conditions that give rise to the need for channel enlargements at Freeport Harbor are the existing channel dimensions, which are inadequate for the length and draft of many of the crude petroleum and chemical tankers operating at Freeport. As a result of channel constrictions, operational practices have been instituted that result in light loading and additional transit times at Freeport Harbor."*

The Port is keenly aware of the need to both widen and deepen the channel, which is being evaluated in the ongoing federal feasibility study. The Port, in cooperation with Port Users, has opted to pursue obtaining a permit to widen the Jetty Channel and Entrance Channel from 400 feet up to 600 feet in order to expedite the substantial benefits of widening, with a target completion date in 2007. This permit action should allow the widened channel to be in operation at least 5 years earlier than the proposed federal improvements.

The decision to expeditiously pursue the widening alone in lieu of the deepening is based on several factors; namely, widening will (a) relieve serious operational constraints, (b) benefit the largest number of shippers, and (c) be substantially less costly.

III.2 Purpose and Need

The purpose and need for the widening can be succinctly stated.

- The purpose of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight transit only of the larger vessels, and (c) restrictions that do not allow large ships requiring waivers to operate when winds exceed 20 knots or cross-currents exceed 0.5 knots.
- The project need is the elimination of the operational constraints, allowing vessels to avoid delays, thereby reduce shipping costs and logistical problems.

IV. RELATED ISSUES

Preliminary coordination with the USACE and resource agencies, prior studies of channel expansion, and discussions with users have identified a number of issues that merit attention when considering channel widening. Following is a brief discussion of the primary issues. In some cases, the applicant did a detailed study of the specific topic. These are available as appendices.

IV.1 Jetty Stability

There was concern that widening the channel by up to 200 feet might undermine the jetties and make them unstable. A study was commissioned that included obtaining additional soil borings and conducting a detailed engineering study of the jetty's stability for a widened channel. The study showed that the jetty stability would not be jeopardized by the proposed widening. That portion of the jetty channel beyond the beach that has a

full jetty can be widened to 600 feet without any risk to the jetty's stability. The inner portion that consists of a heavy revetment along the shoreline can be widened to 550 feet without any risk. Thus, that portion of the channel from station 0+00 to station 43+00 will be widened to 600 feet. Station 43+00 to station 38+00 will be a transition zone with the remaining distance to the Lower Turning Basin (station 38+00 to station 51+84) being widened to 550 feet (Geotechnical Study of Jetty Stability and Channel Widening Project, Freeport Ship Channel, Freeport, Texas; Fugro Consulting, April 2005).

IV.2 Beneficial Use of Dredged Material

The channel widening to 600 feet will generate approximately 2.8 million CY of new material. This is all virgin cut material and consists of 1.2 million CY of clay/silty clay and 0.8 million CY of sand/silty sand (Geotechnical Study of Jetty Stability and Channel Widening Project, Freeport Ship Channel, Freeport, Texas; Fugro Consulting, April 2005). These findings are consistent with prior USACE geotechnical investigations.

The primary beneficial use of the dredged material is to create a topographic high in the form of a berm. It will be built approximately 2.5 miles off the Quintana Beach in 40± feet of water. There is adequate dredged material to build a berm approximately 8,000 feet long by 2,000± feet wide including slopes, to a height of 15 feet.

The primary benefit of the berm will be to fisheries in the form of a topographic high and relatively hard substrate in an area that is very flat and has very soft bottom conditions. A second, and relatively minor, benefit is that the berm may offer some storm protection to a portion of the eroding Quintana Beach during a moderate hurricane.

The dredging is expected to produce approximately 300,000± CY of material that can be used for beach nourishment. To the extent that it can be economically recovered, it will be placed on the beach at Quintana. While not ideal for beach nourishment, approximately 300,000 CY of comparable virgin cut beach quality material was placed on Surfside Beach during the Freeport Harbor 45-Foot Project in the early 1990s with broad public acceptance.

Dredging will be done by pipeline dredge or a mix of pipeline and hopper dredges. Given the current status of the U.S. dredging industry, this flexibility is needed to get the best bid prices. It is likely that a pipeline dredge will be used in the Jetty Reach and a hopper dredge in the Entrance Reach; however, dredging contractors have indicated that a pipeline dredge might be used for both reaches.

IV.3 Cultural Resources

The primary area of potential concern is the 200-foot increment that the channel will be widened. A marine archeological investigation is currently underway. It has been coordinated with USACE archaeologists and is being done to meet applicable USACE standards. The results will be provided to the Galveston District when they are available.

IV.4 Threatened and Endangered Species

The primary endangered species of concern is sea turtles. Dredging protocols have been developed and agreed to for all USACE hopper dredging projects within the Freeport Channel. These same protocols will be applied to the non-federal widening.

IV.5 Water Quality

Sediment samples from borings were subjected to a range of chemical testing to applicable USACE and EPA protocols. The results were then reviewed against the applicable criteria with the results being that no contamination was found that exceeded screening criteria. Consequently, the material meets all criteria for open water placement or for beach nourishment. (Letter Report; PBS&J, Martin E. Arhelger, April 2005)

All reasonable efforts will be made to control sediment dispersion during construction of the berm. This will include (a) control of the dredging operations to maximize generation of clay balls and minimize liquid content, (b) placement of an outfall pipe with deflectors near the bottom, and (c) use of submerged silt curtains around the discharge location.

IV.6 Air Quality

The dredging and placement of approximately 2 million CY will be done over a 4-5 month period. Based on current technology, this will probably generate over 25 tons of NO_X and VOC, thus requiring a Conformity Analysis Review under the Clean Air Act. Once completed, the widening will eliminate significant ship waiting time and associated emissions.

An analysis is currently underway to determine the emissions during dredging and verify that a Conformity Analysis will be required. The same effort is also assessing the potential reduction in ship-related emissions that will result from a decrease in waiting time.

IV.7 Recreation

The Freeport Harbor Channel is widely recognized as a valuable recreational asset that provides small boat access to the Gulf, fishing from the jetties and shoreline, and the opportunity to watch ships from up close. The proposed widening should not negatively impact any of these uses. Potential recreational benefits include improved fishing on the offshore berm and expansion of eroding beaches due to beach nourishment.

IV.8 Cumulative Impacts

The proposed widening is not expected to generate an increase in total ship traffic calling at Freeport. Rather, the widening will remove existing operating constraints, thereby

increasing the efficiency of existing operations. Thus, the widening should have no cumulative impacts.

V. CLOSING

Attached you will find a completed application (USACE form 4345), permit drawings (eight sheets), and supporting information.

We are submitting this application on behalf of the applicant, the Brazos River Harbor Navigation District of Brazoria County, Texas, as authorized on page 1 of the application form.

We are requesting that you review this application package as expeditiously as practical. Please contact the undersigned if you need any clarification or additional information.

Sincerely,

SHINER MOSELEY AND ASSOCIATES, INC.

Thomas B. Rodino

Captain Thomas B. Rodino (USCG Retired)
Senior Maritime Consultant

Joe C. Moseley

Joe C. Moseley, Ph.D., P.E.
Principal

JCM/dd

Enclosures

cc with Enclosures: Brazos River Harbor Navigation District (David Knuckey, P.E.)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT *(33 CFR 325)*	OMB APPROVAL NO. 0710-0003 Expires December 31, 2004

The public reporting burden for this collection of information is estimated to average 10 hours per response, although the majority of applications should require 5 hours or less. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington DC 20503. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies. Submission of requested information is voluntary, however, if information is not provided, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME Brazos River Harbor Navigation District	8. AUTHORIZED AGENT'S NAME AND TITLE *(an agent is not required)* Joe C. Moseley, Ph.D., P.E., Vice President
6. APPLICANT'S ADDRESS P.O. Box 615 Freeport, TX 77542-0615	9. AGENT'S ADDRESS Shiner Moseley and Associates, Inc 555 N. Carancahua, Suite 1650 Corpus Christi, Texas 78478
7. APPLICANT'S PHONE NUMBERS WITH AREA CODE a. Residence b. Business 979-233-2667, ext. 4257	10. AGENT'S PHONE NUMBERS WITH AREA CODE a. Residence b. Business 361-857-2211

11. **STATEMENT OF AUTHORIZATION**

I hereby authorize Shiner Moseley and Associates, Inc. to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE **(David M. Knuckey, P.E.)** — DATE 4/14/05

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE *(see instructions)*
Widening of the Freeport Ship Harbor Jetty and Entrance Channel

13. NAME OF WATERBODY, IF KNOWN *(if applicable)* Gulf of Mexico	14. PROJECT STREET ADDRESS *(if applicable)* N/A
15. LOCATION OF PROJECT Brazoria (COUNTY) — Texas (STATE)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN *(see instructions)*
N/A

17. DIRECTIONS TO THE SITE

Proceed south from Lake Jackson on SH 332; cross the Gulf Intracoastal Waterway. Turn right at stop light and proceed to end of street that dead-ends at the Ship Channel.

18. Nature of Activity *(Description of project, include all features)*

- Dredge channel to a maximum bottom width of 600 ft from the Lower Turning Basin to the -51 ft contour, a distance of approximately 4.8 miles.
- Dredging will be performed primarily with pipeline dredge; with the possible use of some hopper dredge.

19. Project Purpose *(Describe the reason of purpose of the project, see instructions)*

The purpose of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight operations only for larger vessels, and (c) restrictions that do not allow large vessels requiring waivers to enter port when winds exceed 20 knots or cross-currents exceed 0.5 knots.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Provide beneficial uses: (a) create a berm to provide a topographic high and hard substrate (for habitat and beach protection) and (b) put sand on beach for beach nourishment.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

Clay / silty clay ..... 1,200,000 CY
Sand / sandy silt ..... 800,000 CY
Total ..... 2,000,000 CY

22. Surface Area in Acres of Wetlands or Other Waters Filled *(see instructions)*

(a) Offshore berm ..... < 370 acres (including slopes)
(b) Beach nourishment..... < 10 acres of new beach area at initial equilibrium

23. Is Any Portion of the Work Already Complete? Yes ☐ No ☒ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

See Sheet 8 of attached permit drawings.

25. List of Other Certifications or Approvals/Denials Received from other Federal, State, or Local Agencies for Work Described in This Application

AGENCY	TYPE APPROVAL *	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building and flood plain permits

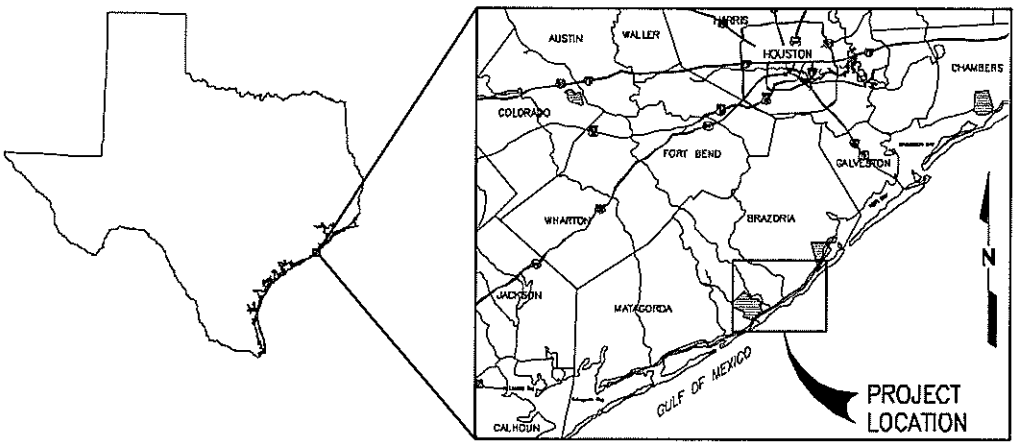
26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

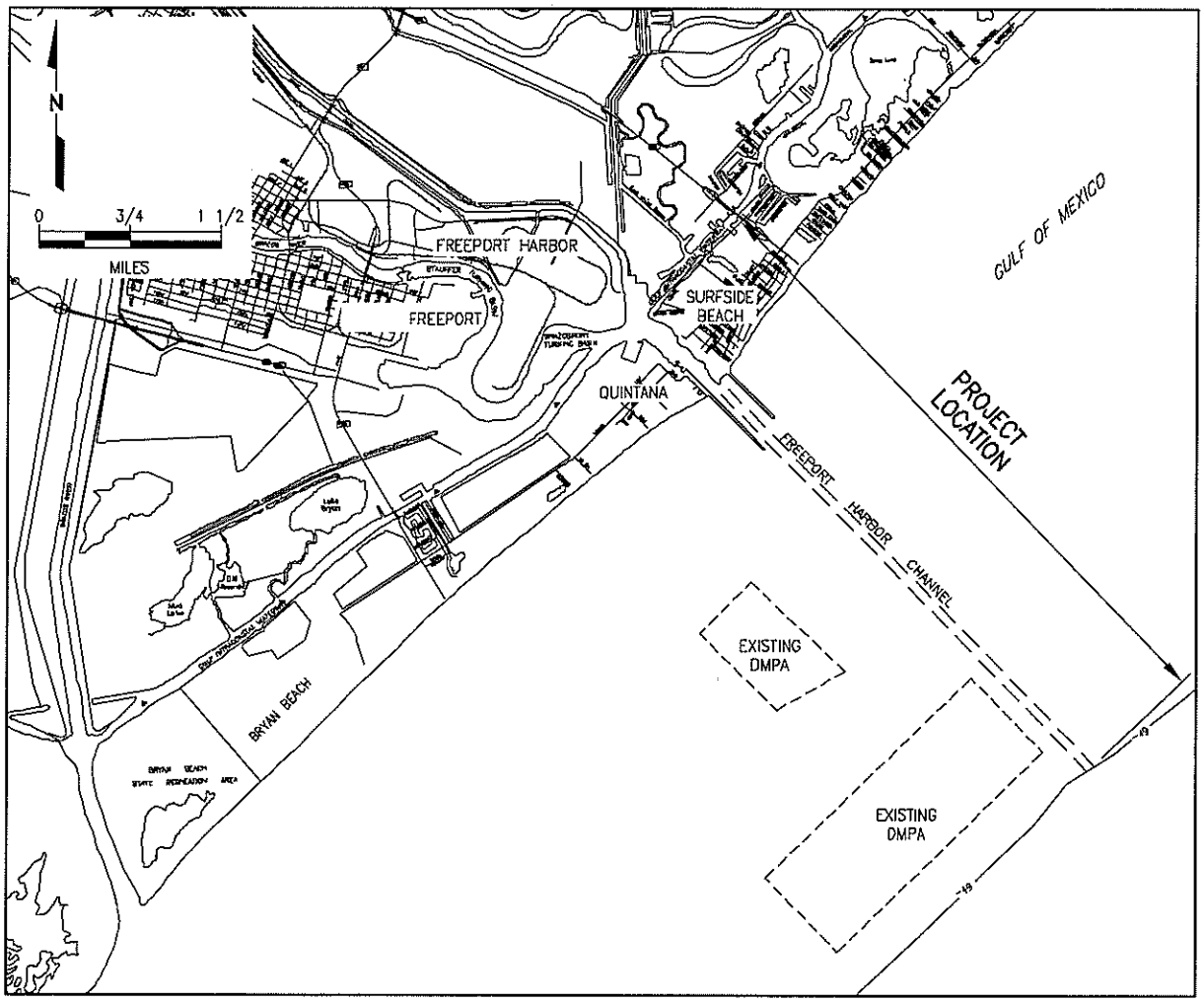
N/A	N/A	Joe C Moseley	4/14/05
SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT – Shiner Moseley	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in Block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States, knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a materiel fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

PROJECT LOCATION





P • O • R • T
FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

PROJECT No: 200.40142.00 | SHEET 1 of 8

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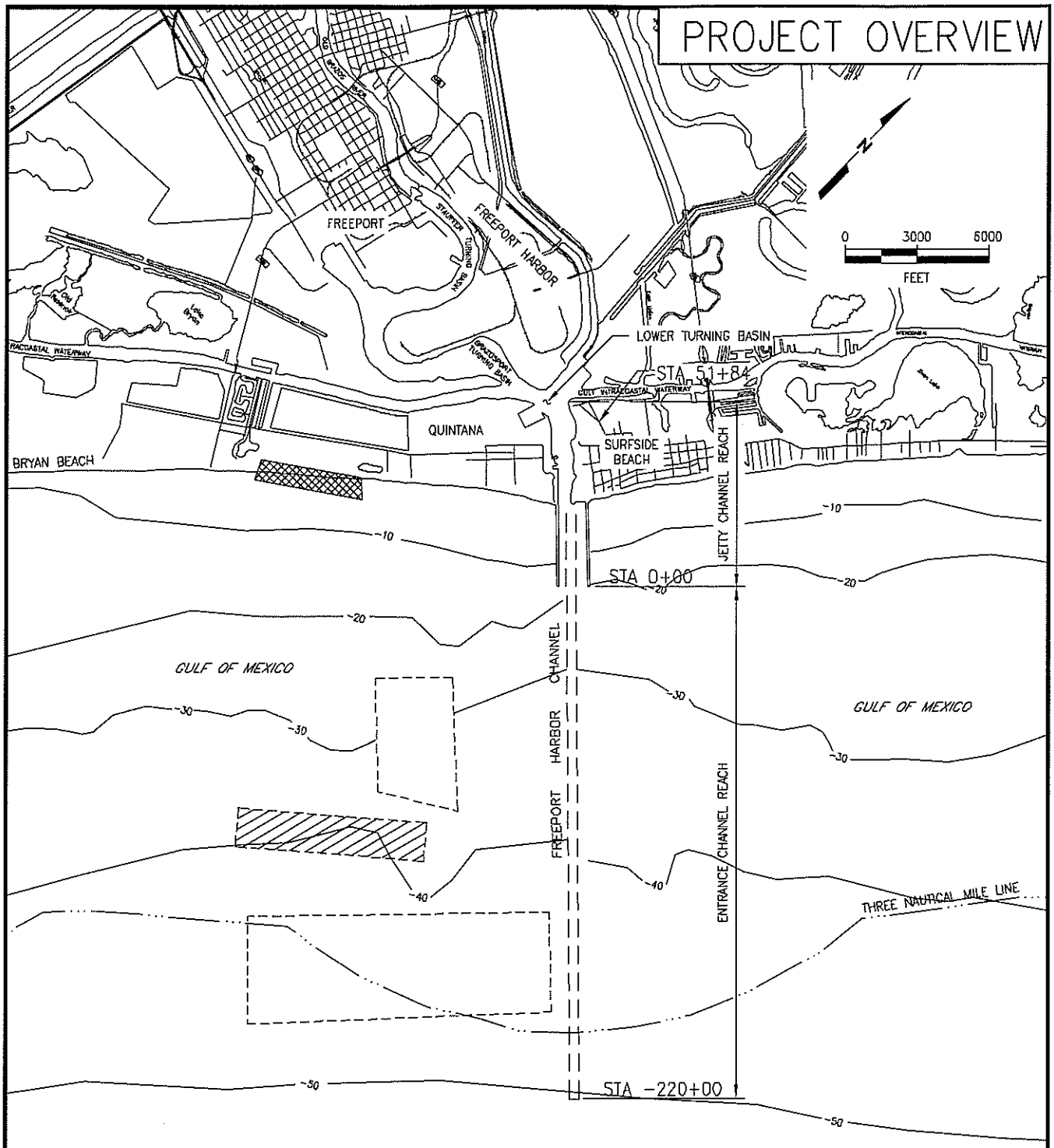
PROJECT OVERVIEW



LEGEND:

- PROPOSED NEW BENEFICIAL USE AREA: BERM FOR HABITAT
- PROPOSED BEACH NOURISHMENT AS BENEFICIAL USE
- EXISTING USACE DMPA

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA		
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00 / SHEET 2 of 8

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

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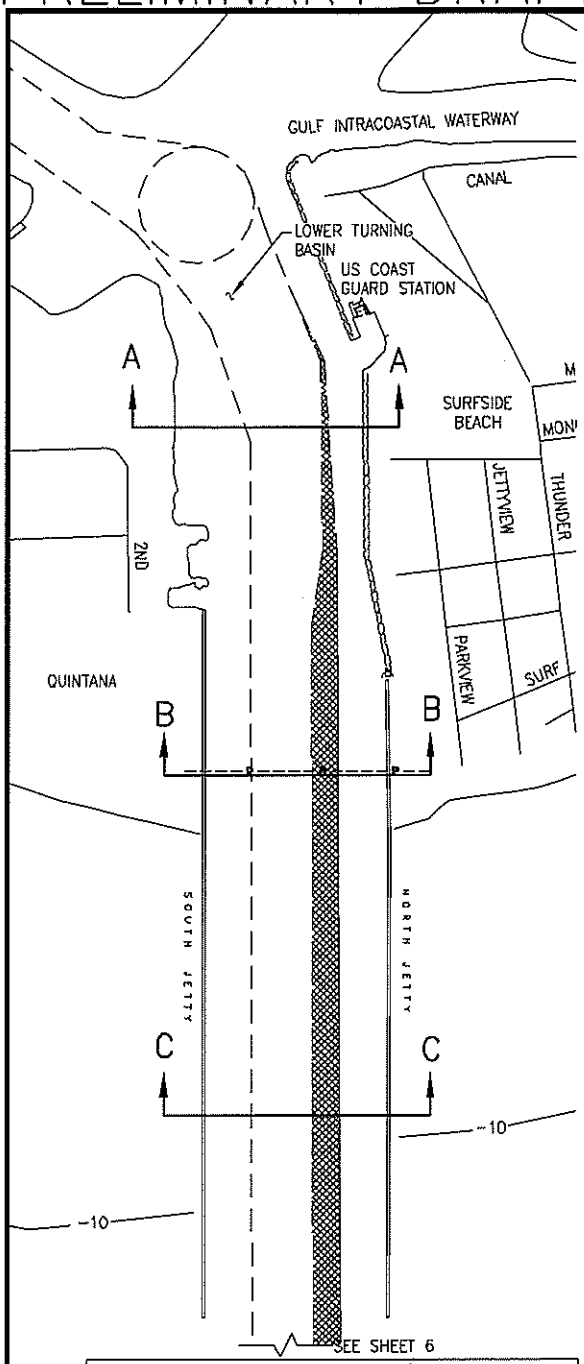
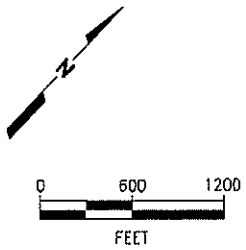
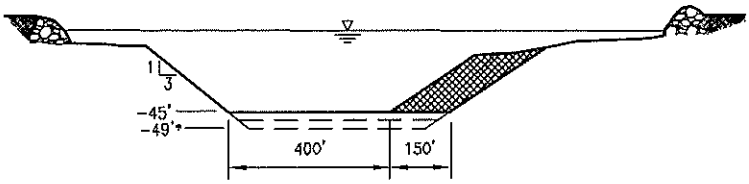
PRELIMINARY DRAFT

JETTY CHANNEL REACH

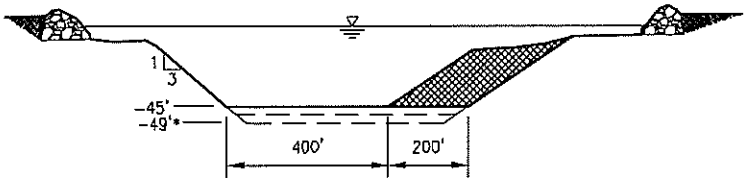




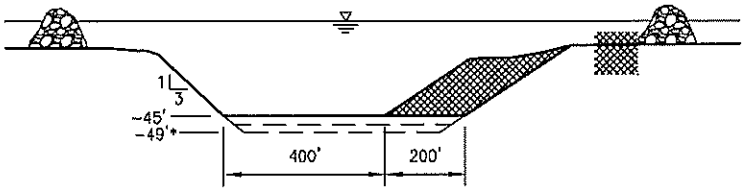
PROPOSED DREDGE INCREMENT



SECTION A–A



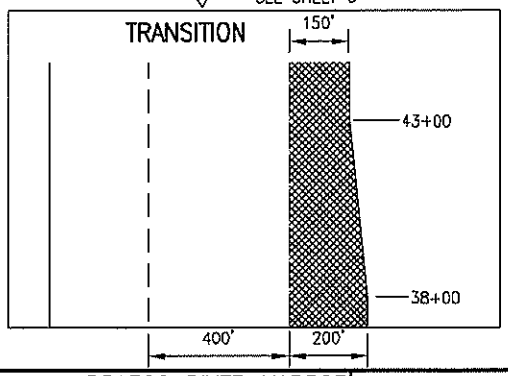
SECTION B–B



SECTION C–C

NOTES:

* INCLUDES 2' OF MAINTENANCE PLUS 2' OF OVERDREDGE



P • O • R • T
FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT

COUNTY: BRAZORIA

PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 3 of 8

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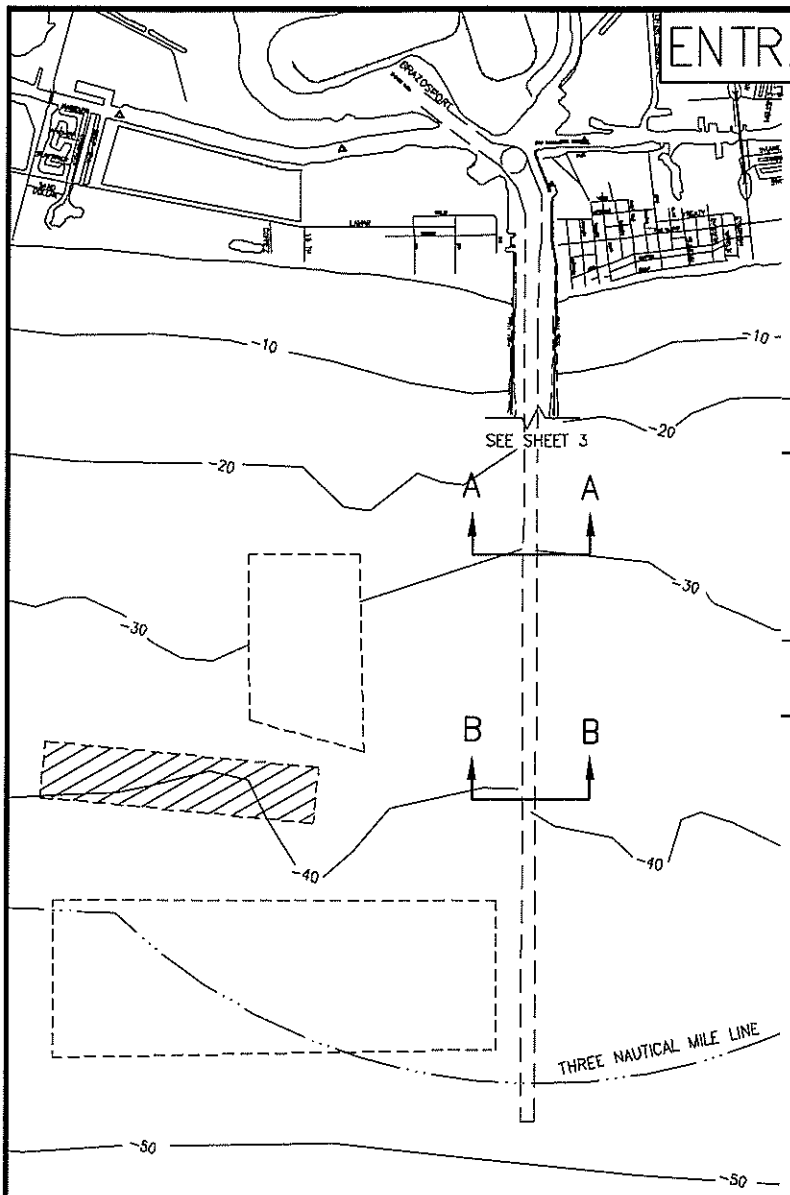
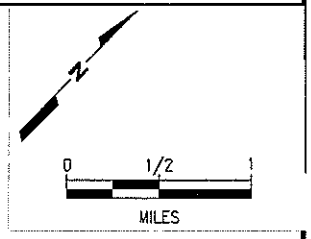
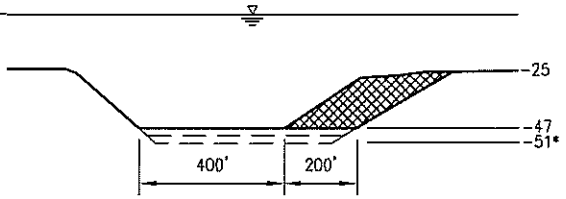
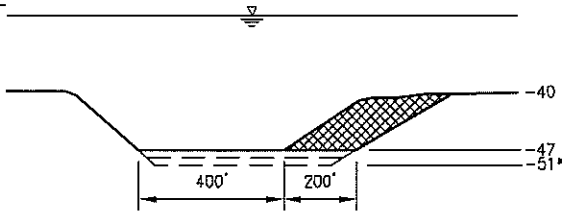
ENTRANCE CHANNEL REACH







SECTION A–A



SECTION B–B

NOTES:

* INCLUDES 2' OF MAINTENANCE PLUS 2' OF OVERDREDGE

LEGEND:

- PROPOSED DREDGE INCREMENT
- PROPOSED NEW BENEFICIAL USE AREA: BERM FOR HABITAT
- PROPOSED BEACH NOURISHMENT AS BENEFICIAL USE (SEE SHEET 7)
- EXISTING USACE DMPA

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 4 of 8

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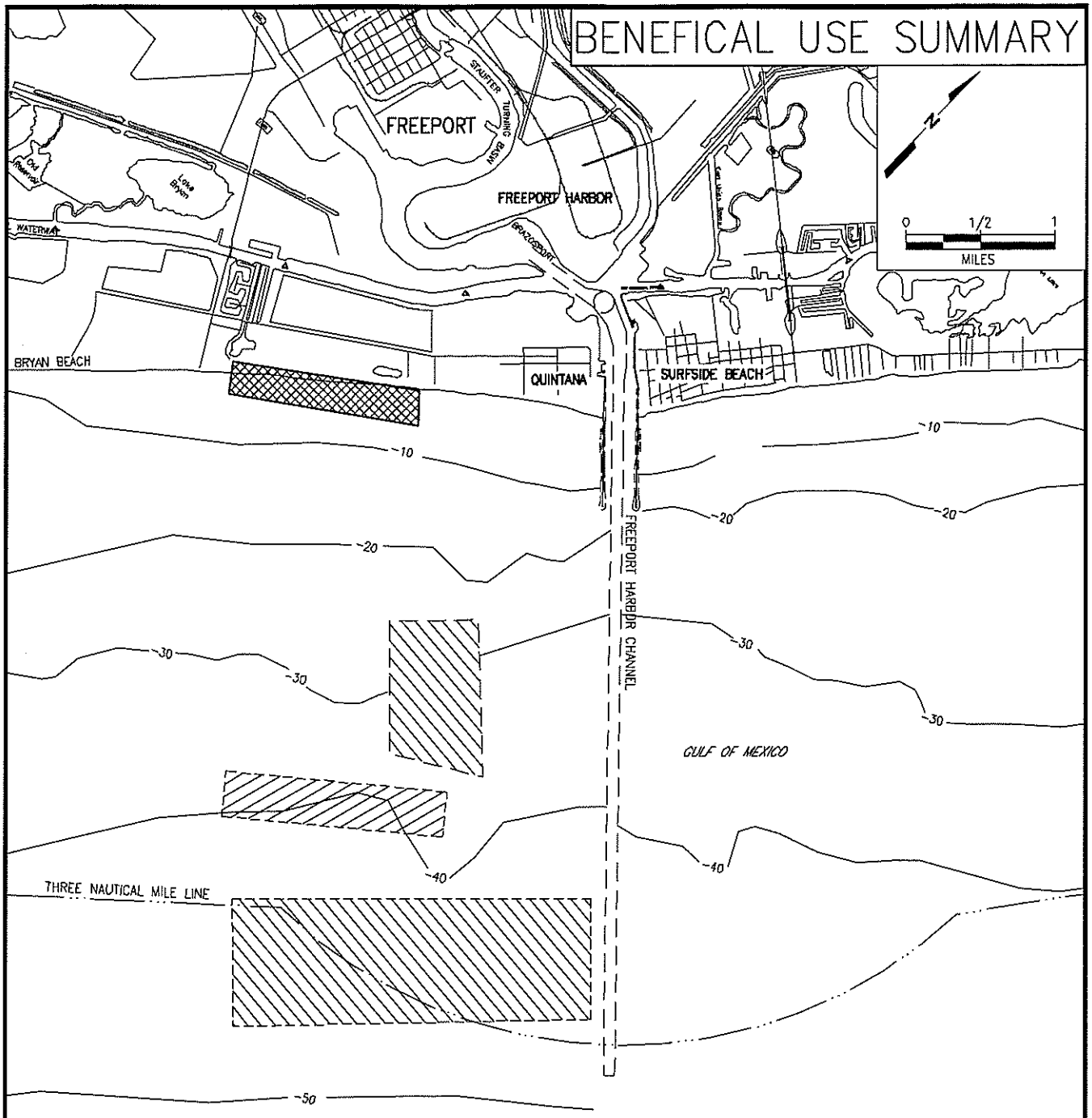
BENEFICAL USE SUMMARY



NOTES:

OFFSHORE BENEFICIAL USE AREA. CONSTRUCT A BERM OF TO PROVIDE HARD SUBSTRATE AND TO OFFER LIMITED BEACH PROTECTION. SEE SHEET 6 OF 8.

BEACH QUALITY MATERIAL, IF FOUND IN ECONOMICALLY RECOVERABLE QUANTITIES, WILL BE USED AS BEACH NOURISHMENT FOR SURFSIDE BEACH. SEE SHEET 7

EXISTING USACE DMPA

P • O • R • T FREEPORT

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PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00	SHEET 5 of 8

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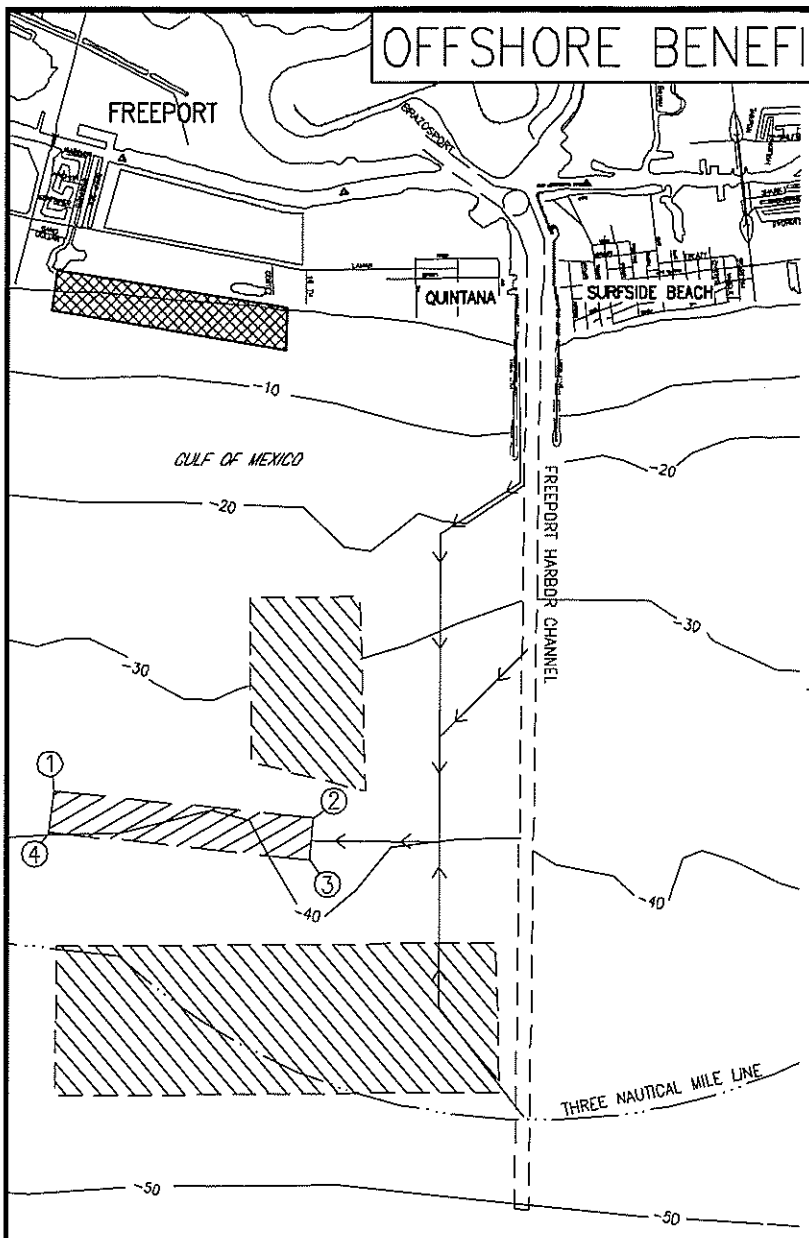
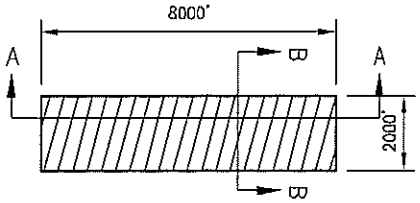
OFFSHORE BENEFICAL USE AREA–BERM





PLAN

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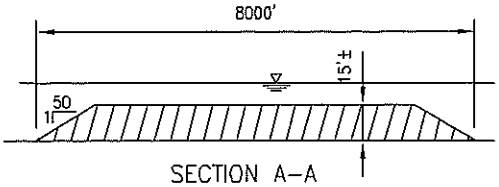
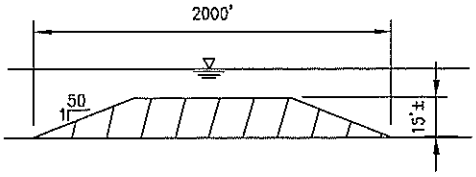


SECTION A–A

SCALE: NONE



SECTION B–B

SCALE: NONE

NOTES:

LEGEND

- PROPSED BEACH NOURISHMENT
- PROPOSED OFFSHORE BENEFICIAL USE AREA
- ① N28°53'05" W95°15'12"
- ② N28°53'54" W95°17'01"
- ③ N28°53'37" W95°16'48"
- ④ N28°52'48" W95°17'59"
- EXISTING USAGE OFFSHORE PLACEMENT AREAS
- PIPELINE ROUTING (TYPICAL)

N

0 1/2 1
MILES

P O R T
FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA		
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL			
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	PROJECT No: 200.40142.00 / SHEET 6 of 8

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
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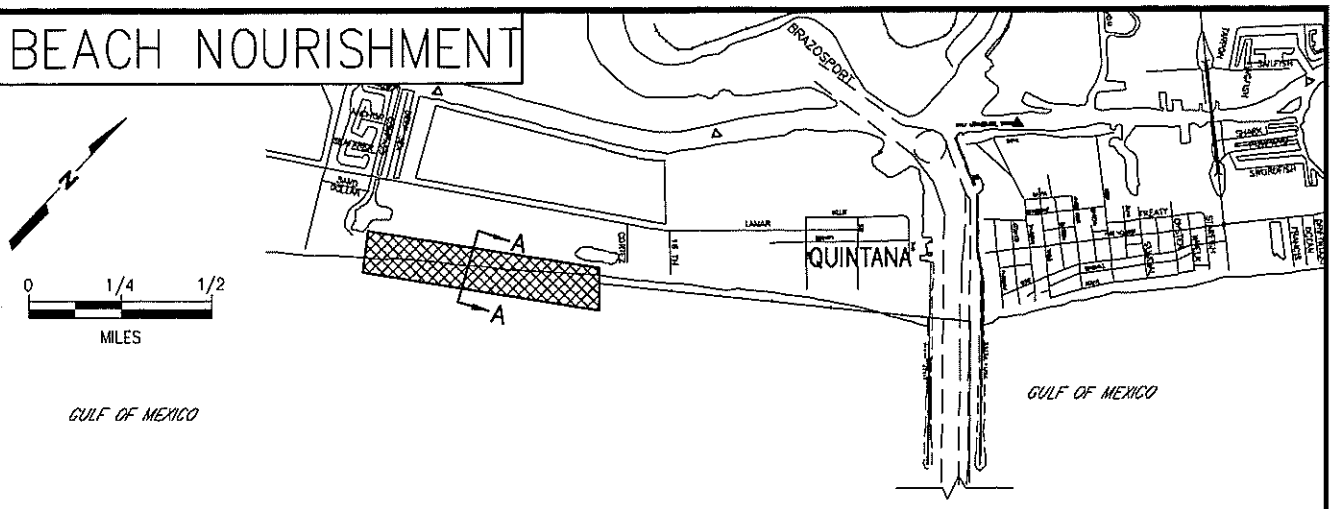
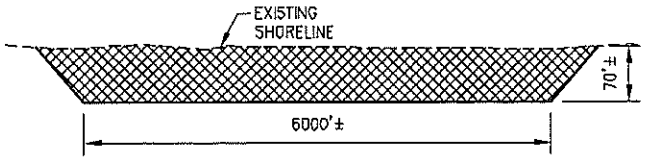
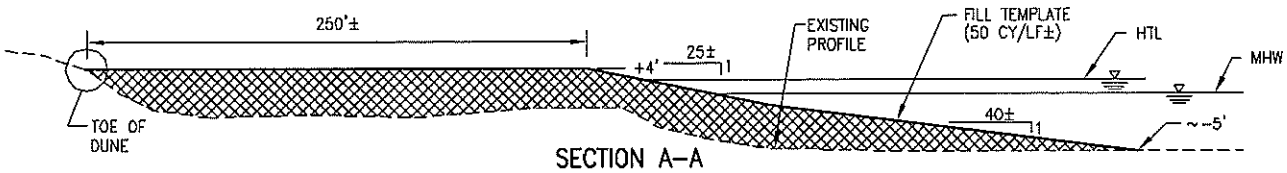
BEACH NOURISHMENT



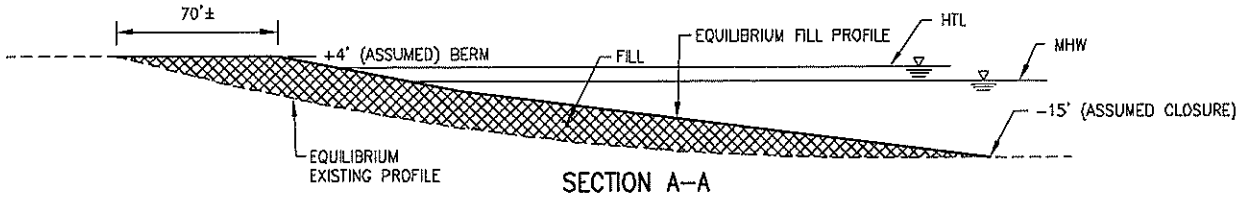


PLAN VIEW AT INITIAL EQUILIBRIUM

(MATERIAL MAY BE PLACED AT ONE OR BOTH LOCATIONS)



SECTION A–A
INITIAL PLACEMENT



SECTION A–A
AT INITIAL EQUILIBRIUM

NOTES:

1. MHW = 3.28 MLT; HTL = 5.01 MLT
2. BEACH FILL LENGTH WILL DEPEND ON THE AMOUNT OF RECOVERABLE BEACH QUALITY MATERIAL; 300,000 CY WOULD CONSTRUCT APPROXIMATELY 6000 LF OF BEACH AT A FILL TEMPLATE OF 50 CY/LF. THIS WOULD CREATE APPROXIMATELY 9± ACRES OF BEACH AREA AT INITIAL EQUILIBRIUM.

LEGEND

PROPOSED BEACH NOURISHMENT

PIPELINE ROUTING (TYPICAL)

P O R T FREEPORT

FOR COE USE ONLY

Permit Application No.:

APPLICANT: BRAZOS RIVER HARBOR NAVIGATION DISTRICT	COUNTY: BRAZORIA	
PURPOSE: WIDEN EXISTING ENTRANCE AND JETTY CHANNEL		
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT

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ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

PROJECT No: 200.40142.00 | SHEET 7 of 8

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ADJACENT PROPERTY OWNERS

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FOR COE USE ONLY

Permit Application No.:_____

APPLICANT: PORT OF FREEPORT	COUNTY: BRAZORIA		
PURPOSE: WIDEN EXISTING SHIP CHANNEL			
DATE: 4/15/05	REV. DATE:	DATUM: USACE MLT	

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478

PROJECT No: 200.40142.00 | SHEET 8 of 8

Exhibit B-Habitat Assessment

HABITAT ASSESSMENT OF POTENTIAL DREDGED MATERIAL PLACEMENT SITES
FREEPORT SHIP CHANNEL WIDENING PROJECT
FREEPORT, TEXAS

Background

Future widening of the Freeport Ship Channel will necessitate the disposal of approximately 3 million cubic yards (MCY) of dredged material. Prior to consideration of the disposal of this material into a designated Ocean Dredged Material Disposal Site (ODMDS), identification and assessment of other potential beneficial use (BU) areas and upland confined placement alternatives must be considered.

During a Dredged Material Management Plan (DMMP) workshop in December 2005, three potential BU areas were identified in addition to previously-identified offshore sites:

1. Swan Lake
2. 332 Bridge
3. Bryan Lake

These areas were targeted due to their significant size and potential open water capacity. During a follow-up meeting in January 2006 and a subsequent desktop investigation and field visit, the consensus of the resource agencies was that Swan Lake could be removed as a viable beneficial use area due to the significant presence of oysters and fishing activities. However, resource agencies requested that a habitat assessment be conducted for the 332 Bridge and Bryan Lake marsh areas. The following presents the results of the habitat assessment.

Habitat Assessment

A habitat assessment was conducted of two potential BU sites, 332 Bridge and Bryan Lake, in the Freeport, Texas area by Kim Halbrook and Chemaine Sahadi of HDR/SMA and Kathy Calnan of PBS&J on January 23, 2006. Chemaine is the primary author of this Habitat Assessment. These sites were surveyed for potential marsh restoration/creation opportunities. The habitat assessment considered the following factors:

(1) Approximate acreage of open water that could be elevated for low marsh plant growth;
(2) Approximate acreage of high marsh and how it is located relative to the low marsh;
(3) Presence of oysters; and
(4) Marsh restoration/creation potential

The following is a brief description of each site and a summary of habitat assessment results.

332 Bridge

The 332 Bridge site is located approximately one mile northeast of the Freeport Jetty Channel (Exhibit 1). Photographs of the site taken during the January 23rd site visit are provided in Exhibit 2. This 328 acre site is comprised of four potential BU areas including a four acre area located at the northern corner of the site, a four acre area located at the eastern corner of the site, a 12 acre area located just south of Hwy 332 near the western extent of the site, and a 42 acre area located at the southern corner of the site (Exhibit 1). A fifth potential BU area was identified and considered as well; this area is approximately 14 acres in size and is located adjacent to the 12 acre area described above.

The January 23rd site visit revealed that approximately 132 acres of the 328 acre site is low marsh and consists of characteristic wetland vegetation including *Spartina alterniflora*, *Distichilis spicata*, *Batis maritima*, and *Salicornia virginica*. Also observed within the low marsh habitat were vegetated flats consisting mostly of *Monanthochloe littoralis* and *Salicornia virginica*. Open water areas that could be elevated for low marsh plant growth occupy approximately 76 acres of the site. Open water areas at the site appear to be tidally connected via a natural channel that connects to an existing drainage canal at both the northwestern and southwestern ends of the site (Exhibit 1). Approximately 7 acres of the 328 acre site contain oyster beds. A test pit sample at the 328 acre site revealed a low chroma silty clay soil, which is indicative of hydric soils.

The northern four acre area is an open water pond which is connected to adjacent water bodies via the natural channel. The pond is surrounded by functional low salt marsh habitat consisting mostly of *Spartina alterniflora*. This low marsh transitions into high salt marsh and vegetated flats to the south. The water in the pond is approximately 1-1.5 ft. deep at this location. No evidence of oysters was observed (Exhibit 1). During the site visit, several waterfowl species, including Reddish Egrets, Griebs, and Great Egrets, were observed utilizing this area.

The eastern four acre area is located adjacent to Hwy 332 and due to low tide, was not inundated during the site visit. This area is also surrounded by functional low marsh habitat consisting mostly of *Spartina alterniflora*. Several oyster beds, with an approximate total acreage of 0.1 acres, were observed fringing the perimeter of the area (Exhibit 1). Approximately 60% oyster coverage was observed within the 0.1 acre area. The natural channel also provides tidal influence to this location.

The 12 acre area is located adjacent to an upland area containing a Texaco Station and a fish market. The area consists of functional estuarine low marsh habitat and an open water area approximately 1-1.5 ft. in depth. The area also contains several oyster beds with an approximate total acreage of 0.3 acres and an estimated percent coverage of 60%. Oyster beds were also located along an existing channel adjacent to the 12 acre area. Oyster beds within this channel have an approximate total acreage of 0.6 acres with an estimated percent coverage of 60% (Exhibit 1). Conversations with Mr. Kurt Evans, owner of the Texaco Station, revealed that historically most of the 12 acre area consisted

of low marsh habitat with little open water. Over time, it appears that subsidence has caused a transition from a dominant low marsh habitat to a more open water habitat with functional fringing low marsh. Mr. Evans also presented an historical aerial photo of the area, dated early 1980s, that showed low marsh habitat extending approximately 10-15 ft. from the upland area with little open water.

The 42 acre area consists mostly of open water with a few fringing low marsh areas along its western boundary (Exhibit 1). Several oyster reefs, with an approximate total acreage of 6 acres, were observed along the western boundary of the 42 acre area (where the natural channel flows through this location) and also in several locations within the middle of the water body (Exhibit 1). It should also be noted that small scattered oyster clumps were appeared to be located in other parts of the area. Approximately 30% oyster coverage was observed within the 6 acre area. Water depths during the site visit were approximately 2-2.5 ft. Mr. Evans stated that historically, the 42 acre area contained more of a low marsh habitat but that over time subsidence had transitioned the area to open water. He estimated that 60% of the existing open water areas were marsh 30 years ago. He also stated that this area was frequently used for fishing.

The 14 acre area consists entirely of open water with fringing low marsh along its eastern, northern and western boundaries and the drainage canal along its western boundary, with a large opening into the canal. Based on conversations with Mr. Evans this area was excavated for fill material approximately 40 to 50 years ago. The water depth in this area is roughly 5-6 ft. on average with a soft bottom. Mr. Evans also stated that this area is an extremely popular recreational fishing area with a typical abundance of trout, redfish and flounder being caught.

Marsh Restoration/Creation Potential at 332 Bridge Site:

Both the northern and eastern 4 acre sites are surrounded by healthy functional marsh and do not have the capacity to receive a substantial quantity of dredged material from the project (approximately 3,200,000 CY total and 300,000 CY of silty sand material from the jetty channel). Water depths at these locations are shallow (1-1.5 ft at northern 4 acre site; 0-1 ft. at eastern 4 acre site) and site acreages are too small to utilize a significant amount of dredged material for marsh restoration. In addition, the shallow open water of these sites provides diversity within the entire existing low marsh complex and infilling would likely reduce rather than improve the habitat quality.

The 12 acre area also appears to be a healthy functional marsh consisting of low marsh habitat interspersed with shallow open water areas. In our opinion, it appears that this area may not benefit from additional dredged material to raise elevations for low marsh vegetation growth. The 12 acre open water area also provides circulation, habitat diversity and contains several oyster beds that would most likely be displaced should dredged material be placed in this area.

Of the potential BUs at the 332 Bridge site, the 42 acre area and the 14 acre area appear to have the most potential for marsh creation / restoration. The 42 acre area is almost entirely open water with water depths of 2-2.5 ft; however a deeper water natural channel is still apparent on the aerial photo. If many of the oyster beds correspond to the edges of

this 'channel', dredged material may be strategically placed to avoid them. The goal of dredged material placement would be to raise elevations to a water depth (1-1.5 ft) that would be suitable for low marsh vegetation such as *Spartina alterniflora* establishment. Although there are several oyster beds within the 42 acre area, they are found mostly on the western fringe and are distributed sparsely within the main water body. The 14 acre area is open water with depths of 5-6 ft. If dredged material is placed to raise the elevation to 1-1.5 ft., low marsh vegetation would likely establish. The primary drawback of filling this area would be the loss of recreational fishing grounds. Should these potential BU areas be utilized, well-controlled placement of the dredged material, maintenance and/or creation of tidal conveyances, and containment measures to prevent material from entering the drainage canal would be needed.

Bryan Lake

The Bryan Lake site is located approximately three miles west of the Freeport Jetty Channel (Exhibit 3). Photographs of the site taken during the January 23rd site visit are provided in Exhibit 2. The roughly 913 acre site is comprised of three potential BU areas including a 100 acre area, 30 acre area, and 50 acre area. The 30 acre and 100 acre areas are located just east of the Bryan Mound Strategic Petroleum Reserve facility. The 50 acre area is located east of the 100 and 30 acre areas.

The January 23rd site visit revealed that approximately 660 acres of the 913 acre site is low estuarine marsh and consists of characteristic wetland vegetation including *Spartina alterniflora, Bolboschoenus robustus, Distichilis spicata, Batis maritima*, and *Salicornia virginica. Spartina alterniflora* mainly fringes the perimeter of the marsh. In some areas, *Bolboschoenus robustus* is found growing immediately landward of *Spartina alterniflora.* High marsh habitat consisted mostly of *Iva frutescens* which fringed the perimeter of the marsh just landward of *Spartina alterniflora* and *Bolboschoenus robustus*. Open water areas that could be elevated for low marsh plant growth occupy approximately 180 acres of the site. The 100 acre and 30 acre sites appear to be tidally connected to the Gulf Intracoastal Waterway (GIWW). Approximately 6 acres of the site contains oyster beds.

The 100 acre area can be characterized as open water. A natural channel connects the 100 acre area with the 30 acre area and the GIWW. Low marsh habitat surrounds the 100 acre area and several oyster beds were observed fringing the shoreline on the northern section of the water body. Scattered oyster beds, with an approximate total acreage of 5.8 acres were also observed within the main water body and along connecting channels at this location. Approximate percent coverage of oysters within the 5.8 acre area is estimated at 70%. Water elevations at this location were approximately 1-1.5 ft. During the site visit, several waterfowl, including Great Egrets and Roseate Spoonbills, were observed utilizing this area.

The 30 acre area is tidally connected to the 100 acre area and the GIWW via a natural channel. Low marsh habitat surrounds the perimeter of this area and evidence of oyster beds was observed. Approximately 0.2 acres of oyster beds were located within the 30 acre area with an estimated percent coverage of 60%. Several waterfowl species, including a flock of Roseate Spoonbills, were seen utilizing this area. Water depths at this location are approximately 1-1.5 ft, on an average tide.

The 50 acre area, located east of the other two sites, is also surrounded by low marsh habitat. A natural channel connects this area to the GIWW and water depth at this location is less than 1 ft. A small oyster bed was observed at the mouth of the natural channel, with an approximate acreage of 0.4 acres and an estimated percent coverage of 50%. Several waterfowl species were also seen utilizing this site.

Marsh Restoration/Creation Potential at Bryan Lake:

The three open water areas at Bryan Lake are not well suited as viable BUs. All three water bodies are shallow (1.5 ft or less) and contain oysters. The surrounding low marsh habitat is healthy and functional and the area does not appear to require additional dredged material to raise elevations for low marsh vegetation growth. In addition, the shallow open water of these sites provides diversity within the entire existing low marsh complex. This area also appears to be frequently utilized by waterfowl for foraging and loafing.

Conclusion and Recommendations

It is our opinion that of the sites reviewed during the January 23rd site visit, only the 42 acre area and the 14 acre area located within the 332 Bridge site should be considered potentially viable BU options for the placement of dredged material. Although these areas are considered potentially viable for this purpose, it must be reiterated that filling of these areas to create low marsh vegetation grounds will negatively impact some functioning oyster beds as well as popular and functioning recreational fishing grounds.

HDR | SHINER MOSELEY AND ASSOCIATES, INC.

SMA JOB NO.: 200.50170

PORT OF FREEPORT	POTENTIAL BU AREAS
FREEPORT CHANNEL WIDENING	EXHIBIT 1

View looking northwest of low marsh and open water habitat at the 332 Bridge Site. An existing levee can be seen in the background (01/22/06).

View looking north of open water habitat at the 332 Bridge site. The northern 4 acre area can be seen in distance (01/22/06).

Close-up view of typical existing low marsh habitat at the 332 Bridge Site (01/22/06).

View looking northwest of low marsh habitat (in the foreground) and high marsh habitat (n the background) . High marsh habitat (i.e. vegetated flats) can be recognized by their darker color. (01/22/06)

View looking northeast of northern 4 acre area (01/22/06).

View looking northwest of northern 4 acre area (01/22/06).

View looking southeast of 12 acre area (01/22/06).

Closer view of 12 acre area looking southwest (01/22/06).

View looking southwest of 12 acre tract (01/22/06).

View looking south of 42 acre area. Oyster reefs can be seen scattered throughout this location (01/22/06).

Close-up view looking east of 42 acre area (01/22/06).

View looking east of eastern 4 acre area. This area was not inundated during the January 22nd site visit (01/22/06).

Closer view of eastern 4 acre site looking northeast (01/22/06).

View looking southeast of 100 acre area at the Bryan Lake Site. Note the oyster reefs located within the main waterbody (01/22/06).

View looking east along eastern channel of 100 acre area. Note oyster beds fringing the shoreline (01/22/06).

View looking east along eastern shoreline of the 100 acre area (01/22/06).

View looking southwest of oyster beds located within the 100 acre area (01/22/06).

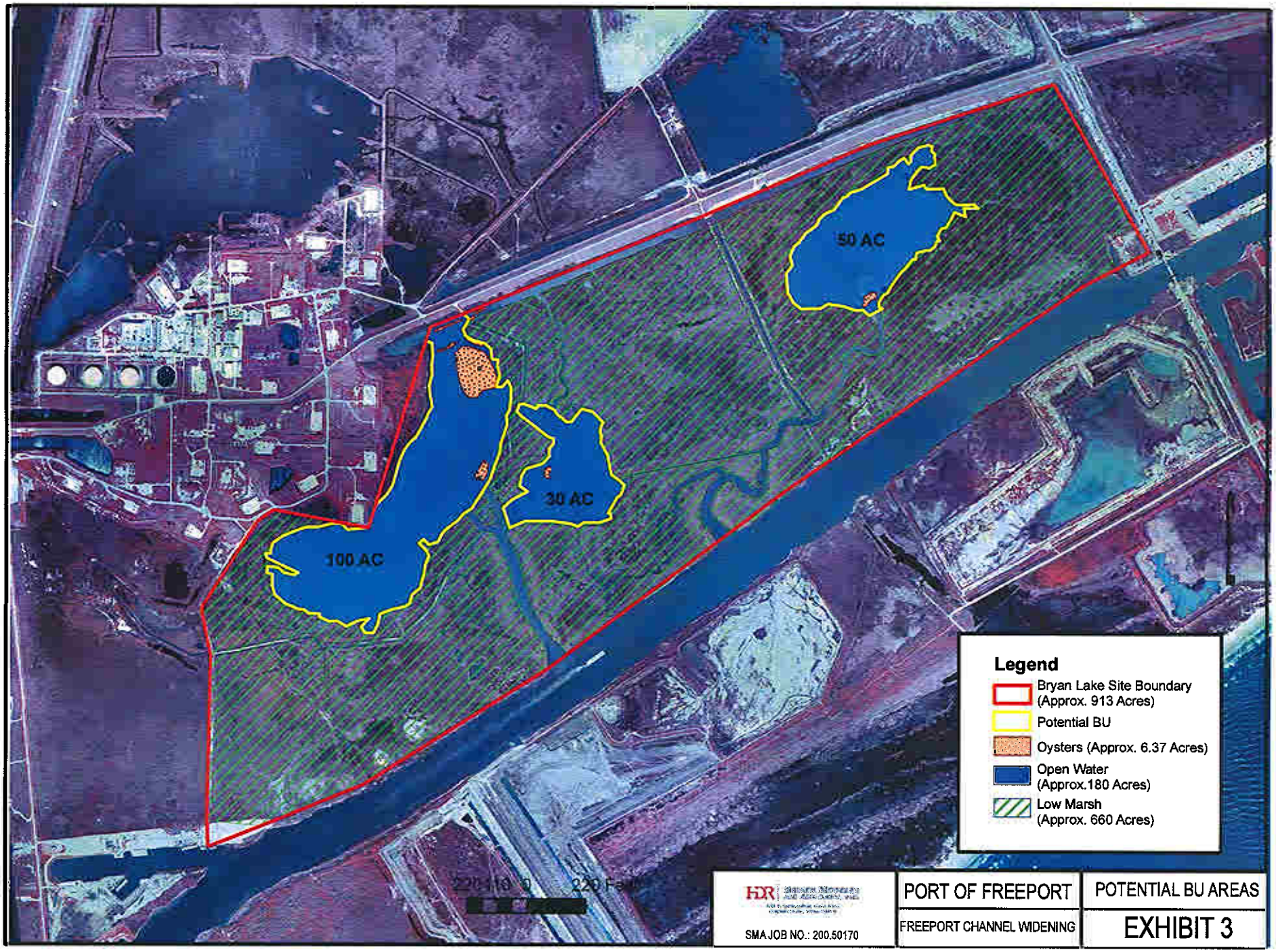
View looking west along existing channel that connects to 100 acre area. Note oysters within the channel (01/22/06).

View looking west of high marsh habitat that fringes the 100 acre, 30 acre, and 50 acre areas. High marsh habitat consists mostly of *Iva frutescens* (01/22/06).

View looking west of 50 acre area (01/22/06).

View looking southwest of 50 acre area (01/22/06).

View looking south of 50 acre area (01/22/06).


50 AC
30 AC
100 AC
Legend
Bryan Lake Site Boundary (Approx. 913 Acres)
Potential BU
Oysters (Approx. 6.37 Acres)
Open Water (Approx.180 Acres)
Low Marsh (Approx. 660 Acres)
220 110 0 220 Feet
HDR
SMA JOB NO.: 200.50170
PORT OF FREEPORT
FREEPORT CHANNEL WIDENING
POTENTIAL BU AREAS
EXHIBIT 3

Appendix C

Ocean Dredged Material Disposal Site Analyses

Ocean Dredged Material Disposal
Site Analyses

Document No. 060299
PBS&J Job No. 441591

OCEAN DREDGED MATERIAL DISPOSAL SITE ANALYSES

October 2006

Printed on recycled paper

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1.0 INTRODUCTION

The existing Freeport Harbor Project was authorized by the River and Harbors Acts of May 1950 and July 1958, providing for an Entrance Channel of 38-foot (ft) depth and 300-ft width from the Gulf to a point inside the jetties and for inside channels of 36-ft depth and 200-ft width up to and including the Upper Turning Basin. In 1970, Congress passed Section 101 of the River and Harbors Act of 1970 (PL 91-611; House Document 289, 93rd Congress – 2nd Session, 31 December 1975) and in 1974, the President authorized the relocation and deepening of the Jetty Channel to 45-ft depth and 400-ft width and the Entrance Channel to 47-ft depth and 400-ft width, with an extension of approximately 4.6 miles into the Gulf.

The Brazos River Harbor Navigation District (BRHND) of Brazoria County, Texas (also known as Port Freeport) applied to the U.S. Army Corps of Engineers (USACE), Galveston District, for a Clean Water Act Section 404 permit and Rivers and Harbors Act Section 10 permit for dredge and fill activities related to the widening of portions of the Freeport Ship Channel on April 14, 2005. Activities subject to the jurisdiction of the USACE would include dredging in navigable waters to widen portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Entrance Channel and placement of fill in waters of the U.S. This Ocean Dredged Material Disposal Site (ODMDS) Analyses document is being circulated for review as an appendix to the Environmental Impact Statement (EIS) being prepared for the proposed channel widening project.

1.1 PROPOSED WIDENING PROJECT

Port Freeport proposes to widen, but not deepen, portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Entrance Channel. Beginning at Channel Station 63+35, which is just about even with the center of the U.S. Coast Guard (USCG) Station access channel, the Jetty Channel will be gradually widened, at the authorized depth, up to an additional 150 ft over the next 1,835 ft to Channel Station 45+00. Over the next 500 ft, to Channel Station 40+00, the widening will be less gradual and will go from the additional 150 ft to an additional 200 ft. From Channel Station 40+00, through the rest of the Jetty Channel and to the end of the Entrance Channel at Channel Station -260+00, the channel will be widened an additional 200 ft. The length of channel that is proposed for widening is 32,335 ft or 6.1 miles, of which 5.7 miles will be widened by 200 ft. Port Freeport proposes to place new work (or construction or virgin) dredged material in the 45-ft Project new work material ODMDS and maintenance material in the existing U.S. Environmental Protection Agency (EPA) ODMDS for maintenance material (Figure C.1-1).

1.1.1 Project Purpose and Need

The purpose of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight-only operations for larger vessels, and (c) restrictions that do not allow the larger vessels to enter the Port when winds exceed 20 knots or crosscurrents exceed

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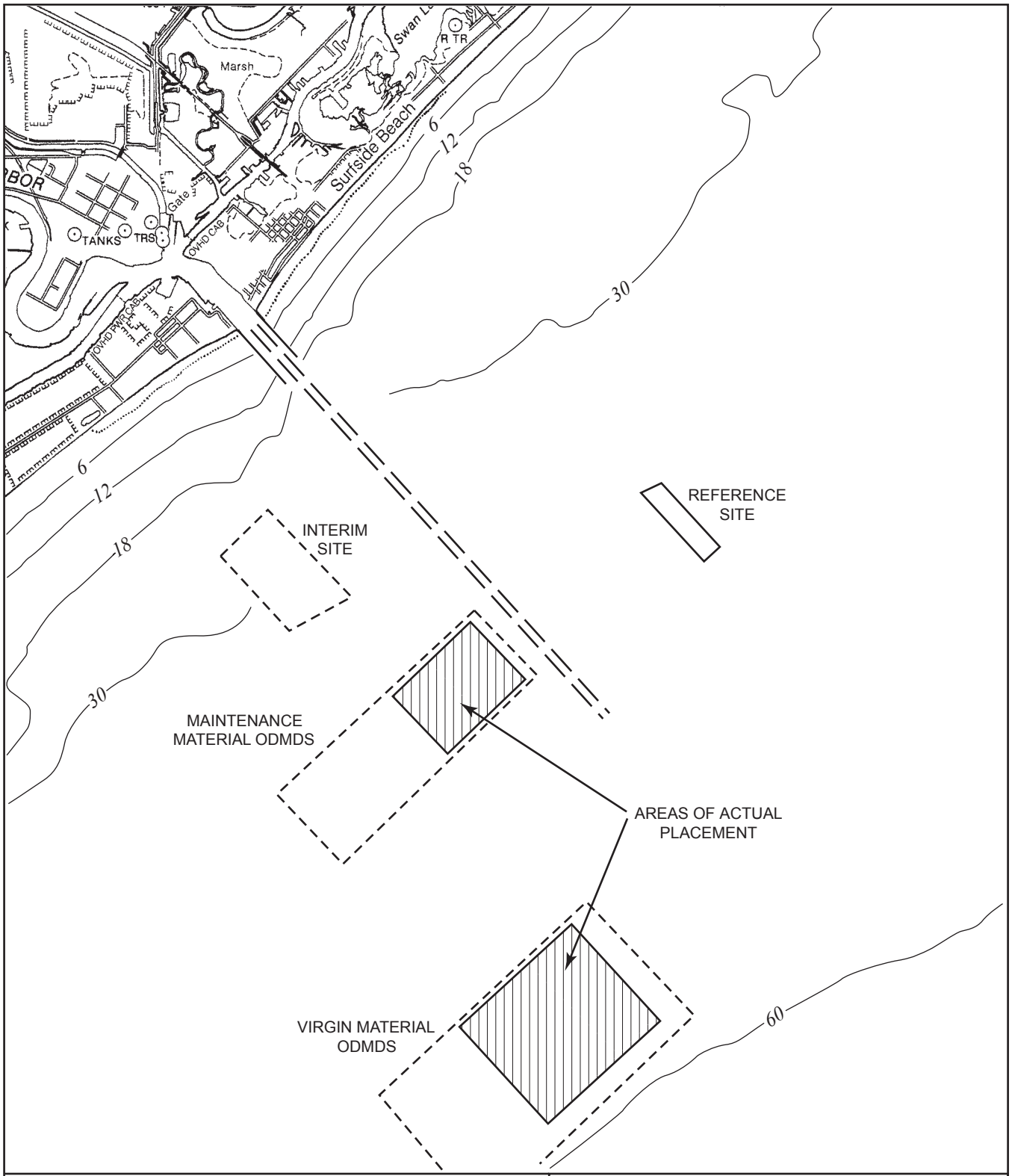

north

0 1 mile

30 Depth in Feet

ODMDS Ocean dredged material disposal site

Base Map: NOAA Navigation Chart 11321 (1990)

PBSJ

• Engineering
• Environmental Consulting
• Surveying

Figure C.1-1

GENERAL BATHYMETRY AND ODMDSs PORT FREEPORT, TEXAS

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0.5 knot. The maximum ship dimensions permitted by the pilots at Freeport Harbor are: 825-ft length over all (LOA), 145-ft maximum beam, and 42-ft draft.

The project need is the elimination of the operational constraints to allow vessels to avoid delays, thereby reducing shipping costs and logistical problems and increasing vessel safety. In the 905(b) analysis (USACE, 2002), the USACE noted the problems mentioned above; i.e., "that the relatively narrow (400-ft wide) entrance and main channels limit the Freeport Harbor Channel to one-way for all vessels and daylight-only operation for the larger vessels." It is also noted that "the light-loading, one-way traffic, and daylight-only operation result in significantly higher costs to users of Port Freeport than would be experienced if the harbor were enlarged and deepened. The transportation savings that would result from improvements at Freeport Harbor would be economic benefits to the nation." Thus the USACE has confirmed the need for the project and that the project serves the national interest.

1.1.2 Project Alternatives

Design parameters for channel dimensions are normally based on the channel width versus the maximum vessel beam allowed to transit the channel. Two possible widths (500 and 600 ft) were examined as alternatives for the proposed channel widening project. Since studies (Fugro Consultants, Inc. [Fugro], 2005) showed that the maximum channel width should not exceed 600 ft to maintain jetty stability (550 ft inside Channel Station 38+00) and since the USACE had selected 600 ft as the maximum width alternative (USACE, 2002), 600 ft was the maximum width examined. An analysis indicated that the 600-ft width is preferred over the 500-ft width to effectively meet the purpose and need for the project.

The proposed widening would generate approximately 3.2 million cubic yards (mcy) of new dredged material. Approximately 2.9 mcy of the new work material would consist of clay material and about 300,000 cubic yards (cy) would consist of silty sand. A Dredged Material Management Plan (DMMP) Workgroup, comprising state and Federal agency representatives and other entities, met to discuss the potential alternatives for dredged material placement. Additional information regarding the DMMP Workgroup can be found in Section 2.3 of the EIS. Seventeen placement alternatives were identified and considered by the DMMP Workgroup. These alternatives included upland confined placement areas (UCPA), beach nourishment, marsh restoration, upland beneficial use (BU), offshore BU, and use of an ODMDS.

These BU alternatives were subjected to a preliminary screening process to determine feasibility. Through this process, it was determined that the physical characteristics of the clay material made it unsuitable for the BUs being considered. The three offshore potential BU sites (habitat, feeder, and energy dissipating berms) were removed from further consideration by the DMMP Workgroup or the Applicant for various reasons, including reliability as a BU, lack of permanence, and/or overall performance.

Placement of the 300,000 cy of silty/sand new work material at either Surfside Beach or placement on Quintana Beach in front of the Seaway UCPA was determined to be another BU option. Three potential marsh restoration BU areas were identified during a DMMP workshop in December 2005, but the

ultimate consensus of the Workgroup was that none of the marsh restoration sites were desirable or feasible (EIS Section 2.3). Therefore beach nourishment at either Quintana or Surfside remained as a viable BU placement option for the 300,000 cy of new work material. The two alternative locations, Surfside and Quintana, are both carried through the EIS for complete analysis, along with the No-Action alternative.

Since a BU was available for the sandy material, all non-BU options, including ocean placement, were eliminated for the sandy material. Once it was determined the 1.9 mcy of clay material were not viable for the BU alternatives being considered, several upland placement options were considered. However, the upland placement areas either did not have capacity to accept the material or were designated for other uses. The major portion of the dredging of the clay material will be dredged by hopper dredge and, therefore, ocean placement was selected as the preferred alternative for placement of this material.

1.2 ODMDS DESIGNATION

Ocean disposal of dredged material was not specifically regulated in the United States until passage of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). Limited regulation was provided by the Supervisors' Act of 1888 and the Refuse Act of 1899. Under these acts, transportation and navigation factors, rather than environmental considerations, guided selection of placement locations by the USACE and the issuance of permits for ocean disposal.

Although the Fish and Wildlife Coordination Act of 1958 initially referred to inland tidal waters, it included consideration of the effects of dredged material on commercially important marine species. This act, together with subsequent judicial decisions, empowered the USACE to refuse permits if the dredging or filling of a bay or estuary would result in significant, unavoidable damage to the marine ecosystem.

MPRSA and the Federal Water Pollution Control Act (FWPCA), later amended by the Clean Water Act of 1977, both passed in 1972 and specifically addressed waste disposal in the aquatic and the marine environment. The FWPCA and the Water Quality Improvement Act of 1970 set up specific water-quality criteria to be used as guidelines in controlling discharges into marine and aquatic environments. These water-quality criteria applied to placement of dredged material only in cases where fixed pipelines were used to transport and discharge dredged material into the environment at discrete points. MPRSA, however, specifically regulates the transport and ultimate disposal of waste materials in the ocean. Under Title I of MPRSA, the primary regulatory vehicle of the Act, a permit program for the disposal of dredged and nondredged materials was established that mandates determination of impacts and provides for enforcement of permit conditions.

The August 1975 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (Convention) is the principal international agreement governing ocean dumping. The Convention specifies that contracting nations will regulate disposal in the marine environment within their jurisdiction, disallowing all disposal without permits. The nature and quantities of all waste material and the circumstances of disposal must be periodically reported to the International Maritime

Organization (formerly the Inter-Governmental Maritime Consultative Organization), which administers the Convention.

In October 1973, the EPA issued the final Ocean Dumping Regulations and Criteria (the Regulations or Ocean Dumping Regulations), revised in January 1977 (40 CFR Parts 220 to 229). These regulations established procedures and criteria for review of ocean disposal permit applications (Part 227); assessment of impacts of ocean disposal and alternative disposal methods; enforcement of permits; and designation and management of ocean disposal sites (Part 228). They also established procedures by which the EPA is authorized to designate ODMDSs and times for ocean disposal of acceptable materials under Section 102(c) of the MPRSA and the criteria for site designation, including general and specific criteria for site selection.

The EPA is mandated with the authority to regulate ocean dumping and with the responsibility for site designation, monitoring, and management by Congress as stated specifically in 40 CFR 228.4(e)(1). The EPA has been requested to redesignate an ODMDS site for the placement of construction material and approve placement of maintenance material in an existing designated maintenance material ODMDS for the Freeport Harbor Entrance and Jetty Channels Widening Project. While EPA is a member of the DMMP Workgroup, EPA is not advocating expansion of the waterway. Although EPA is responsible for designating ocean dumping sites according to Section 102 of the Marine Protection, Research, and Sanctuaries Act, and such sites may be necessary for construction and maintenance of the proposed widening project, USACE may, with concurrence of EPA, select an alternative site in accordance with MPRSA 103(b), when use of an EPA-designated site is not feasible..

Site designation by EPA does not authorize any dredging project nor does it permit disposal of any dredged material. Sites are designated in areas where a need for ocean disposal has been indicated, based on past dredging demands and/or projected demands associated with new or expanded projects. However, site designation does not in and of itself preclude the consideration of other placement options, including beneficial use options or the no action alternative. Once designated as an approved ocean disposal site, the appropriateness of ocean disposal is determined on a case-by-case basis in accordance with the ocean dumping criteria.

The existing designated maintenance material ODMDS is bounded by:

28° 54′ 00″ N, 95° 15′ 49″ W; 28° 53′ 28″ N, 95° 15′ 16″ W;

28° 52′ 00″ N, 95° 16′ 59″ W; 28° 52′ 32″ N, 95° 17′ 32″ W.

Water depth ranges from 31 to 38 ft and the site is 3 miles from shore at its closest point (see Figure C.1-1). The area of the site equals 3.50 square statute miles.

The existing one-time-designated virgin (or construction) material ODMDS, designated for the construction material from the 45-ft project in 1990, is bounded by:

28° 50′ 51″ N, 95° 13′ 54″ W; 28° 51′ 44″ N, 95° 14′ 49″ W;

28° 50′ 15″ N, 95° 16′ 40″ W; 28° 49′ 22″ N, 95° 15′ 45″ W.

Water depth ranges from 54 to 63 ft and the site is 6 miles from shore at its closest point (see Figure C.1-1). The area of the site equals 2.02 square statute miles.

1.2.1 ODMDS Designation Purpose and Need

EPA's action for which this document was prepared is the redesignation of a site for the ocean placement of new work (construction) material to be dredged from widening the Freeport Harbor Entrance and Jetty Channels, and to approve placement of future maintenance material from the widening in the existing maintenance material ODMDS for the Freeport Harbor Channel. A Final Environmental Impact Statement (FEIS) for the new construction and maintenance dredging of the Freeport Harbor Channel (for the authorized 45-ft project), was prepared by the EPA (1990). The maintenance material ODMDS was designated by EPA for the continued placement of dredged material removed from the Freeport Harbor Ship Channel and the ODMDS for construction material was designated for one-time use. The purpose of EPA's action is to redesignate, based on 40 CFR 228, the new work ODMDS, which will provide an environmentally acceptable and economically and physically feasible area for the placement of the construction material from the Freeport Harbor Entrance and Jetty Channels and to approve the placement of future maintenance material from the widening of the Entrance and Jetty Channels for the Freeport Harbor Channel Widening Project in the existing designated maintenance material ODMDS.

1.2.2 ODMDS Designation Alternatives

In EPA (1990) a suite of alternatives was examined for the location of the virgin material ODMDS and the maintenance material ODMDS. These included the No-Action alternative, upland placement, and offshore. The offshore alternatives included mid-shelf, continental slope, and nearshore, including the interim-designated, historically used site. The alternative analysis concluded that only the nearshore alternative was feasible, and the most appropriate sites were selected by eliminating unfeasible areas. The one-time-use virgin material ODMDS and the maintenance material ODMDS resulted from the selection process and were designated. The need to identify and evaluate new nearshore alternative sites was obviated by the fact that the previous ODMDS designation analyses (EPA, 1990) are still deemed to be valid and thorough.

2.0 PROPOSED USE OF THE ODMDSs

Predominantly southward longshore transport has caused shoaling of the existing channel at a rate of approximately 1.98 mcy at approximately 10-month intervals or 2.3 mcy/year. It is anticipated that the channel widening will not impact this number. The proposed use of the existing maintenance material ODMDS is for future maintenance material. The existing site was sized based on a 2.1-mcy discharge

(EPA, 1990), and therefore should be of sufficient size to contain 1.98-mcy/dredging cycle. However, as discussed below, modeling was conducted to ensure that it is large enough.

The existing virgin material ODMDS was designated for one-time use for the 45-ft project (EPA, 1990), based on an anticipated 5.1 mcy of construction material. It is proposed that this site be redesignated for the placement of an additional 2.9 mcy of construction material from this channel widening project. As in the previous designation (EPA, 1990), this designation would be for a one-time use.

3.0 CHARACTERIZATION OF THE ODMDSs

Based on information provided by the USACE, Table C.3-1 provides dredging dates and volumes dredged from the Freeport Harbor Entrance and Jetty Channels from 1951 through 2004. However, only the dredging history in the period since deepening to 45-ft, 1992 through 2004, is included in the frequency and volume calculation. For that period, the average time between the beginnings of each dredging operation is approximately 10.4 months, and the average amount of maintenance material dredged is approximately 1.98 mcy. This does not mean that all of the Entrance and Jetty Channels are dredged every 10.4 months, on average, but it does indicate the average frequency of use of the maintenance material ODMDS.

Chemical data have been collected on ODMDS sediments from the maintenance material ODMDS at interval since 1974. Additionally, a study was conducted by Battelle (2004) for the EPA in 2003. The USACE and EPA data are presented in Tables C.3-2 and C.3-3, respectively. The data in Table C.3-2 are discussed in Section 3.9 of the EIS to which this document is attached and indicate no cause for concern. The range of concentrations is similar for the USACE and the Battelle data. Relative to the data in Table C.3-3, Battelle (2004) states:

> There were no elevated concentrations of metals in sediments from the active discharge quadrants (Q1 and Q2), the inactive quadrants (Q3 and Q4), the Down Current site or the Reference site. No measurements exceeded ER-L guidelines (Long et al., 1995) and all concentrations were similar to those reported for the earth's crust, indicating only natural input (Krauskopf, 1967).

The Battelle Sampling Plan included two stations in the actual disposal area of the maintenance material ODMDS (see Figure C.1-1), two in the downcurrent area of the ODMDS (where placement does not occur), a station located 1,000 ft downcurrent of the ODMDS, and a reference station (see Reference Site, Figure C.1-1). Alls stations were a composite of samples collected at three substations. It should be noted that sediment had recently been placed in the ODMDS and so there was some mounding in the actual disposal area, but none in the nonplacement areas of the ODMDS. Battelle calculated that enough maintenance material had been placed in the site since it was designated to create a mound 33.4 ft high, had it remained in place. However, because it is a dispersive site, only mounding of 2 to 4 ft in the

Table C.3-1
Dredging History

Start	Finish	Dredge Work Type	Prescribed Yards	Over-Depth Yards	Total Yards
Nov-51	Nov-51	Maintenance	474,788	0	474,788
Oct-71	Dec-71	Maintenance	796,500	160,585	957,085
Nov-70	May-71	Maintenance	1,614,436	0	1,614,436
Oct-71	May-72	Maintenance	1,161,215	0	1,161,215
Nov-72	May-73	Maintenance	868,540	0	868,540
Sep-73	Jan-74	Maintenance	1,089,540	0	1,089,540
Dec-73	Jan-74	Maintenance	743,610	0	743,610
Nov-74	Dec-74	Maintenance	1,010,361	0	1,010,361
Sep-75	Dec-75	Maintenance	2,095,572	0	2,095,572
Aug-78	Oct-78	Maintenance	966,648	0	966,648
Aug-80	Jan-81	Maintenance	1,098,920	0	1,098,920
Jun-82	Aug-82	Maintenance	1,388,226	0	1,388,226
Jun-83	Oct-83	Maintenance	1,109,789	0	1,109,789
Oct-84	Nov-84	Maintenance	976,249	209,886	1,186,135
Oct-84	Nov-84	Maintenance	212,799	0	212,799
Jul-86	Aug-86	Maintenance	761,384	164,325	925,709
May-87	Jul-87	Maintenance	1,048,569	193,336	1,241,905
Sep-87	Sep-87	Maintenance	213,773	0	213,773
Aug-88	Sep-88	Maintenance	676,132	167,808	843,940
Aug-89	Sep-89	Maintenance	999,961	0	999,961
Aug-92	Nov-92	Maintenance	2,262,716	621,816	2,884,532
Jul-93	Sep-93	Maintenance	1,415,742	0	1,415,742

Table C.3-1 (Concluded)

Start	Finish	Dredge Work Type	Prescribed Yards	Over-Depth Yards	Total Yards
Aug-94	Nov-94	Maintenance	2,599,267	0	2,599,267
Sep-95	Jan-96	Maintenance	2,081,837	592,189	2,674,026
Jul-96	Aug-96	Maintenance	579,500	0	579,500
Jan-97	Apr-97	Maintenance	1,886,633	602,475	2,489,108
Nov-97	Dec-97	Maintenance	703,453	349,704	1,053,157
Oct-98	Dec-98	Maintenance	1,860,017	474,419	2,334,436
Sep-99	Jan-00	Maintenance	1,093,696	461,919	1,555,615
Jul-00	Nov-00	Maintenance	1,241,830	618,017	1,859,847
Oct-00	Jan-01	Maintenance	2,202,288	0	2,202,288
Jun-01	Sep-01	Maintenance	1,956,384	522,865	2,479,249
May-02	Aug-02	Maintenance	1,996,354	0	1,996,354
Aug-03	Oct-03	Maintenance	1,726,186	0	1,726,186
Sep-04	Nov-04	Maintenance	1,249,655	659,176	1,908,831

TOTAL					
No. yrs	54	years/cycle	1.54	Total cy	49,961,090
No. dredgings	35	months/cycle	18.5	cy/cycle	1,427,460
				cy/yr	925,205
SINCE 1992					
No. yrs	13	years/cycle	0.87	Total cy	29,758,138
No. dredgings	15	months/cycle	10.4	cy/cycle	1,983,876
				cy/yr	2,289,088

TABLE C.3-2

DETECTED PARAMETERS
FREEPORT HARBOR ENTRANCE CHANNEL ODMDS and REFERENCE STATIONS

					Station:	FH-88-DA1			FH-88-REF1			FH-89-DA1			FH-89-REF1		
					Date:	3/15/1988			3/15/1988			4/7/1989			4/7/1989		
					Channel Station:												
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						46.8			23.6						56.2
Silt		%						34.7			64.2						40.3
Clay		%						18.5			12.2						3.5
D50		mm						0.07									0.08
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<2.0		2.27	<2.0	<2.0	3.14	<2.0		<1.0	<2.0	<2.0	<1.0
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	4.40		<0.1	2.60	2.70	<0.1	<2.0		<0.1	<2.0	<2.0	<0.1
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<10.0		8.68	<10.0	<10.0	10.11	<10.0		4.60	<10.0	<10.0	3.90
Copper	µg/L	mg/kg	4.8	13.5	34.0	4.0		4.20	<1.0	<1.0	4.79	<1.0		5.90	<1.0	<1.0	2.60
Lead	µg/L	mg/kg	210	133	46.7	<5.0		5.60	<5.0	<5.0	6.38	<5.0		1.20	<5.0	<5.0	<1.0
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.1	<0.20	<0.2	<0.1	<0.20		<0.1	<0.20	<0.2	<0.1
Nickel	µg/L	mg/kg	74	118	20.9	24.2		7.00	25.6	27.8	9.04	<5.0		7.10	<5.0	<5.0	4.90
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<1.0	<2.0	<2.0	<1.0	<2.0		<0.5	<2.0	<2.0	<0.5
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	**98.6**		27.45	39.2	<5.0	30.32	<5.0		14.8	<5.0	<5.0	18.1
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5		<5.0	<0.5	<0.5	<5.0	<0.5		<5.0	<0.5	<0.5	<5.0
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

TABLE C.3-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR ENTRANCE CHANNEL ODMDS and REFERENCE STATIONS

					Station:	FH-93-DA1			FH-93-REF1			FH-95-DA1			FH-95-REF1		
					Date:	7/20/1993			7/20/1993			2/2/1995			2/2/1995		
					Channel Station:												
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						12.7			21.8			5.4			6.0
Silt		%						63.2			46.8			66.4			75.2
Clay		%						24.1			31.4			28.2			18.8
D50		mm						0.02			0.04			0.06			0.06
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0		<0.10	<1.0	<1.0	<0.10
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.10		1.10	<0.10	<0.10	1.00	14.90		**329.10**	15.30	**42.30**	**145.50**
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0		11.70	<1.0	<1.0	12.00	<1.0		<0.10	<1.0	<1.0	<0.10
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0		4.70	<1.0	<1.0	4.60	<1.0		36.04	<1.0	<1.0	27.86
Lead	µg/L	mg/kg	210	133	46.7	<1.0		5.10	<1.0	<1.0	4.70	<1.0		15.38	<1.0	<1.0	16.04
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.02	<0.20	<0.2	<0.02	<0.20		**15.40**	<0.20	<0.2	**8.95**
Nickel	µg/L	mg/kg	74	118	20.9	<1.0		16.30	5.2	<1.0	8.10	<1.0		<0.10	<1.0	<1.0	<0.10
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<0.20	<2.0	<2.0	<0.20	<2.0		23.07	<2.0	<2.0	20.16
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0		30.4	<1.0	52.3	29.7	<1.0		<0.10	<1.0	<1.0	<0.10
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.5		<50.0	<0.5	<0.5	<50.0	<0.5		88.51	<0.5	<0.5	67.62
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

TABLE C.3-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR ENTRANCE CHANNEL ODMDS and REFERENCE STATIONS

					Station:	FH-97-PA1A			FH-97-REF1			FH-97A-PA1A			FH-97A-REF1		
					Date:	1/25/1997			1/25/1997			9/30/1997			9/30/1997		
					Channel Station:												
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						18.1			18.7			6.7			8.8
Silt		%						24.7			33.2			48.8			38.5
Clay		%						57.2			48.1			44.5			52.7
D50		mm						0.00			0.01			0.01			0.00
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	8.0	2.96	<1.0	8.0	3.66
Barium	µg/L	mg/kg	N/A	N/A	N/A	25.7		110.0	25.1	17.4	217.0	24.7	56.0	231.0	17.6	28.0	208.0
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.1		<0.10	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0		33.9	<1.0	<1.0	22.1	<1.0	<1.0	16.1	<1.0	<1.0	22.9
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00		19.3	1.80	4.36	13.6	<1.00	<1.00	9.77	<1.00	<1.00	11.3
Lead	µg/L	mg/kg	210	133	46.7	<1.0		45.0	<1.0	<1.0	25.3	1.07	<1.0	3.26	<1.0	<1.0	3.23
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.02	<0.20	<0.2	<0.02		<0.20	0.02		<0.20	0.02
Nickel	µg/L	mg/kg	74	118	20.9	<1.0		**23.1**	<1.0	<1.0	18.9	<1.0	1.0	15.6	<1.0	1.0	18.9
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<0.20	<2.0	<2.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0		62.4	<1.0	4.3	52.3	<1.0	10.3	55.4	6.1	14.4	70.0
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01		<1.0	<0.01	<0.01	<1.0	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	<0.03		6.58	<0.03	0.64	6.74	<0.03	<0.03	4.10	<0.03	<0.03	3.84

TABLE C.3-2 (Continued)

DETECTED PARAMETERS
FREEPORT HARBOR ENTRANCE CHANNEL ODMDS and REFERENCE STATIONS

					Station:	FH-98-PA1A			FH-98-REF1			FH-OB-00-PA1A			FH-OB-00-REF1		
					Date:	9/30/1997			9/30/1997			5/23/2000			5/23/2000		
					Channel Station:												
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						1.6			21.9			28.2			6.1
Silt		%						44.3			41.0			41.6			33.4
Clay		%						54.1			37.1			30.2			60.5
D50		mm						0.00			0.02			0.05			0.00
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<1.00		5.77	<1.00	<1.00	3.94	<1.00		3.43	<1.00	<1.00	4.92
Barium	µg/L	mg/kg	N/A	N/A	N/A	23.7		151	22.2	57.9	122	31.7		76.0	26.2	47.5	81.2
Cadmium	µg/L	mg/kg	40	45.4	1.20	0.17		0.14	<0.10	<0.10	<0.10	0.60		<0.10	0.90	0.40	0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0		17.9	<1.0	<1.0	13.5	<1.00		6.00	<1.00	<1.00	8.91
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00		12.10	<1.00	<1.00	9.83	<1.00		7.53	<1.00	<1.00	9.34
Lead	µg/L	mg/kg	210	133	46.7	<1.0		4.58	<1.0	<1.0	3.41	<1.00		11.1	<1.00	<1.00	16.1
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		0.02	<0.20	<0.20	0.05	<0.20		0.04	<0.20	<0.20	0.04
Nickel	µg/L	mg/kg	74	118	20.9	<1.00		15.4	<1.00	<1.00	12.1	4.00		8.04	<1.00	<1.00	12.50
Selenium	µg/L	mg/kg	290	564	N/A	<1.00		<0.20	<1.00	<1.00	<0.20	<1.00		0.20	<1.00	<1.00	0.27
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0		0.23	<1.0	<1.0	<0.10	<1.00		<0.10	<1.00	<1.00	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	20.5		51.8	10.6	1.1	44.2	10.7		31.2	47.1	5.2	34.3
TOC	mg/L	%	N/A	N/A	N/A	<1.00		7350	<1.00	<1.00	6880	<1.0		10100	<1.0	<1.0	15500
Total PCB	µg/L	ug/kg	N/A	N/A	N/A	<0.01		<1.00	<0.01	<0.01	<1.00	<0.01		<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	<0.03		11.8	<0.03	5.70	5.70	<0.03		29.0	<0.03	0.36	3.05

TABLE C.3-2 (Concluded)

DETECTED PARAMETERS
FREEPORT HARBOR ENTRANCE CHANNEL ODMDS and REFERENCE STATIONS

					Station:	FH-EC-04-REF			FH-EC-05-REF		
					Date:	4/29/2004			6/29/2005		
					Channel Station:						
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						12.9			7.5
Silt		%						28.2			5.7
Clay		%						58.9			86.8
D50		mm						0.00			0.00
Percent Solids		%						47.2			47.4
Arsenic	µg/L	mg/kg	69	149	8.2			6.93			7.53
Barium	µg/L	mg/kg	N/A	N/A	N/A			N/A			N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20			0.13			0.2
Chromium	µg/L	mg/kg	1,100	1,090	81.0			19.6			23.8
Copper	µg/L	mg/kg	4.8	13.5	34.0			12.2			15.4
Lead	µg/L	mg/kg	210	133	46.7			17.6			16.8
Mercury	µg/L	mg/kg	1.8	2.1	0.15			<0.20			<0.20
Nickel	µg/L	mg/kg	74	118	20.9			18.8			20.8
Selenium	µg/L	mg/kg	290	564	N/A			<0.50			<0.50
Silver	µg/L	mg/kg	1.9	2.0	1.00			<0.20			<0.20
Thallium	µg/L	mg/kg	N/A	N/A	N/A			0.21			0.38
Zinc	µg/L	mg/kg	90	92.7	150			25.4			17.9
TOC	mg/L	%	N/A	N/A	N/A			10300			13300
Total PCB	µg/L	ug/kg	N/A	N/A	N/A			N/A			N/A
Ammonia	mg/L	mg/kg	1.7	N/A	N/A			71.0			12.2

Chromium = CrIII and Total Cr
Var = varies based on pH, salinity, and temperatures
N/A means that no analyses were conducted for a particular parameter in a particular year
WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

Table C.3-3*
Metal Concentrations in Sediments (mg/kg dry weight).

Metal	Site						ER-L [1]	Earth Crust [2]
	Q1	Q2	Q3	Q4	DC	Reference		
Antimony	0.025	0.025	0.025	0.025	0.025	0.06	-	0.2
Arsenic	5.1	5.1	5.4	3.8	4	5.3	8.2	1.8
Beryllium	0.83	0.84	0.54	0.54	0.59	0.97	-	2.8
Cadmium	0.064	0.083	0.039	0.046	0.043	0.116	1.2	0.2
Chromium	20.7	16.1	11.8	10.6	11.7	16.4	81	100
Copper	8.65	10	5.68	6.17	6.66	13.5	34	55
Lead	14.2	14.4	10.2	9.79	11	14.1	46.7	12.5
Mercury	0.03	0.03	0.02	0.02	0.02	0.02	0.15	0.08
Nickel	16.1	16.5	11.7	11.4	12.3	19.7	20.9	75
Selenium	0.4	0.4	0.5	0.4	0.4	0.6	-	0.05
Silver	0.04	0.05	0.03	0.03	0.03	0.04	1	0.07
Zinc	54.3	50.4	41.8	39.6	43.3	45.5	150	70

[1] = Long et al. 1995

[2] = Krauskopf 1967

* *Ver batim* from Battelle (2004)

northeastern third of the ODMDS, probably from the recently placed material, was observed. Battelle (2004) also found that the majority of benthic macroinfaunal indicators were negatively correlated to percent fines, which could lead to a short-term impact on the infauna since maintenance material averaged 8.9% (EIS Table 3.9-2) sand versus 24.9% and 17.3% average sand for the ODMDS and Reference site, respectively, based on the data in Tables C.3-2 and C.3-3.

Conversely, USACE studies (Espey, Huston & Associates, Inc. [EH&A], 1991, 1993a, 1993b, 1994) demonstrated that impacts from construction material placement at the virgin material ODMDS were not detected 6 months after cessation of dredging. Sand content near the ODMDS averaged 11% during the predredging survey in 1990 versus 38% for the reference sediment. Six months after placement, the sand content increased to 48% near the ODMDS versus 54.6% at the reference site. In the preconstruction benthic invertebrates survey, only one of the eight monitoring stations surrounding the ODMDS had a greater number of taxa than the reference station. Six months after construction, only one station had fewer. Similar results were found for total number of individuals and mean density. By 18 months after construction, the sand content at the reference site was generally higher than at the monitoring stations surrounding the ODMDS, and benthic metrics were also higher, confirming the results found by Battelle (2004).

4.0 CHARACTERIZATION OF THE MATERIAL EXPECTED TO BE DREDGED

4.1 VIRGIN MATERIAL

Throughout this document, it is assumed that information relative to the construction material dredged for the 45-ft project and presented in EPA (1990) is valid for the proposed widening, since the widening project is an expansion of the 45-ft project and will also be dredged to 45 ft. The data included in EPA (1990) and EPA (1989) are included in this document by reference. However, the standards and criteria to which the sample concentrations are compared have changed since the construction material ODMDS was designated in 1990. Therefore, where pertinent, the data from EPA (1989) will be discussed. Additionally, chemical analyses were conducted on material from core samples taken in the area to be included in the widening (Fugro, 2005; PBS&J, 2005). Those data are included in Table C.4-1.

There were six exceedances of effects range low (ERLs) in the Fugro (2005) data (Table C.4-1), all by nickel, with an ERZ of 20.9 mg/kg. The exceedance values ranged from 23.8 milligram per kilogram (mg/kg) (114% of the ERL) to 35.3 mg/kg (170% of the ERL), but no toxicity was exhibited by sensitive water column or benthic organisms, during bioassays conducted the sediments according to procedures provided in EPA/USACE (1991). The results of the bioassays and several other factors lead to the conclusion that the nickel ERL exceedances do not lead to a cause for concern. The other factors are (1) there is no way to determine if nickel was the causative factor in the data that led to the nickel ERL (see Project EIS Section 3.9.3.1); (2) toxicity data have demonstrated that nickel concentrations in the same

TABLE C.4-1

CONCENTRATIONS OF DETECTED CONSTITUENTS IN SOILS (dry weight)
FREEPORT WIDENING PROJECT

Date Sampled: February 2005

Parameter	Units	NOAA ERL*	B-1,E,26' 0211038	B-2,E-1,24' 0211039	B-2,E-2,46' 0211040	B-3,E-1,26' 0211041	B-3,E-2,35' 0211042	B-4,E-1,35' 0211043	B-4,E-2,40' 0211044	B-5,E-1,34' 0211045	B-5,E-2,59' 0211046	B-6,E-2,32-34' 0211047
Antimony	mg/kg	N/A	< 0.0986	< 0.0934	< 0.0971	< 0.0948	< 0.0977	< 0.0977	< 0.0971	< 0.0878	< 0.0910	< 0.0966
Arsenic	mg/kg	8.2	2.7	2.4	1.4	0.700	8.2	2.0	4.1	0.600	2.0	1.6
Beryllium	mg/kg	N/A	1.15	1.18	1.46	0.274	1.46	0.743	1.16	0.142	0.983	0.433
Chromium, Total	mg/kg	81.0	28.1	46.0	59.9	7.8	46.8	15.3	23.2	4.1	20.2	9.9
Copper	mg/kg	34.0	25.8	19.1	19.9	3.6	26.1	10.1	19.5	1.6	12.2	4.6
Lead	mg/kg	46.7	14.9	27.6	29.9	5.1	39.9	7.0	15.6	2.8	10.7	6.8
Manganese	mg/kg	N/A	257.7	184.7	214.1	130.2	723.2	157.2	489.6	85.2	290.1	311.9
Mercury	mg/kg	0.150	< 0.00794	< 0.00664	< 0.00663	< 0.00613	< 0.00647	< 0.00597	< 0.00647	< 0.00602	0.0111	0.0129
Nickel	mg/kg	20.9	**30.2**	**26.8**	**33.3**	6.0	**35.3**	17.6	**29.8**	3.3	**23.8**	10.6
Thallium	mg/kg	N/A	0.294	0.284	0.340	< 0.190	0.324	< 0.195	0.285	< 0.176	0.214	< 0.193
Zinc	mg/kg	150	61.7	63.1	73.5	38.0	64.5	34.8	58.9	10.5	50.4	40.6
Fluoranthene	ug/kg	600	< 635	< 531	< 265	534	< 259	< 239	< 259	< 241	< 237	< 259
Percent Solids	%	N/A	63.0	75.3	75.4	81.5	77.3	83.8	77.3	83.0	84.5	77.1

ERL = Effects Range Low for Marine Sediments. There are no ERLs for soils.

range as those found in these samples did not cause toxicity; (3) the concentrations are less than a factor of two of the ERL; (4) the concentrations are below the Effects Range Medium (ERM) concentration (51.6 mg/kg) and well below the Apparent Effects Threshold values, of which 110.0 mg/kg (for echinoderm larvae) is the lowest value (Buchman, 1999); and (5) there are no Action Levels established by the Food and Drug Administration for poisonous or deleterious substances in human food and animal feed (which includes fish and shellfish) for nickel. Based on this information and the fact that no other ERLs were exceeded, there would appear to be no cause for concern relative to placing these soils in the Gulf of Mexico.

A reexamination of the data presented in EPA (1989) determined that the concentration of no parameter in the elutriates exceeded the EPA Water Quality Criteria (WQC, Table C.4-2), except perhaps copper in 1976, and nickel in one boring station (Station 12, 0–6 ft) of 19 in 1974. The concentration of copper (<10 µg/l) may exceed the WQC, but since the detection limit (10 µg/l) was higher than the Criterion, this cannot be determined. However, the WQC for copper has been raised from 2.9 µg/l to 4.8 µg/l, so the likelihood of an exceedance is no greater than when the virgin material ODMDS was designated.

4.2 MAINTENANCE MATERIAL

As noted above, the characteristics of the maintenance material are discussed in Section 3.9 of the EIS to which this document is appended and will not be repeated here.

5.0 MODELING OF DREDGED MATERIAL DISTRIBUTION

The placement of dredged material was simulated using an updated version (MDFATE; USACE/EPA, 1991) of a 1976 model, Dredged Material Fate (DMF), developed for the USACE through the Dredged Material Research Program by Tetra Tech., Inc. (Brandsma and Divoky, 1976). The modifications to this model were made under the supervision of Dr. Billy H. Johnson of the Waterways Experiment Station of the USACE. The purpose of the modeling was to determine if the previously designated virgin material ODMDS and the existing maintenance material ODMDS were of sufficient size to contain the construction and future maintenance from the Freeport Entrance and jetty Channel Widening Project.

This program models the initial behavior and final disposition of dredged material deposited “instantaneously” at the site of interest through the doors of a hopper dredge. The MDFATE model assumes that this procedure may be broken into three phases: (1) convective descent, during which the discharge cloud falls under the influence of gravity; (2) dynamic collapse, occurring when the descending cloud impacts the bottom or arrives at a level of neutral buoyancy at which point the descent is retarded and horizontal spreading dominates; and (3) long-term passive dispersion, commencing when the material transport and spreading are determined more by ambient currents and turbulence than by the dynamics of the disposal operation (Johnson and Holliday, 1978). The model also includes the settling of suspended solids.

TABLE C.4-2
RANGE OF VALUES FOR ELUTRIATE SAMPLES
WITH CHANNEL VIRGIN SEDIMENT

Parameter	Water* Quality Criteria	1974[a]	1976[a]
Metal (ug/l)			
Arsenic	69	--	0.1 - 4
Cadmium	40	<1	2 - 3
Chromium	1,100	--	10 - 20
Copper	4.8	--	10
Lead	210	--	10 - 20
Mercury	1.8	--	0.36 - 0.73
Nickel	74	40 - 130	10 - 20
Selenium	290	--	0.1 - 1.9
Zinc	90	--	10 - 20

*EPA (2002).
[a] USACE (1978).

The model was run for the size of hopper dredge that is anticipated to be used in the Project, a 3,600-cy hopper dredge (19.5-ft loaded draft, 9.5-ft light draft, 27-inch suction pipe, 11 knots loaded, 12 knots light, 4 knots during discharge, 4 minutes to empty hoppers). Model runs were made for both the previously designated virgin material ODMDS and the existing maintenance material ODMDS. Based on EPA (1989), it was anticipated that a 0.5 knot surface current and a 0.25 bottom current would be used in the modeling. However, the model will not accept but one current velocity, so a 0.38 knot current, parallel to the long axis of the ODMDSs was entered into the model.

5.1 VIRGIN MATERIAL

The percentage of the various soil particle types anticipated in the virgin sediment to be dredged was estimated using the information from EPA (1989) and confirmed by Fugro (2005) to be 2.5% shell, 4.5% sand, 21.0% silt, and 72% clay (as clayballs).

Output from the MDFATE model simulates the results of depositing the entire amount of dredged material on the ocean floor at predetermined grid points. In the models, the mounds of virgin material were slightly skewed in the current and vessel-heading directions and would form rounded diamond-shapes, slightly elongated in the down-current and vessel-travel directions, although this is difficult to see at the scale of the figures in Attachment A. At its thickest, the mound elevation for the largest mound of virgin material in the ODMDSs would be 3 to 4 ft. Based on preliminary model runs using the placement scheme included in EPA (1989), mound height at the edges of the ODMDS was not zero at all points. Therefore, the placement scheme was revised to eliminate some of the outer placement points in order to ensure that the material remained in ODMDS. As can be seen from Attachment A, after adjustment of the placement scheme, the lateral extent from the peak of the mounds at the edge of the mounding to the point where the model indicates mound thickness is reduced such that ambient water depth is reached remains totally within the boundaries of the ODMDS. Therefore, as an examination of Attachment A will reveal, the size of the construction material ODMDS is more than sufficient to contain the virgin material from the proposed channel widening.

5.2 MAINTENANCE MATERIAL

The MDFATE model program was also run on the maintenance material using a 3,600-cy hopper dredge. The percentage of the grain sizes anticipated in the maintenance material to be dredged from the widened Entrance and Jetty Channels was based on the grain size of past maintenance material, using historical information from analyses of maintenance material from the existing channel dating from 1988 through 2005 (USACE Galveston District Dredging Histories Data Base). The MDFATE model runs for future maintenance dredged material placement utilized the historic maintenance material grain size data as input. Again, the placement scheme from EPA (1989) had to be revised by reducing the first row of placement points along the edges of the long axes and adding more interior placement points in the down-current direction and the model rerun (Attachment A). As a result of that analysis, it was found that the mound elevation for the largest mound of maintenance material in the ODMDSs would be 5 to 6 ft.

Therefore, the size of the existing maintenance material ODMDSs was more than sufficient for future routine maintenance from the Widening Project (Attachment A).

6.0 ENVIRONMENTAL CONSEQUENCES

As required by the Ocean Dumping Regulations (40 CFR 220–229) promulgated to interpret the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), the previously designated construction material ODMDS will be examined relative to the five general criteria and the eleven specific factors (40 CFR 228.5 and 40 CFR 228.6(a), respectively). Since the maintenance material to be dredged from the proposed widened channel should be the same as existing maintenance material, except for volume, the existing routine maintenance material ODMDS will be examined to determine if it is of sufficient size to receive the greater quantity of material. This information will be included in the examination relative to the 5 general criteria and the 11 specific factors, where pertinent. In the following section, the criteria and factors are presented in italics, followed by the statement indicating compliance.

Other environmental regulations, which are pertinent to ODMDS designation, are addressed in the Project EIS to which this ODMDS analysis is attached: Coastal Zone Management (Project EIS Section 6.0 and Appendix H), Endangered Species Act (Project EIS Section 4.15 and Appendix G), Magnuson-Stevens Fishery Conservation and Management Act or Essential Fish Habitat (Project EIS Sections 3.14.2 and 4.14 and Appendix E), cultural and historic resources (Project EIS Section 4.16), and Section 4.1 Water Quality Certification (Project EIS Section 6.0).

6.1 REGULATORY CHARACTERIZATION

6.1.1 Five General Criteria

6.1.1.1 40 CFR 228.5(a)

The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.

The construction material ODMDS, like the other nonexcluded areas in EPA (1989), were selected, including appropriate buffer zones, to avoid sport and commercial fishing activities, as well as other areas of biological sensitivity. The excluded areas include a white shrimp breeding area, a sport and commercial fishing harvest area, two reef areas and the jetties, all with buffer zones; platforms; submerged shipwrecks; and several single oil and/or gas platforms. The buffer zones were sized on the basis of the physical movement of the disposal material, since sediment analysis in EPA (1989) and PBS&J (2005) concluded that the quality of the material proposed for discharge met the criteria of 40 CFR 227. The preferred sites are outside the Channel, including the navigation channel buffer zone, and they avoid known navigational obstructions.

6.1.1.2 40 CFR 228.5(b)

Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.

The results of the analyses and studies (EH&A, 1989, 1991, 1993a, 1993b, 1994; PBS&J, 2005), as discussed above, indicate that the construction material dredged for the 45-ft project was acceptable for ocean disposal under 40 CFR 227. The biota of the area near the ODMDS is healthy (EH&A, 1994). While toxicity tests have not been conducted for the virgin sediments, there is no evidence to suggest that they would not meet the criteria of 40 CFR 227 and chemical analysis at the Freeport Channel, as noted in Section 4.1 of this ODMDS assessment, and experience with other Texas Gulf Coast areas, including the nearby Galveston Harbor Channels, support an expectation that the virgin sediment would be acceptable for ocean disposal. The appropriate sizes for the buffer zones and for the preferred sites are based on the sediment transport information and the physical oceanographic characterization of the Freeport area. These, combined with the information on the expected quality of the material to be dredged, as discussed above, and recent modeling with MDFATE, ensure that perturbations caused by disposal would be reduced to ambient conditions at the boundaries of the new work ODMDS.

6.1.1.3 40 CFR 228.5(c)

If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in 228.5–228.6, the use of such sites will be terminated as soon as suitable alternative disposal sites can be designated.

Although included in the General Criteria, this item is not really a criterion for site designation, and, in fact, information presented in EPA (1990) was designed to answer the question raised by 40 CFR 228.5 (c). A suitable alternative to the interim site was designated and extensive monitoring and surveillance programs, including bathymetric scans; water, sediment and elutriate chemistry; bioassays; bioaccumulation studies; and benthic infaunal analyses (EH&A, 1991, 1993a, 1993b, 1994), do not indicate that any problems are apparent at the construction material ODMDS.

6.1.1.4 40 CFR 228.5(d)

The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and to permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study.

The size of the construction material ODMDS was as small as possible to meet reasonably the criteria stated at 40 CFR 228.5 and 228.6(a) for the 45-ft project. The determined size for the virgin material site is 3.49 square statute miles (2.64 square nautical miles) while that for the future maintenance material site is 2.02 square statute miles (1.53 square nautical miles) versus 0.53 square statute miles for the interim-designated site. The monitoring program included in EPA (1989) determined no adverse long-range impacts. Modeling with MDFATE was conducted to determine if the size of the ODMDS was sufficient for the proposed channel widening project. The size of the site was not reduced for the widening project, even though the projections indicate less material will be dredged for the widening project than was dredged for the 45-ft project because the area has been designated in the past.

6.1.1.5 40 CFR 228.5(e)

EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.

It was determined in EPA (1989) that cost, safety and time factors, plus difficulties with monitoring and surveillance, dictated that the distance to the edge of the continental shelf at Freeport precluded the use of any ODMDS off the shelf. Additionally, the lack of resilience of the deep-ocean benthic community and the grain size disparity between the material to be discharged and the deep-ocean sediments off Freeport indicated that an off-shelf disposal site would cause severe impacts to the off-shelf benthic community. No advantage to an off-shelf site was noted. The virgin material ODMDS has been historically-used for the 45-ft project.

6.1.2 Eleven Specific Factors

40 CFR 228.6(a) states that the factors included below as Sections 6.1.3.1 through 6.1.3.11 will be considered in the selection process for site designation.

6.1.2.1 40 CFR 228.6(a)(1)

Geographical position, depth of water, bottom topography, and distance from coast.

The preferred site for the virgin material disposal, as determined in EPA (1990), is bounded by the following coordinates (see Figure C.1-1):

28° 50′ 51″ N, 95° 13′ 54″ W; 28° 51′ 44″ N, 95° 14′ 49″ W;

28° 50′ 15″ N, 95° 16′ 40″ W; 28° 49′ 22″ N, 95° 15′ 45″ W.

The water depth at the preferred site ranges from 54 to 63 ft (see Figure C.1-1), the bottom topography is flat and the preferred virgin material ODMDS is approximately 6 miles from the coast at its closest point.

6.1.2.2 40 CFR 228.6 (a)(2)

Location in relation to breeding, spawning, nursery, feeding or passage areas of living resources in adult or juvenile phases.

EPA (1989) reports a white shrimp breeding area, a sport and commercial fishing harvest area, and a reef area, approximately 5 miles southwest of the construction material ODMDS. EPA (1989) also reports a small collection of coral heads (reefs), approximately 5 miles east of the construction material ODMDS, the jetties are approximately 6 miles north northeast. There appear to be no oil and/or gas platforms within 5 miles of the end of the jetties and only 9 within 10 miles of the end of the jetties (NOAA Coast Survey Nautical Chart 11321, 30th Ed., July 2004), and none are in the ODMDS. The *George Vancouver*, a Liberty Ship, which is part of the TPWD artificial reef program, is located about 10.5 miles southwest of Freeport.

6.1.2.3 40 CFR 228.6(a)(3)

Location in relation to beaches or other amenity areas.

The virgin material ODMDS is roughly 6 miles from beaches and at least 3 miles from other amenity areas. These include a white shrimp breeding area, a sport and commercial fishing harvest area, and a reef area at the southwest border of the ZSF a small collection of coral heads (reefs) at the northeast border (EPA, 1990).

6.1.2.4 40 CFR 228.6(a)(4)

Types and quantities of wastes proposed to be disposed of and proposed methods of release, including methods of packaging the waste, if any.

Virgin construction material (2.9 mcy) only will be discharged into the construction material ODMDS. Historically, the construction material ODMDS was designated for the 5.1 mcy of material to be removed in connection with the 45-ft project. Based on chemical analyses of the virgin material, which indicated no problems with the acceptability of these materials for ocean disposal, EPA (1989) concluded that no special location or precautions would be necessary for the disposal of the materials to be dredged except for grain size. The virgin material ODMDS was sited in the silty-clay regime, with which it was most compatible.

6.1.2.5 40 CFR 228.6(a)(5)

Feasibility of surveillance and monitoring.

The construction material ODMDS is amenable to surveillance and monitoring, as is evidenced by EH&A (1991, 1993a, 1993b, 1994).

6.1.2.6 40 CFR 228.6(a)(6)

Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current velocity, if any.

These physical oceanographic parameters were used (1) to develop the necessary buffer zones for the exclusion analysis, and (2) to determine the minimum size of the preferred site in EPA (1989). Predominant longshore currents, and thus predominant longshore transport is to the southwest. Steady longshore transport and occasional storms, including hurricanes, should remove the placed material from the site. The size of the ODMDSs was modeled using MDFATE, which includes vertical mixing, to ensure that it was large enough to prevent significant mounding (see Section 5.0).

6.1.2.7 40 CFR 228.6(a)(7)

Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).

The information from EH&A (1994) plus chemical analyses of water from the area concluded that there were no indications of water or sediment quality problems near the construction material ODMDS. Studies of the benthos near the ODMDS (EH&A, 1994) did not indicate any significant decrease or change in composition of the benthos at the ODMDS.

6.1.2.8 40 CFR 228.6(a)(8)

Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the ocean.

The items from the above list which are pertinent to the Freeport ODMDS are shipping, mineral extraction, commercial and recreational fishing, recreational areas, and historic sites. The location of the ODMDS was selected so that its use would not interfere with other legitimate uses of the ocean (EPA, 1990). Disposal operations in the past have not interfered with other uses.

6.1.2.9 40 CFR 228.6(a)(9)

Existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.

Monitoring studies have shown only short-term water column perturbations of turbidity, and perhaps chemical oxygen demand, which resulted from disposal operations. No short-term sediment quality perturbation could be directly related to disposal operations. In general, the water and sediment quality and benthic macroinvertebrate matrices are good throughout the vicinity of the ODMDS (EPA, 1989; EH&A, 1994). This indicates that there have been no long-term impacts on water and sediment quality or on the benthos at the construction material ODMDS.

6.1.2.10 40 CFR 228.6(a)(10)

Potentiality for the development or recruitment of nuisance species in the disposal site.

With a disturbance to any benthic community, initial recolonization will be by opportunistic species. However, these species are not nuisance species in the sense that they would interfere with other legitimate uses of the ocean or that they are human pathogens. EH&A (1993a, 1993b, 1994) determined that the placement of virgin material in the ODMDS has not, and placement of the proposed material should not, attract or promote the development or recruitment of nuisance species.

6.1.2.11 40 CFR 228.6(a)(11)

Existence of or in close proximity to the site of significant natural or cultural features of historical importance.

The nearest site of historical importance to the virgin material ODMDS is approximately 0.5 mile away from the edge of this site in a cross-current direction (Figure C.6-1 from EPA, 1989). Monitoring has determined no movement of material out of the ODMDS that would impact sites of historical importance.

7.0 SITE MONITORING AND MANAGEMENT PLAN

One of the ODMDS management responsibilities cited in 40 CFR 228.3 is "developing and maintaining effective ambient monitoring programs," although this is tempered somewhat by 40 CFR 228.9 (a), which states, "The monitoring program, if deemed necessary by the Regional Administrator or the District Engineer, as appropriate, may include baseline or trend assessment surveys. . ." Since 40 CFR 229 (c) states that "EPA will require the full participation of permittees . . . in the development and implementation of disposal monitoring programs," a monitoring program and SMMP are included in this EIS.

There are two approaches that may be applied to determining unfavorable trends. One is to conduct monitoring surveys on the ecosystem at and near the ODMDSs at regular intervals. The other approach is to determine the quality of the material to be discharged at the site, from a chemical and biological perspective, and thereby, to determine expected impacts. The testing requirements specified in 40 CFR 227.13, as applied by the USACE, Galveston District, satisfy parts of both of the above-mentioned approaches.

7.1 CONSTRUCTION MATERIAL

While the literature on maintenance material disposal on the Gulf coast indicates only minor short-term and negligible long-term mounding from placement activities, little information is available for virgin material ODMDSs. The USACE conducted monitoring following construction of the 45-ft project, for which the virgin material ODMDS was originally designated. No significant change in water quality,

sediment quality, or benthic community was detected (EH&A, 1993a; Barry A. Vittor & Associates, Inc., 1993, 1994). Mounding from the construction material, while acceptable, is higher and of firmer material than is true for the maintenance material. Additionally, construction placement is expected to last for only a period of two years or less and more frequent monitoring would be expected than would be necessary for the periodic, but short-term placement which occurs with maintenance dredging. The following monitoring and surveillance program is proposed for the Widening Project ODMDS during construction. The monitoring is discussed in detail below.

1. A major consideration in the acceptability of the size of the ODMDS was the location of the dredge when each discharge occurs. To prevent excessive mounding, it is necessary that a method be utilized to record the location of each discharge to ensure that the dredge places material all over the ODMDS while it avoids approaching the edges of the ODMDS too closely. The following is the scheme used in the modeling to avoid excessive mounding and dispersal of material outside the ODMDS: two discharge at all exterior placement points (one should a larger dredge be used), followed by one discharge at each of the interior placement points in a given sequence until each has been utilized. Continue repeating the sequence with one discharge at each interior placement point until construction is complete.
2. Routine bathymetric scans should be conducted for the ODMDS to determine that there is no excessive mounding; e.g., to elevations greater than 5.0 ft above the existing bottom elevation (unless an alternate height is determined in agreement between the EPA and USACE on a case-by-case basis), and that there is no short-term transport of material beyond the limits of the ODMDS. Studies have shown that benthic organisms can burrow through 6–9 inches of dredged material without significant impacts on the community (EPA/USACE, 1996). Therefore, a depth of 1.0 ft of sedimentation along the ODMDS boundary will be considered the threshold level for movement of material outside of the designated ODMDS. A Notice to Mariners will be posted relative to any excessive mounding which does occur.
3. Monitoring stations (EPA, 1989), including a control station, stations located immediately outside the ODMDS, and stations located some distance down-current from the site should be sampled for the items noted in the following paragraph, to determine if impacts are occurring outside of the ODMDS. EPA (1989) describes two stations on each side of the ODMDS, roughly 300 ft from the ODMDS edges (Stations B1 through B8), a control site located west of the ODMDS, and two stations located 10,000 ft down-current (southwest) of the down-current edge of the ODMDS.

These stations should be sampled periodically during construction and for one year after the cessation of discharge of virgin material at the site. Frequency of monitoring will be decided by the EPA, in cooperation with the USACE, prior to construction. Samples should be collected for: (1) grain-size analysis, (2) chemical characterization of sediments, and (3) macrobenthic invertebrates (in triplicate). Since chemical analyses, bioassays, and bioaccumulation studies have already been conducted on the construction material (Section 3.2.4), since the construction material was approved for placement at this site for the 45-ft project, and since dredging and placement are a one-time event for construction, no further testing of the virgin material is required prior to dredging.

7.2 MAINTENANCE MATERIAL

Since use of the maintenance material ODMDS is ongoing, as opposed to a one-time event for the virgin material ODMDS, a draft ODMDS Management Plan has been prepared and is included as Attachment B to this ODMDS assessment.

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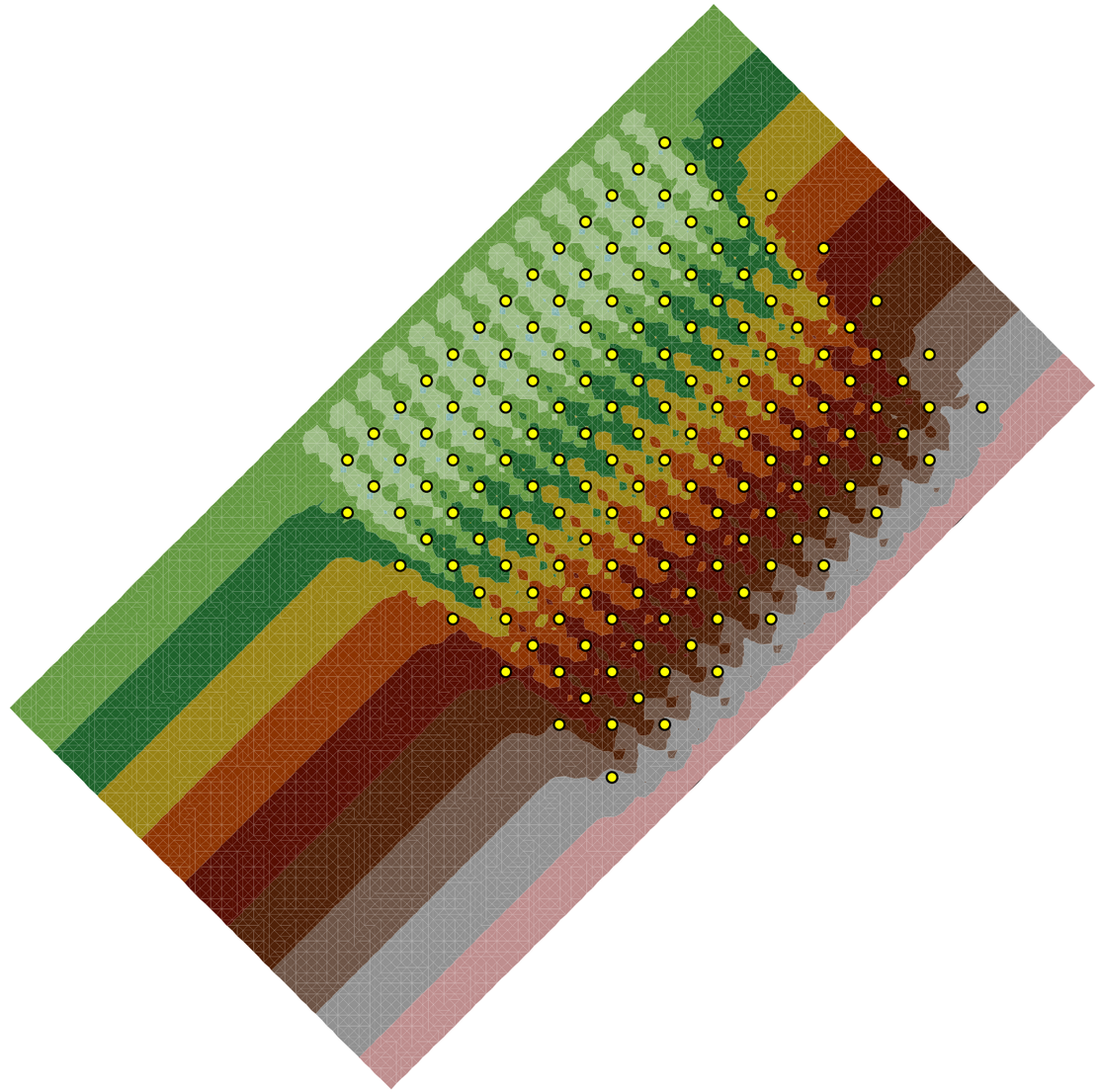
Attachment A

MDFATE Modeling Results



N

5,000 2,500 0 5,000 Feet

Legend

Discharge points

Tin

Elevation

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-54.000 - -53
-55.000 - -54
-56.000 - -55
-57.000 - -56
-58.000 - -57
-59.000 - -58
-60.000 - -59
-61.000 - -60
-62.000 - -61
-62.734 - -62

PBSJ
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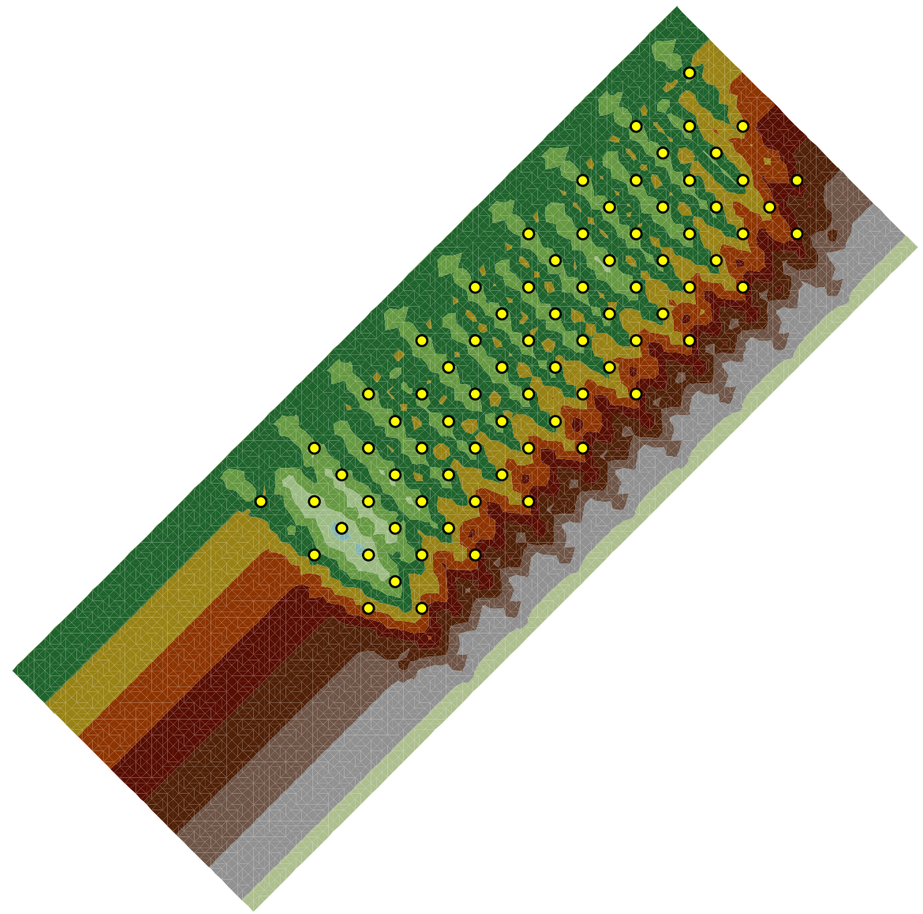
Freeport Widening
Virgin Material ODMDS

Prepared for:	
Job No.:	Scale:
Prepared by:	Date:
File:	



N

5,000 2,500 0 5,000 Feet

Legend

Discharge Points

Tin

Elevation

-29.000 - -28
-30.000 - -29
-31.000 - -30
-32.000 - -31
-33.000 - -32
-34.000 - -33
-35.000 - -34
-36.000 - -35
-37.000 - -36
-38.000 - -37
-38.358 - -38

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Freeport Widening Maintenenace Material ODMDS

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Prepared by:	Date:
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Attachment B

Site Management and Monitoring Plan

US Army Corps of Engineers
Galveston District

FREEPORT HARBOR, TEXAS

ODMDS MANAGEMENT PLAN FOR THE MAINTENANCE SITE

AS REQUIRED BY

SECTION 102 OF THE

MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

ATTACHMENT B
SITE MANAGEMENT PLAN

FREEPORT HARBOR, TEXAS
OCEAN DREDGED MATERIAL DISPOSAL SITE

I. General

The Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972 (33 U.S.C. Section 1401, *et seq.*) is the legislative authority regulating the disposal of dredged material into ocean waters, including the territorial sea. The transportation of dredged material for the purpose of placement into ocean waters is permitted by the U. S. Army Corps of Engineers (USACE) or, in the case of Federal projects, authorized for disposal under MPRSA Section 103(e), applying environmental criteria established by the Environmental Protection Agency in the Ocean Dumping Regulations (40 CFR Parts 220-229).

Section 102(c) of the MPRSA and 40 CFR 228.4(e)(1) authorize the Environmental Protection Agency (EPA) to designate ocean dredged material disposal sites (ODMDSs) in accordance with requirements at 40 CFR 228.5 and 228.6. Section 103(b) of MPRSA requires that the USACE use dredged material sites designated by EPA to the maximum extent feasible. Where use of an EPA-designated site is not feasible, the USACE may, with concurrence of EPA, select an alternative site in accordance with MPRSA 103(b).

Section 228.3 of the Ocean Dumping Regulations established disposal site management responsibilities; however, the Water Resources Development Act of 1992 (WRDA 92; Public Law 102-580) included a number of amendments to the MPRSA specific to ODMDS management. Section 102(c) of MPRSA as amended by Section 506 of WRDA 92 provides that:

1. Site management plans shall be developed for each ODMDS designated pursuant to Section 102(c) of MPRSA.

2. After January 1, 1995, no ODMDS shall receive a final designation unless a site management plan has been developed.

3. For ODMDSs that received a final designation prior to January 1, 1995, site management plans shall be developed as expeditiously as practicable, but no later than January 1, 1997, giving priority to sites with the greatest potential impact on the environment.

4. Beginning on January 1, 1997, no permit or authorization for dumping shall be issued for a site unless it has received a final designation pursuant to Section 102(c) MPRSA or it is an alternate site selected by the USACE under Section 103(b) of MPRSA.

This site management plan for the Freeport Harbor, TX Ocean Dredged Material Disposal Site was developed jointly by the U.S. Environmental Protection Agency, Region 6 (EPA, Region 6) and the U.S. Army Corps of Engineers, Galveston District (USACE, GD). In accordance with Section 102(c)(3) of the MPRSA, as amended by WRDA 92, the plan includes the following:

1. A baseline assessment of conditions at the site;

2. A program for monitoring the site;

3. Special management conditions or practices to be implemented at the site that are necessary for protection of the environment;

4. Consideration of the quantity of dredged material to be discharged at the site, and the presence, nature, and bioavailability of the contaminants in the material;

5. Consideration of the anticipated use of the site over the long term, including the anticipated closure date for the site, if applicable, and any need for management of the site after the closure;

6. A schedule for review and revision of the plan.

II. Site Management Objectives

The purpose of ocean dredged material site management is to ensure that placement activities do not unreasonably degrade the marine environment or interfere with other beneficial uses (e.g., navigation) of the ocean. The specific objectives of management of the Freeport Harbor, TX Ocean Dredged Material Disposal Site for maintenance material are as follows:

1. Ocean discharge of only that dredged material that satisfies the criteria set forth in 40 CPR Part 227 Subparts B, C, D, E, and G and Part 228.4(e) and is suitable for unrestricted placement at the ODMDS;

2. Avoidance of excessive mounding either within the site boundaries or in areas adjacent to the site, as a direct result of placement operations.

III. Roles and Responsibilities

In accordance with Section 102 (c) of the MPRSA and with the Regional MOU between USACE, GD and EPA, Region 6 on Management of ODMDSs signed August 13, 1993, EPA is responsible for designation of ODMDSs. Where use of an EPA-designated site is not feasible, the USACE, GD may, with concurrence with EPA, Region 6 select an alternative site in accordance with Section 103(b) of the MPRSA as amended by Section 506 of WRDA 1992.

Development of Site Management Plans for ODMDSs within the Galveston District is the joint responsibility of EPA, Region 6 and the USACE, GD. Both agencies are responsible for assuring that all components of the Site Management Plans are implementable, practical, and applicable to site management decision-making.

IV. Funding

Physical, chemical, and biological effects-based testing of dredged material prior to placement at the ODMDS will be undertaken and funded by the USACE, GD. The USACE, GD will also be responsible for costs associated with placement site hydrographic monitoring. Should monitoring indicate that additional studies and/or tests are needed at the ODMDS, the cost for such work would be shared by the USACE, GD and EPA, Region 6. Physical, chemical, and biological effects-based testing at the ODMDS, or in the site environs after discharge, that is not required as a result of hydrographic

monitoring, will be funded by EPA, Region 6. Funding of all aspects of this site management plan is subject to Congressional budget constraints.

V. Baseline Assessment

A. Site Characterization (Existing Maintenance ODMDS). The Freeport Harbor Maintenance ODMDS is located approximately three miles offshore, and about 1,000 feet southwest of the centerline of the Outer Bar Channel. The site is rectangular in shape with corner coordinates located at:

28˚54'00"N, 95˚15'49"W; 28˚53'28"N, 95˚15'16"W;
28˚52'00"N, 95˚16'59"W; 28˚52'32"N, 95˚17'32"W.

This site occupies an area of approximately 1.53 square nautical miles, with depths ranging from 31 to 38 feet. The sediment reference area is located northeast of the channel with vertices at the following coordinates:

28˚54'28"N, 95˚13'40"W; 28˚54'35"N, 95˚13'28"W;
28˚55'07"N, 95˚14'01"W; 28˚54'60"N, 95˚14'13"W.

B. Site Characterization (Historic Virgin Material ODMDS). The Freeport Harbor one-time use historic virgin material ODMDS is located approximately six miles offshore, with its area bounded by the following coordinates:

28˚50'51"N, 95˚13'54"W; 28˚51'44"N, 95˚14'49"W;
28˚50'15"N, 95˚16'40"W; 28˚49'22"N, 95˚15'45"W

The site occupies and area of approximately 2.64 nautical square miles, with depths ranging from 54 to 63 ft.

Baseline conditions at the Freeport Harbor Maintenance and historic Virgin Material ODMDSs were assessed during the site designation process. Details of baseline conditions, including descriptions of the marine environment in the site vicinity and the physical, chemical and biological characteristics of the sediments and the water column at the site, are contained in the Final Environmental Impact Statement (EIS), Freeport Harbor (45-Foot Project), Ocean Dredged Material Disposal Site Designation prepared by EPA, Region 6, in January 1990.

C. Historical Use of Site (Maintenance Material ODMDS). The Freeport Harbor maintenance ODMDS received final designation on March 27, 1990 (55 FR 59). Historical use of the site is depicted below.

D. Historical Use of Site (Virgin Material ODMDS). The Virgin Material ODMDS was designated (EPA, 1990) for one-time use for the 45-ft channel project for placement of 5.1 million cubic yards of new work (virgin) material. This site has been inactive since completion of the 45-ft channel project.

Dredging History

Start	Finish	Dredge Work Type	Prescribed Yards	Over-Depth Yards	Total Yards
Aug-92	Nov-92	Maintenance	2,262,716	621,816	2,884,532
Jul-93	Sep-93	Maintenance	1,415,742	0	1,415,742
Aug-94	Nov-94	Maintenance	2,599,267	0	2,599,267
Sep-95	Jan-96	Maintenance	2,081,837	592,189	2,674,026
Jul-96	Aug-96	Maintenance	579,500	0	579,500
Jan-97	Apr-97	Maintenance	1,886,633	602,475	2,489,108
Nov-97	Dec-97	Maintenance	703,453	349,704	1,053,157
Oct-98	Dec-98	Maintenance	1,860,017	474,419	2,334,436
Sep-99	Jan-00	Maintenance	1,093,696	461,919	1,555,615
Jul-00	Nov-00	Maintenance	1,241,830	618,017	1,859,847
Oct-00	Jan-01	Maintenance	2,202,288	0	2,202,288
Jun-01	Sep-01	Maintenance	1,956,384	522,865	2,479,249
May-02	Aug-02	Maintenance	1,996,354	0	1,996,354
Aug-03	Oct-03	Maintenance	1,726,186	0	1,726,186
Sep-04	Nov-04	Maintenance	1,249,655	659,176	1,908,831
TOTAL SINCE 1992					
No. yrs	13	years/cycle	0.87	Total cy	29,758,138
No. dredgings	15	months/cycle	10.4	cy/cycle	1,983,876

VI. Quantity of Material and Level of Contamination

A. Summary of information used to determine size of the site. Historically, since 1992, the dredging frequency for this navigation project is slightly less than one year or approximately 10 months, with an average of approximately 1,983,876 cubic yards (cy) of material excavated per dredging cycle placed at the maintenance ODMDS. The excavated channel sediments can be characterized as clayey-sandy-silts. The channel sediment may contain a slightly higher percentage of sand than the placement area, and slightly less than the reference area, however, the percentage of silt is similar for all three locations. Average particle size distribution is described in the table below.

LOCATION	% SAND	% SILT	% CLAY
Channel	19.6	52.0	28.4
ODMDS	5.4	66.4	28.2
Reference Area	26.9	56.6	16.5

As described in the site designation EIS, the size of the maintenance ODMDS and virgin material ODMDS were determined by simulations run on a computer model. These simulations assumed an average of 1.98 million cy (mcy) of material to be placed during each maintenance cycle and 2.9 mcy to be placed as part of the widening project. The 1.98 mcy of future maintenance material quantity is not significantly different from the 2.1 mcy of maintenance material simulated during the designation process for the existing maintenance ODMDS (EPA, 1990). Additionally, the 2.9 mcy of virgin material is much less than the 5.1 mcy of virgin material simulated during the designation process for the historic virgin material ODMDS (EPA, 1990). Both sites can be described as dispersive, therefore the dredged material deposited there is expected to erode, especially due to the high percentage of fine-grain components

B. Summary of testing requirements per Regional Implementation Agreement (RIA) and summary of past dredged material evaluations. In July 2003, an RIA was executed between EPA Region 6, and the Galveston District. This RIA described protocols for evaluating the quality of the dredged material and implementation of the Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual dated February 1991. These protocols describe chemical parameters to be analyzed, as well as required detection limits. It also specifies how toxicity testing and bioaccumulation assessments are to be conducted, as well as organisms to be utilized. Since that time, all sediment evaluations have been conducted in accordance with the RIA. Since the mid-1970's, before development of the RIA, dredged material from the Freeport Harbor Project had been evaluated numerous times to determine suitability for offshore placement. This testing was performed to determine levels of metals and organic constituents, as well as toxicity and bioaccumulation assessments. Testing performed for this project is summarized in the following table:

DATE	TYPE OF TESTING
September 17, 1975	Pre-dredging Bulk Analyses
October 6, 1975	During-dredging Bulk Analyses
December 2, 1975	After-dredging Bulk Analyses
April 1978	Toxicity and Bioaccumulation Assmnt.
October 1978	Toxicity and Bioaccumulation Assmnt.
July 1980	Toxicity and Bioaccumulation Assmnt.
January 14, 1982	Pre-dredging Bulk Analyses

DATE	TYPE OF TESTING
February 22, 1983	Pre-dredging Bulk Analyses
July 3, 1984	Pre-dredging Bulk Analyses
February 1985	Toxicity and Bioaccumulation Assmnt.
May 15, 1985	Pre-dredging Bulk Analyses
March 28, 1986	Pre-dredging Bulk Analyses
March 18, 1987	Pre-dredging Bulk Analyses
March 15, 1988	Pre-dredging Bulk Analyses
April 7, 1989	Pre-dredging Bulk Analyses
July 20, 1993	Pre-dredging Bulk Analyses
September 1994	Toxicity and Bioaccumulation Assmnt.
February 2, 1995	Pre-dredging Bulk Analyses

The results of the above testing indicated that the material was suitable for offshore placement without special management conditions.

VII. Anticipated Site Use

The maintenance dredging frequency for the widened project is estimated to be once every 14 months, with an average of approximately 1.98 mcy of maintenance dredge material to be placed at the existing maintenance ODMDS. Presently, the maintenance ODMDS receives on the average of 1.98 mcy of maintenance dredged material at a frequency of once every 10 months.

The new work construction project will generate approximately 2.9 mcy of virgin material to be placed within the proposed virgin material ODMDS previously designated by EPA for the one-time placement of up to 5.1 mcy of virgin dredged material for the 45-ft channel project.

Currently, no beneficial use of material dredged from Freeport Harbor is practiced. It is the policy of the Galveston District to require implementation of beneficial uses of dredged material, wherever practicable. However, the DMMP working group examined various beneficial uses of dredged material placement but did not identify any practicable alternatives.

VIII. Special Management Conditions or Practices

Currently, no special management conditions or practices related to placement of dredged material into the designated ODMDS have been required. As previously discussed, evaluations of sediment quality have indicated that the material from the channel is suitable for offshore placement without such requirements.

IX. Monitoring Program

The primary purpose of the Site Monitoring Program is to evaluate the impact of the placement of dredged material on the marine environment resulting from the redesignation of the historic virgin material ODMDS for one-time use. Since the future maintenance material quantities are expected to be no more than the designation quantities for the maintenance ODMDS, the site monitoring program adopted during the original designation process will apply.

The evaluations will be used for making decisions which will prevent unacceptable adverse effects beyond the site boundary, and will ensure regulatory compliance the proposed redesignation of the virgin material ODMDS. Emphasis will be placed on determining physical impacts of the virgin dredged material generated by the Freeport Harbor Widening project, since to date, the dredged material from the Freeport Harbor Widening Project has been determined to be acceptable for ocean placement, without special conditions.

The size and location of the Freeport Harbor virgin material ODMDS was determined pursuant to the General Criteria as listed in 40 CFR 228.5, and the Specific Criteria at 40 CFR 228.6(a). There are no significant environmental resources delineated within or immediately outside of the designated ODMDS. Since this site is dispersive in nature, the primary concern of the use of this site is the potential short-term build up of dredged material, such that a hazard to navigation is presented. Another concern is whether there is significant short-term transport of the dredged material beyond the ODMDS boundary, specifically, the benthic community can be impacted if significant rapid movement of material off the site occurs, resulting in burial of benthic populations outside the ODMDS.

The Site Monitoring Program is designed as a hypothesis testing, tiered program. If initial tier results fail predetermined limits (i.e., the null hypothesis is rejected), then a more complex set of tests are invoked at the next tier to determine the extent of impact. The tiers are used to facilitate rapid, accurate and economical collection of information for use by the EPA, Region 6 and the USACE, GD. The tiered hypothesis testing for these factors is described below.

TIER l - NULL HYPOTHESIS (Ho).

Deposited dredged material is not mounding to elevations greater than 5.0 feet above the existing bottom elevation; and there is no short-term transport of material beyond the limits of the ODMDS.

Hypothesis Testing

Hydrographic surveys will be obtained before the start of disposal operations, and upon completion of disposal operations.

The ODMDS is located outside of the safety fairway for large vessel traffic, therefore, the mounding will be considered in regard to shallow-draft vessels, only. Considering the grain-size characteristics of typical maintenance dredged material from this channel, significant mounding is not expected subsequent to discharge operations. The threshold elevation for mounding of dredged material within the ODMDS will be 5.0 feet above the existing bottom elevation.

Since the site is dispersive, movement of material from the site is expected to occur after completion of disposal operations. The post-disposal surveying will serve only to detect if the short-term movement of the material out of the designated ODMDS is occurring at a significant rate.

Studies have shown that benthic organisms can burrow through 6-9 inches of dredged material without significant impacts on the community. Therefore, a depth of 1.0 foot of sedimentation along the ODMDS boundary will be considered the threshold level for movement of material outside of the designated ODMDS.

Management Options

If the Null Hypothesis is satisfied at the completion of disposal operations, further post-disposal

monitoring will not occur.

If mounding, and/or movement of material out of the ODMDS have occurred, as determined by the post-dredging survey, the Null Hypothesis will be rejected, and the monitoring program will proceed to Tier 2.

TIER 2-H_o

Deposited dredged material is not mounding to elevations greater than 10.0 feet above the existing bottom elevation; and/or there is no significant short-term transport of material beyond the limits of the ODMDS.

Hypothesis Testing

If transport of material from the site is occurring, hydrographic surveys will be expanded to include the impacted areas and will be performed on a semi-annual basis to determine the changes in dispersion of the material until the impacts no longer occur. A depth of more than 1.0 foot of sedimentation along the ODMDS boundary will be considered the threshold level for significant movement of material outside of the designated ODMDS.

Management Options

If the Null Hypothesis is satisfied at the completion of disposal operations, semi-annual post-disposal monitoring will occur as described.

If significant mounding, and/or significant movement of material out of the ODMDS have occurred, as determined by the after-dredging surveys, the Null Hypothesis will be rejected, and the USACE, GD together with EPA Region 6 will consider various management options to rectify the situation. Such options could include, but are not limited to: Designation of sequential discharge points; Expansion of the ODMDS; or Relocation of the ODMDS within the zone of siting feasibility described in the designation EIS.

Data Collection

Hydrographic surveys will be conducted along transects within the ODMDS. These transects will be oriented perpendicular to the channel in the direction of sediment transport (i.e., southwest). Transect intervals will be every l,000 feet extending 1,000 feet outside each boundary. In addition, a depth profile will be obtained along the boundary.

Surveys will be obtained using a Corps of Engineers, or contract survey vessel equipped with electronic surveying capabilities. The vessel is equipped with microwave positioning equipment that has a horizontal precision of 1 ft. The fathometer, which will display real time depth on real time location, has a precision of 0.5 ft. All data will be collected using methodology described in Engineer Manual EM 1110-2-1003, dated February 28, 1991.

X. Site Management Plan Review and Revision

Pursuant to Section 102(c) of the MPRSA, as amended by WRDA 1992, the site management plan for the Freeport Harbor ODMDS will be reviewed and revised, if necessary, not less frequently than 10 years after adoption and every 10 years, thereafter.

Modifications or updates to the site management plan may be necessary, based on specific needs identified for specific authorized projects. Modifications or updates to the site management plan may be proposed by either the USACE, GD or EPA Region 6. Following a thirty (30) day review period of the changes(s), the modifications may be incorporated into the plan by mutual consent of both agencies.

This Site Management Plan complies with Section 102(c)(3) of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. Sections 1401, et seq.) as amended by Section 506 of the Water Resources Development Act of 1992 (WRDA 92; Public Law 102-580), and has been approved by the following officials of Region 6 of the U.S. Environmental Protection Agency, and Galveston District of the U.S. Army Corps of Engineers. This plan goes into effect upon the date of the last signature:

Richard E. Greene
Regional Administrator
U.S. Environmental Protection Agency,
Region 6

Date

Arthur J. Janecka
Deputy District Engineer and
Chief, Project and Programs Management Division
U.S. Army Corps of Engineers, Galveston District

Date

Appendix D

Freeport Jetty Channel Widening
North Jetty Stability Analysis

FREEPORT JETTY CHANNEL WIDENING NORTH JETTY STABILITY ANALYSIS

Freeport, Texas

Prepared for

ConocoPhillips

Prepared by

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

J200.40233

June 2005

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INTRODUCTION

1.0 AUTHORIZATION

This study was authorized by Captain Kurt M. Hallier with ConocoPhillips on behalf of Port Freeport, the users of the deepwater ship channel, and the Brazos River Pilots Associations.

2.0 PURPOSE AND SCOPE

Presently, strong longshore currents make it difficult for a large ship to enter the Port Freeport Jetty Channel. Transitioning from a strong longshore current to the lack of significant cross current between the jetties is problematic with the existing 400-ft wide channel. Pilots feel that expanding the jetty channel from the current 400-ft width to 600 ft will provide the additional space necessary to accommodate the steering maneuvers required to make this transition. Presently, larger vessels are not allowed to enter the channel when the longshore current exceeds 0.5 knots or the wind exceeds 20 knots. The additional channel width should eliminate this restriction and ease vessel traffic limitations at Port Freeport.

Discussions with users of the Port have centered on widening the channel to the north. The existing south toe of the channel would remain in the same location and the north toe of the channel would move 200 ft to the north. This northern toe movement raises questions about the stability of the existing jetty structure and the effects of dredging on surrounding features.

This study was authorized in order to investigate channel layout options and evaluate the effect of the new channel width on the stability of the existing north jetty. The south jetty stability is not considered, because the south toe of the existing channel would not move under the above described scenario.

The purpose of this project was to:

- Develop desktop rectified aerial layouts of the existing channel alignment.
- Develop layouts for channel widening alternatives.
- Overlay widened channel layouts on aerial backgrounds.
- Develop channel cross-sections depicting past, current and proposed dredging templates and bottom elevations based on USACE data.
- Coordinate with Fugro Consultants (Fugro) in decisions concerning locations, extent and conditions to be analyzed for stability analysis cases. Review work by Fugro and incorporate their findings in our report.
- Provide guidance for costs comparisons between various dredging alternatives.
- Prepare a report outlining widening issues and options. This report will recommend an alignment and discuss relative cost differences between the options. Fugro's report will be included as an appendix to this report.

- Review the Fugro report prior to finalization.
- This report is not intended to address dredged material placement or permitting issues but will address channel geometry modifications to ease maneuvering issues for ship traffic.

3.0 EXECUTIVE SUMMARY

3.1 Channel Widening Options

The original concept for widening the Freeport Ship Channel was to extend the north toe of the channel further to the north by as much as 200 ft. This northern movement would widen the existing 400-ft wide channel to a total width of as much as 600 ft. If analyses indicated that the stability of the jetty would be compromised, then less widening would be considered. It is desirable to not effect the area of material referred to as "the wall" and its growth of seagrasses and the shoreline revetment section installed between approximate Sta. 45+00 and the existing U.S. Coast Guard (USCG) station.

In continued discussions, the Brazos Pilots Association pushed for a full 600-ft wide channel from the entrance channel, through the jetty channel and extending to the lower turning basin. The largest obstacle to overcome with the full 600-ft width concept was the affect on the shoreline revetment section and shoreline from approximate Sta. 45+00 to the USCG station. The resulting side slope from this widening would require the removal and reinstallation of the revetment section and would move the shoreline northward on the order of 50 ft or greater.

A compromise was reached wherein the channel would be widened 200 ft to the north from Sta. 0+00 to Sta. 40+00 providing a 600-ft channel width. From Sta. 40+00 to Sta. 45+00, the channel width would transition from 600-ft total width to 550-ft total width. The channel would be widened to a minimum width of 550 ft from Sta. 45+00 to the lower turning basin. This layout removes a portion of "the wall" and a portion of the seagrasses, but, it preserves the shoreline revetment between approximate Sta. 45+00 and the USCG station.

3.2 Slope Stability Summary

Based on stability analyses performed by Fugro, the jetty structure and shoreline stabilization sections will not be adversely affected by the widening of the channel. Summary results taken from Fugro's jetty stability analysis study are summarized as follows:

Table 3.1 Slope Stability Summary

Location	Desired Factor of Safety		Computed Least Factor of Safety	
	Short term	Long term[1]	Short term[2]	Long term
Station 5+00	=1.3	=(1.3 – 1.5)	1.77	1.79
Station 20+00	=1.3	=(1.3 – 1.5)	1.87	1.60
Station 40+00	=1.3	=(1.3 – 1.5)	1.82	1.5
Station 55+00	=1.3	=(1.3 – 1.5)	1.67	1.38

Notes: 1. Refer to Fugro report for more detailed explanation.
2. A factor of safety of 1.5 was calculated for shallow slope sloughing for short term conditions.
3. See Fugro report, Appendix D, for detailed results.

3.3 Dredge Volumes

The authorized dredge depth for the Jetty Channel is -45 ft MLT plus 2 ft of advanced maintenance plus 2 ft of allowable overdepth (OD). This results in a required depth of -47 ft MLT plus 2 ft of OD. It has been the desire of the users to only dredge the necessary depth and not the portion for advanced maintenance. Volumes were calculated for both the -45-ft and -47-ft scenarios.

Although not part of the original scope, dredge volumes for the entrance channel (end of jetties to the seabar) were calculated. The authorized dredge depth for the Entrance Channel is -47 ft MLT plus 2 ft of advanced maintenance plus 2 ft OD. This results in a required depth of -49 ft MLT plus 2 ft OD. Entrance Channel volumes were calculated for dredge depths of -45 ft plus 2 ft OD and for -49ft plus 2 ft OD. Summaries of dredge volumes are as follows:

Table 3.2 Dredge Volume Summary

Reach	Dredge Depths	Required Depth (CY)	Required Depth (CY)	Total Volume (CY)
Jetty Channel	*-45 FT + 2 FT OD*	1,452,022	78,296	1,530,318
Entrance Channel	*-45 FT + 2 FT OD*	672,589	220,556	893,145
			Total	**2,423,463**
Jetty Channel	*-47 FT + 2 FT OD*	1,554,881	78,296	1,633,177
Entrance Channel	*-49 FT + 2 FT OD*	1,245,202	315,963	1,561,165
			Total	**3,194,342**

3.4 Implication for Federal Assumption of Maintenance

It is very likely that the section of the widened portion of the channel will have to match the adjacent federal section (authorized dredge depths) prior to assumption. Because of the magnitude of the potential cost deferment ($5.8 million), the issue of when this deepening should be done merits further scrutiny.

3.5 Other Considerations

Allowances have been made in the estimate of probable costs to cover the costs of mitigating seagrass removal and required modification of aids to navigation. Chemical testing of dredged materials has been performed and no impact on dredging or placement is expected.

3.6 Probable Construction Costs and Comparisons

Opinions of probable construction costs were developed on the basis of comparative values assuming that all of the dredged material is placed offshore and that there is no fee required for disposal. Possible means of material removal are hydraulic cutter head dredge, hopper dredge, and/or clamshell dredge and scow. We recommend that dredging be permitted such that dredging contractors can select the most suitable and most economical dredge method(s) for this project based n their experiences and available equipment.

Our opinion of probable cost for dredging, depending on the initial dredge depth selected, is as follows:

Table 3.3 Opinions of Probable Construction Costs

Reach	Dredge Depths	Total Dredged Volume (CY)	Construction Cost
Jetty Channel	*-45 FT + 2 FT OD*	1,530,318	$21,100,000
Entrance Channel	*-45 FT + 2 FT OD*	893,145	
Jetty Channel	*-47 FT + 2 FT OD*	1,633,177	$27,000,000
Entrance Channel	*-49 FT + 2 FT OD*	1,561,165	

Note: Costs for removing existing debris or wrecks are not included in these costs.

THE REPORT

4.0 BACKGROUND

Presently, strong longshore currents make it difficult for a ship to enter the Port Freeport Jetty Channel. Transitioning from a strong longshore current to the lack of significant cross current between the jetties is problematic with the existing 400-ft wide channel. Pilots feel that expanding the jetty channel from the current 400-ft width to 600 ft will provide the additional space required to accommodate the steering maneuvers required to make this transition. Presently, larger vessels are not allowed to enter the channel when the longshore current exceeds 0.5 knots or the wind exceeds 20 knots. The additional channel width should eliminate this restriction and ease vessel traffic limitations at Port Freeport.

The U.S. Army Corps of Engineers (USACE) is currently evaluating widening the channel to 600 ft as well as deepening the current channel depth to as deep as elevation -60 ft. Initially, the USACE is proposing to widen the channel 150 ft to the north and 50 ft to the south. Port Freeport and the users of the port have expressed a desire to cooperate with and support the proposed USACE evaluation as much as practical, as it parallels this study.

The major concerns are relative to the stability of the new underwater dredged slopes as well as the overall stability of the existing north jetty, which will be closer to the proposed side slopes. Also, widening of the channel to the north could have adverse effects on the shoreline area, surface drainage, and existing stone shoreline protection system located between about Sta. 40+00 and Sta. 63+35.

4.1 Existing Channel Alignment and North Jetty Information

Existing land and channel features used for the study were provided by the USACE Drawing No. "NAD83BASE.DGN". The accuracy of the provided features was investigated using Navigation Charts and the following USACE record plans:

- Project Title "Construct 3,700 Feet of North Jetty and Remove Existing North Jetty", File No. 515-67, March 1987;
- Project Title "Dredge Entrance Channel Sta. -230+00 to Sta. +50+35.91", File No. 501-398, January 1990; and
- Project Title "South Jetty Rehabilitation – North Jetty Extension", File No. BRAZ 501-400, November 1990.

4.2 Aerial Photograph

The aerial photograph used for the evaluation was taken by Lanmon Aerial Photography, Inc. on August 6, 2003 (see E1). Fieldwork was performed to gather location data in order to rectify the aerial photograph to existing features such as street intersections and other visual markers. Although the entire limits of the aerial photograph were not completely rectified, the portions that include areas covered by this report were surveyed in order to adjust the scale of the layout.

4.3 Hydrographic Data

The jetty channel cross-sections included for this evaluation were generated from Shiner Moseley's hydrographic survey performed on October 10, 2004 (see E2). The generated channel cross-sections compared adequately with the USACE generated channel sections. The USACE channel cross-sections were generated from ASCII xyz survey data file, which was the result of surveys performed by the USACE in 2003. The USACE data was used to calculate dredge volumes for the entrance channel.

5.0 FULL CHANNEL WIDENING ALTERNATIVE

From a navigation point of view, the most desirable alternative would be to increase the existing 400-ft channel width to 600 ft beginning at Sta. 0+00 and extending all the way into the lower turning basin (near the existing USCG station). The proposed channel widening from Sta. 0+00 to Sta. 52+00 will be 200 ft. However, the channel widening from Sta. 52+00 to Sta. 63+35 would be 128 ft since the existing channel width to the north of the channel centerline is 272 ft (the channel is currently 472 ft wide in this area).

Widening between Sta. 40+00 and the USCG station will have impacts on existing seagrasses and existing shorelines. These areas have emergent and shallow areas adjacent the channel, some of which support seagrass growth. Dredging these areas will remove a portion of the seagrass and require that the existing shoreline revetment be removed and relocated to the north. Determination of property ownership and discussions with the city of Surfside would need to be scheduled to explore this option. Due to shoreline impacts, drawings were not prepared for this option.

6.0 PARTIAL CHANNEL WIDENING ALTERNATIVES

6.1 Partial Channel Widening 400 Ft to 600 Ft Option

This alternative entails increasing of the existing channel width from 400 ft to 600 ft beginning at Sta. 0+00 and ending at Sta. 38+00. The proposed channel widening will be 200 ft in the direction of the north jetty. Thereafter, the proposed widened channel width will transition from 600 ft in width at Sta. 38+00 to tie into the existing channel width at Sta. 43+00; i.e. transition the additional north side channel width from 200 ft to 0 ft. The proposed length of the transition is 500 ft.

As a result of ongoing discussions with the Brazos Pilots, this option was considered not adequate by the Pilots and abandoned.

6.2 Partial Channel Widening 550 Ft to 600 Ft Option

This alternative entails increasing of the existing channel width from 400 ft to 600 ft beginning at Sta. 0+00 and ending at Sta. 40+00 (see E3 and E4). The proposed channel widening will be 200 ft in the direction of the north jetty. Thereafter, the proposed widened channel will transition from 600 ft in width at Sta. 40+00 to 550 ft in width at Sta. 45+00. The proposed 550-ft channel width will be constant and will end at Sta. 63+46.

The layout of this channel widening option is included in Appendix A along with channel cross-sections showing dredge depth of -45 ft + 2 ft OD. Dredge volumes were calculated using the double end area method and using three-dimensional computer models. Since overdepth calculations were straight forward, manually calculated overall depth volumes were added to computer generated prism volume to obtain total dredge volumes. Tables in Appendix B show calculated dredge volumes by both methods. The summary dredge volumes for the minimum required depth and for the authorized depths are as follows:

Table 6.1 Dredge Volume Summary

Reach	Dredge Depths	Required Depth (CY)	Required Depth (CY)	Total Volume (CY)
Jetty Channel	*-45 FT + 2 FT OD*	1,452,022	78,296	1,530,318
Entrance Channel	*-45 FT + 2 FT OD*	672,589	220,556	893,145
			Total	**2,423,463**
Jetty Channel	*-47 FT + 2 FT OD*	1,554,881	78,296	1,633,177
Entrance Channel	*-49 FT + 2 FT OD*	1,245,202	315,963	1,561,165
			Total	**3,194,342**

7.0 UNDERWATER DREDGE SLOPE AND NORTH JETTY STABILITY

Fugro performed all of the slope stability analyses in accordance the USACE guidelines presented in EM 1110-2-2904, "Design of Breakwaters and Jetties", 8 August 1986 and EM 1110-2-1902, "Slope Stability", 31 October 2003.

Fugro completed slope stability analyses on widened channel cross-sections at Sta. 55+00, Sta. 40+00, Sta. 20+00, and Sta. 5+00 with 3 (horizontal) on 1 (vertical) underwater dredge slope configuration as provided by Shiner Moseley. The slope stability analyses yielded factors of safety of 1.3 and greater for short-term and 1.3 to 1.5 or greater for long-term conditions as shown in table 7.1. Additionally, the stability of 4 (horizontal) on 1(vertical) underwater dredge slope was analyzed at Sta. 40+00, Sta. 20+00, and Sta. 5+00 and yielded factors of safety of 1.3 and greater for short-term and 1.3 to 1.5 and greater for long-term loading conditions in each case.

Table 7.1 Slope Stability Summary

Location	Desired Factor of Safety		Computed Least Factor of Safety	
	Short term	Long term[1]	Short term[2]	Long term
Station 5+00	=1.3	=(1.3 – 1.5)	1.77	1.79
Station 20+00	=1.3	=(1.3 – 1.5)	1.87	1.60
Station 40+00	=1.3	=(1.3 – 1.5)	1.82	1.5
Station 55+00	=1.3	=(1.3 – 1.5)	1.67	1.38

Notes: 1. Refer to Fugro report for more detailed explanation.
2. A factor of safety of 1.5 was calculated for shallow slope sloughing for short term conditions.
3. See Fugro report, Appendix D, for detailed results.

Fugro's final report is included in Appendix D.

8.0 AIDS TO NAVIGATION

The existing channel centerline has range markers at the end of the entrance and jetty channel reach. The front range has an optical height of 40 ft and is located just offshore of a dredged material disposal area seaward of the intracoastal and on the north side of the ship channel. The rear range has an optical height of 148 ft and is located on Dow Chemical property adjacent to a drainage ditch. The line of site of the centerline and the ranges pass almost over a turning dolphin at a Dow Chemical ship dock. This dock is capable of berthing large tankers with high freeboards and bridges with high air drafts that could interfere with line of sight.

Moving the existing ranges 100 f in a northerly direction to reflect the new channel centerline, will make the line of site pass through a tanker at the Dow facility. The air draft of the tanker will necessitate taller towers when these range markers are moved. Discussions with the Pilots, USCG, Port Freeport, and other users will be necessary to determine new designs and locations for the ranges. Other buoys will also probably have to be relocated. An amount of $500,000 has been included to cover the costs of these modifications.

Since this is a public waterway and is adjacent to a federal project (the existing ship channel), it may be possible for the USCG to make aids to navigation changes under their federal budget. It could also be that for that to take place, federal assumption of maintenance for the channel may have to be in place.

9.0 SEAGRASS REPLACEMENT

The channel widening project will eliminate a small amount of seagrass that exists along the north bank of the ship channel between Sta. 38+00 and Sta. 45+00. Cost provisions have been included in the estimate of probable construction costs to mitigate the loss of this seagrass by reestablishing seagrass beds at the rate of 3:1 (relocated acreage:affected acreage). A suitable location will need to be determined for the relocation effort.

10.0 IMPLICATIONS FOR FEDERAL ASSUMPTION OF MAINTENANCE

It is our understanding that a primary objective is to get the federal government to assume the maintenance cost of the widened increment. This will require congressional action, which is being pursued by Port Freeport's representatives. Congress will normally closely consult with the USACE prior to any such authorization. It is very probable that the USACE will insist that the widened increment be dredged to the same depth as the adjacent federal section prior to the federal assumption of maintenance. Thus a key issue is whether or not the widened increment should be initially constructed to the same depth as the adjacent federal channel (jetty channel –45 ft + 2ft advanced maintenance + 2ft overdepth and entrance channel –47 ft + 2 ft advanced maintenance + 2ft overdepth) or should initial construction be to a lesser depth and then be deepened immediately prior to federal maintenance assumption. Because of the magnitude of the potential cost deferment ($5.8 million), this question merits further attention.

11.0 PROBABLE CONSTRUCTION COSTS

Opinion of probable construction costs are provided in Appendix C. Costs for both the -45 dredge depth and the -47/-49 (jetty channel / entrance channel) dredge depths have been presented. Costs for removing wrecks or other physical items from the area to be dredged have not been included. The existence of these items should be explored in subsequent detailed geophysical studies.

Dredging costs can fluctuate significantly due to the amount of dredging work in progress nationwide (how busy dredge contractors are), fuel costs fluctuation, and increased dredge volumes from the time initial estimates of volumes are made. Contingency amounts have been included in the opinion of costs for these items. Other costs that have been included are mitigation for disturbed seagrasses and modifications to aids to navigation.

Opinion of construction amounts for both depth options are as follows:

Table 11.1 Opinions of Probable Construction Costs

Reach	Dredge Depths	Total Dredged Volume (CY)	Construction Cost
Jetty Channel	*-45 FT + 2 FT OD*	1,530,318	$21,100,000
Entrance Channel	*-45 FT + 2 FT OD*	893,145	
Jetty Channel	*-47 FT + 2 FT OD*	1,633,177	$27,000,000
Entrance Channel	*-49 FT + 2 FT OD*	1,561,165	

Notes: Costs for removing existing debris or wrecks are not included in these costs.

12.0 SUMMARY AND CONCLUSION

The proposed widening of the Port Freeport entrance channel (end of jettys to the seabar) and the jetty channel (end of jetties to the lower turning basin) is being considered to ease navigation constraints due to longshore currents and winds when approaching the jetty channel. It is proposed that the entrance channel be widened 200 ft to the north providing a total 600-ft width. The recommended widening limits for the jetty channel are as follows:

Sta. 0+00 to Sta. 40+00.....widen 200 ft to the north for a total width of 600 ft

Sta. 40+00 to Sta. 45+00 .....widen to the north to transition from a width of 600 ft to 550 ft

Sta. 45+00 to Sta. 63+46.....widen to the north for total width of 550 ft

Volumes of material removed and resulting costs vary depending on the initial dredge depth selected. Dredge depth can either be selected based on the needed depth for the deepest draft ship or on the existing congressionally authorized depths and allowances for advanced maintenance and allowable overdepth. Selecting the shallowest needed dredge depths will result in the lowest initial construction cost. However, if it is desired to pursue legislation to include the widened channel under federal maintenance, it will probably be necessary to dredge to the authorized depth to establish a history of need for these depths and the need for federal maintenance assumption. If

federal assumption of maintenance is being contemplated, then federal assumption evaluation criteria should be investigated prior to making this decision.

NOTES

1. AERIAL PHOTOGRAPH SHOWN ON THIS SHEET WAS TAKEN BY LANMON AERIAL PHOTOGRAPHY, INC. ON 8/6/03.
2. CHANNEL FEATURES SHOWN WERE PROVIDED BY U.S. ARMY CORPS OF ENGINEERS DRAWING "NADBESBASE.DGN"

REV	DATE	DESCRIPTION	APP
0			

DR	FJM	03/05
CK		
PM		
DWG	GRAPHIC	
JOB #	40233-00-E1	
FILE #	200.40233.00	

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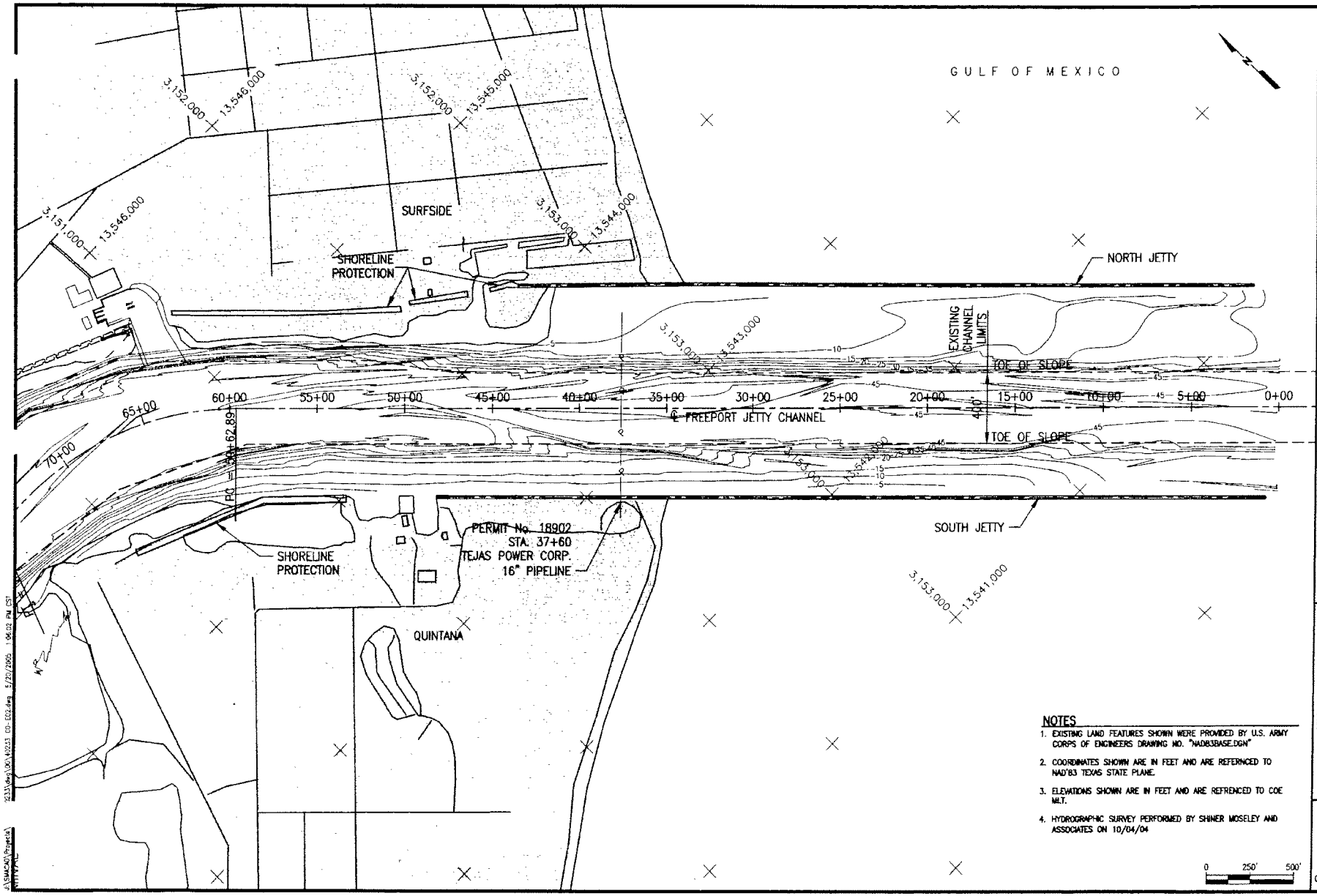
CONOCOPHILLIPS

FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS

FREEPORT TEXAS

EXISTING CHANNEL ALIGNMENT

SHEET E1 OF 11 REV 0



NOTES

1. EXISTING LAND FEATURES SHOWN WERE PROVIDED BY U.S. ARMY CORPS OF ENGINEERS DRAWING NO. "NAD83BASE.DGN"
2. COORDINATES SHOWN ARE IN FEET AND ARE REFERNCED TO NAD'83 TEXAS STATE PLANE.
3. ELEVATIONS SHOWN ARE IN FEET AND ARE REFRENCED TO COE MLT.
4. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

REV	DATE	DESCRIPTION	APP
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FN/BLJ 03/05
GRAPHIC
40233-00-E2
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Corpus Christi, Texas 78478

CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS

EXISTING CONDITIONS

SHEET E2 OF 11 REV 0

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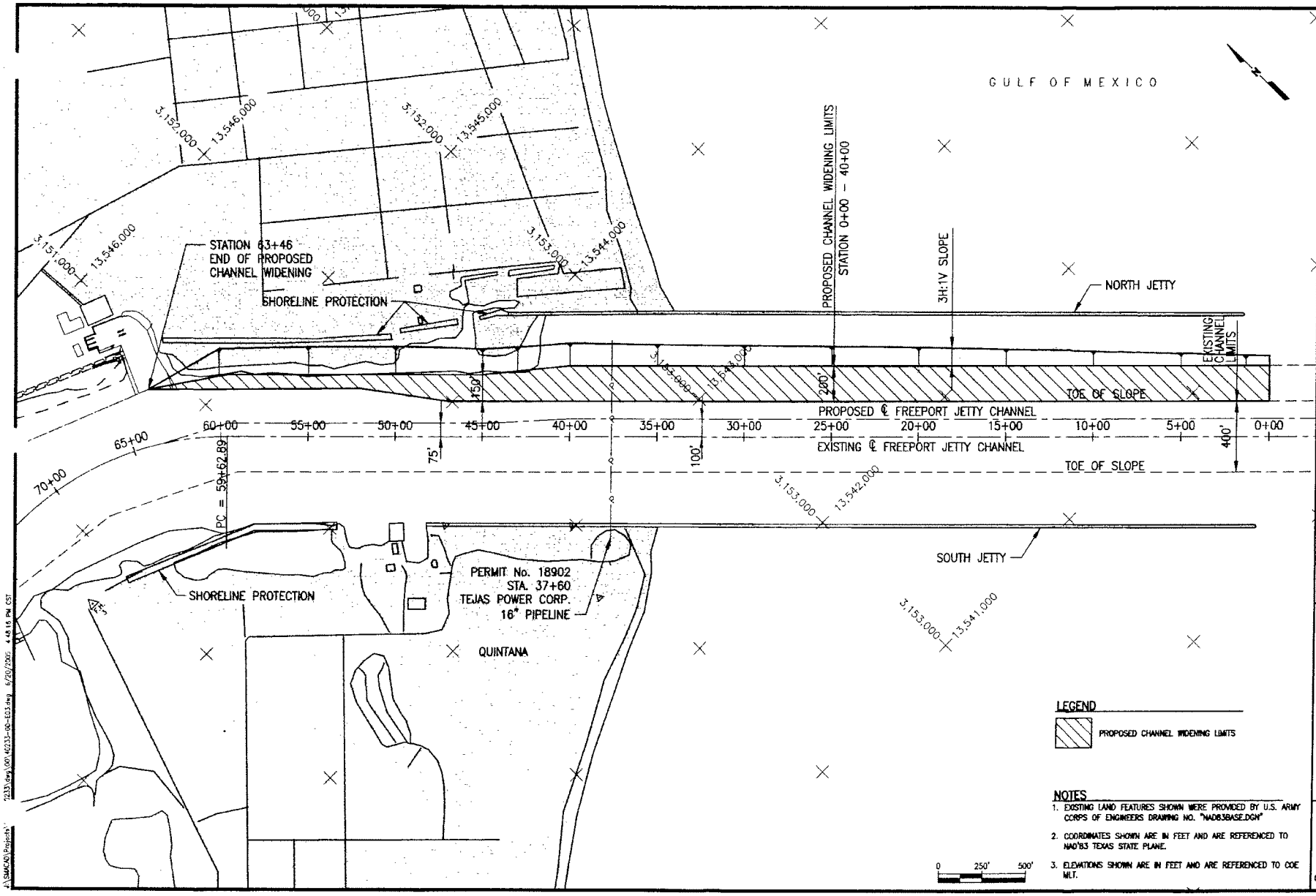

LEGEND

PROPOSED CHANNEL WIDENING LIMITS

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2. COORDINATES SHOWN ARE IN FEET AND ARE REFERENCED TO NAD'83 TEXAS STATE PLANE.
3. ELEVATIONS SHOWN ARE IN FEET AND ARE REFERENCED TO COE MLT.

REV	DATE	DESCRIPTION	APP
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FW/BJ 03/05 GRAPHIC 40233-00-E3 200.40233.00

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FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS

FREEPORT TEXAS

PROPOSED WIDENING PLAN

SHEET E3 OF 11 REV 0

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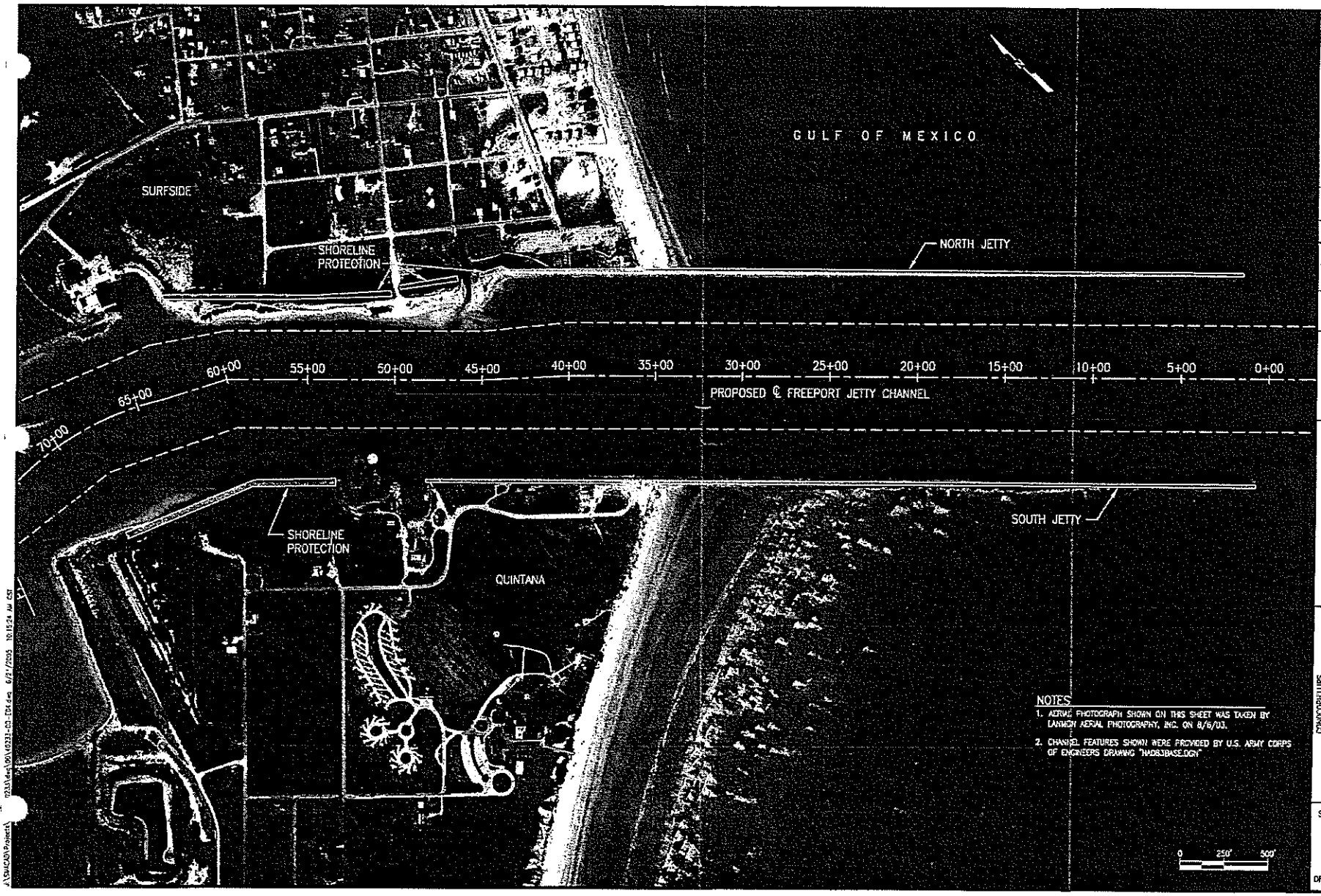

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2. CHANNEL FEATURES SHOWN WERE PROVIDED BY U.S. ARMY CORPS OF ENGINEERS DRAWING "NAD83BASE.DGN"

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DR.	CK.	APP.
FIELD BK.		GRAPHIC
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P#	200.40233.00	

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FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS

PROPOSED WIDENING PLAN AERIAL

SHEET E4 OF 11 REV 0

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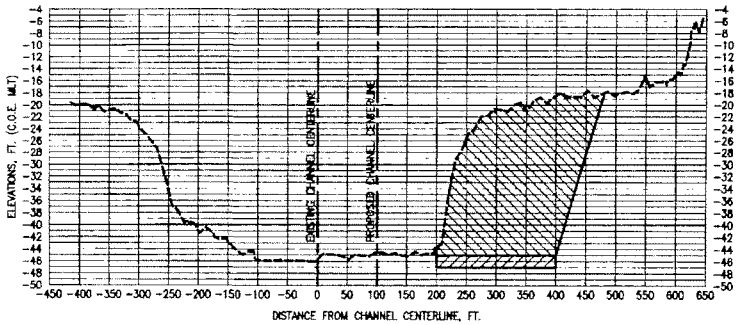

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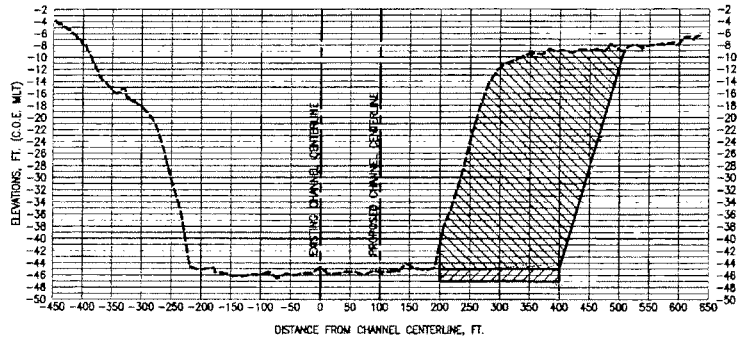

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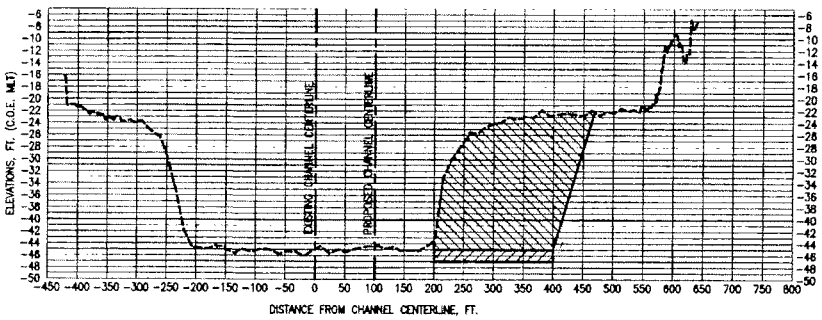

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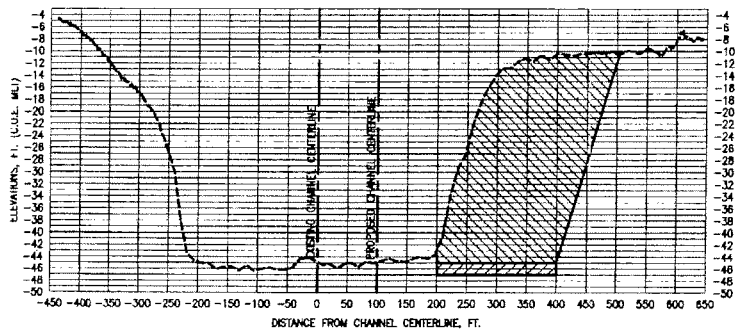

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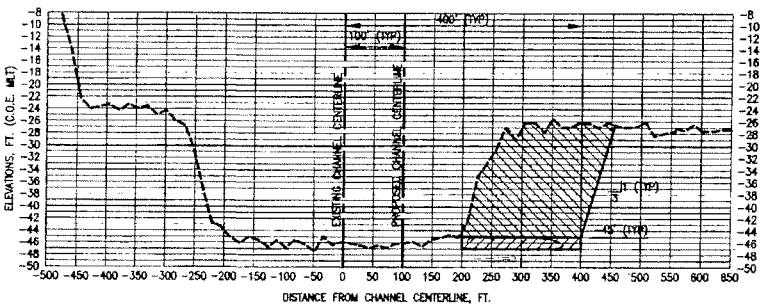

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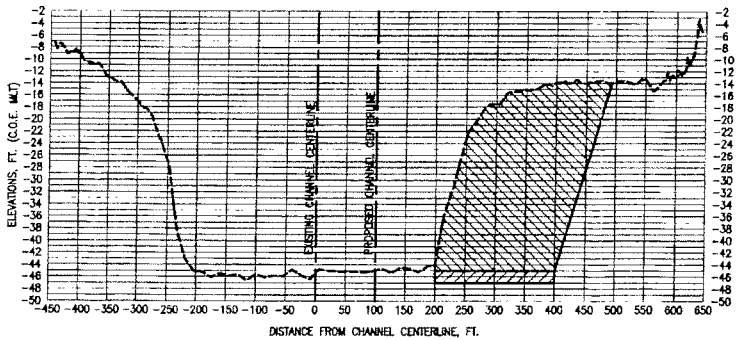

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NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

HORIZONTAL 0 100' 200' VERTICAL 0 10' 20'

REV	DATE	DESCRIPTION	APP
0			

FM/BLJ 03/05 GRAPHIC

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200.40233.00

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CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS

JETTY CHANNEL SECTIONS
STA. 0+00 - STA. 23+00

SHEET E5 OF 11 REV 0

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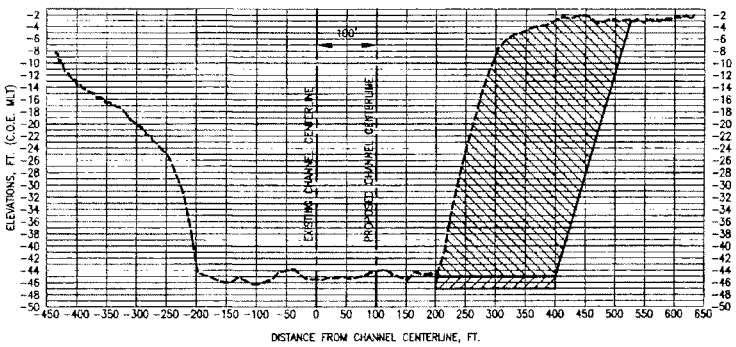

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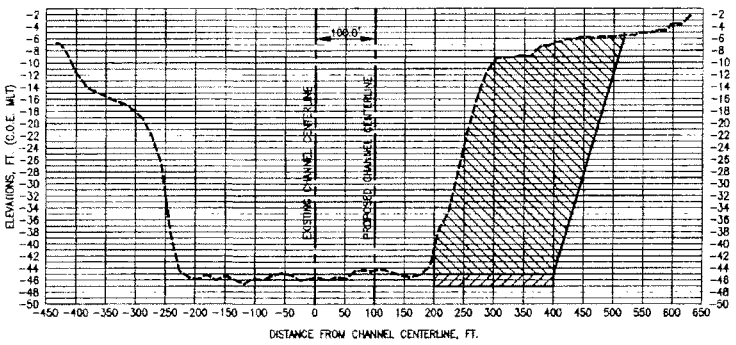

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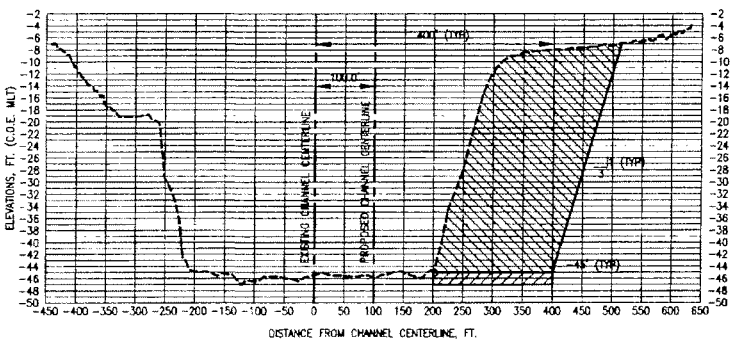

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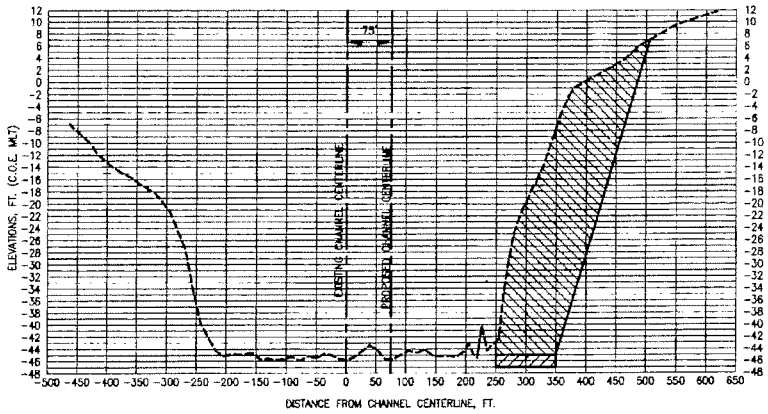

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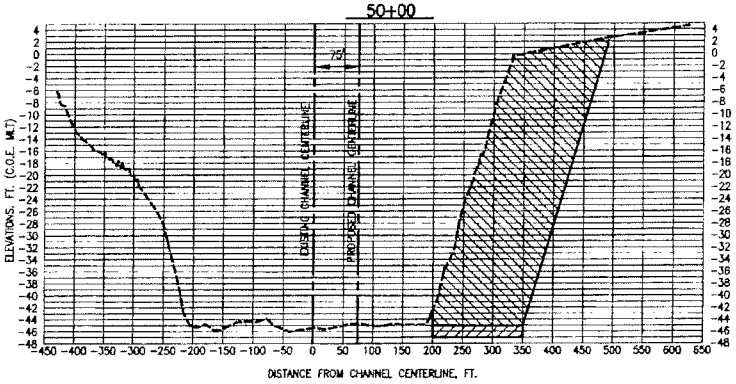

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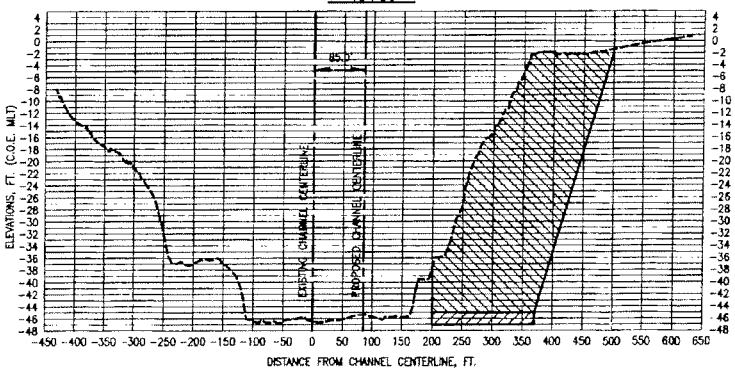

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NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

HORIZONTAL 0 100' 200'

VERTICAL 0 10' 20'

REV	DATE	DESCRIPTION	APP
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FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS

FREEPORT TEXAS

JETTY CHANNEL SECTIONS
STA. 30+00 - STA. 50+00

SHEET E6 OF 11 REV 0

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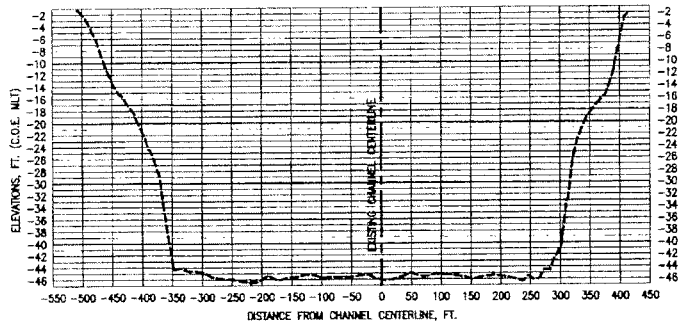

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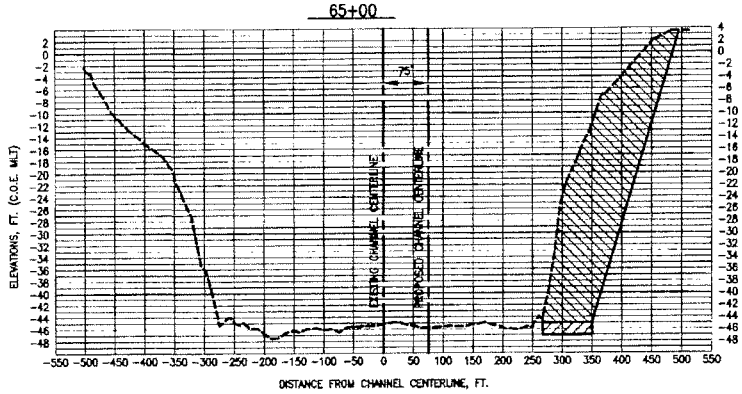

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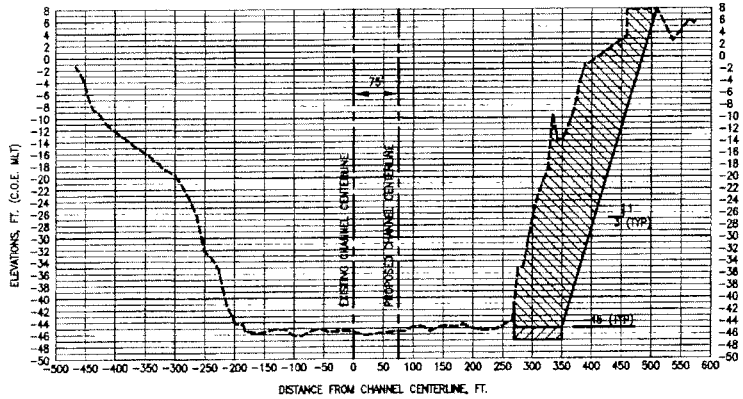

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NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

HORIZONTAL 0 100' 200'

VERTICAL 0 10' 20'

REV	DATE	DESCRIPTION	APP
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JOB 200.40233.00			

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FREEPORT TEXAS

JETTY CHANNEL SECTIONS
STA. 55+00 - STA. 65+00

SHEET **E7** OF 11 REV 0

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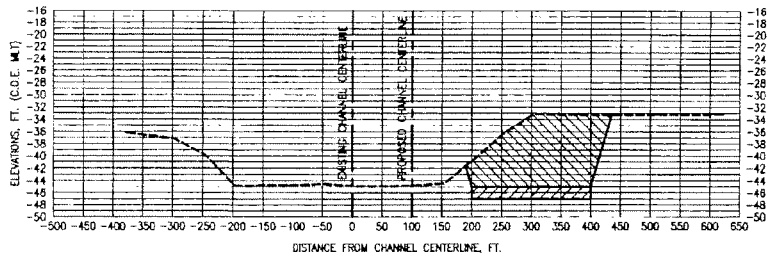

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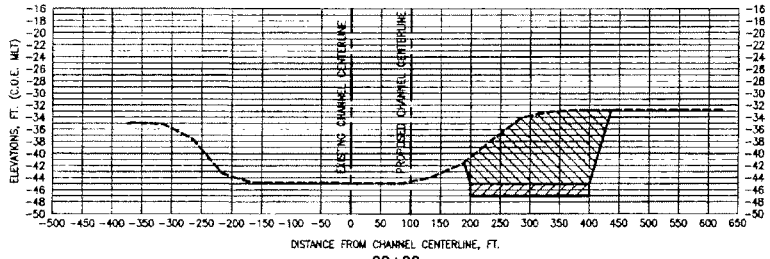

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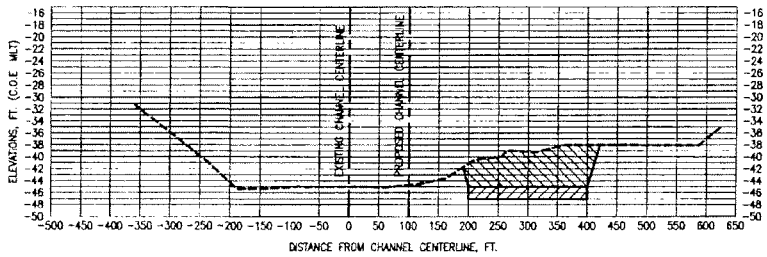

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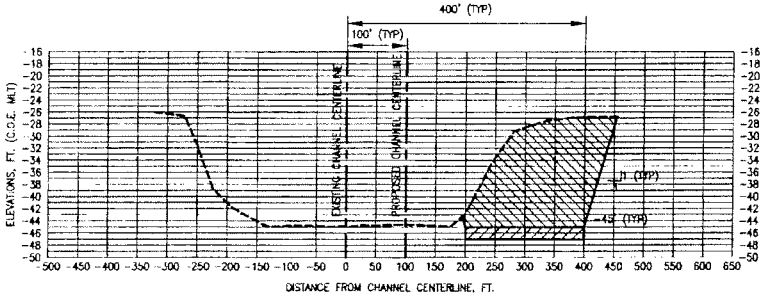

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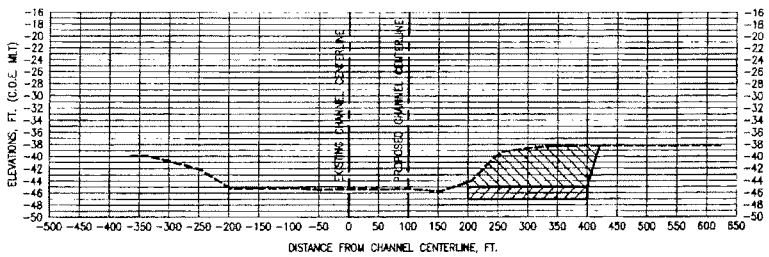

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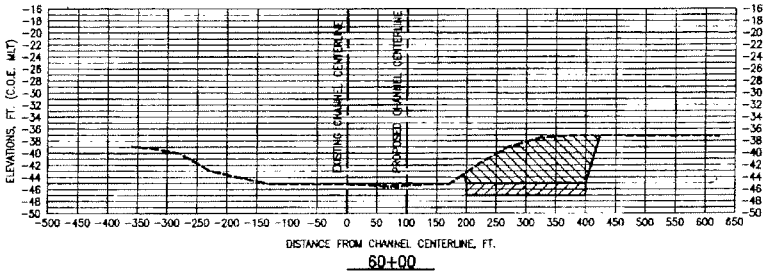

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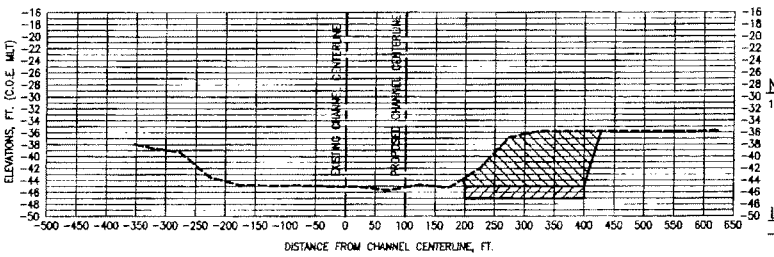

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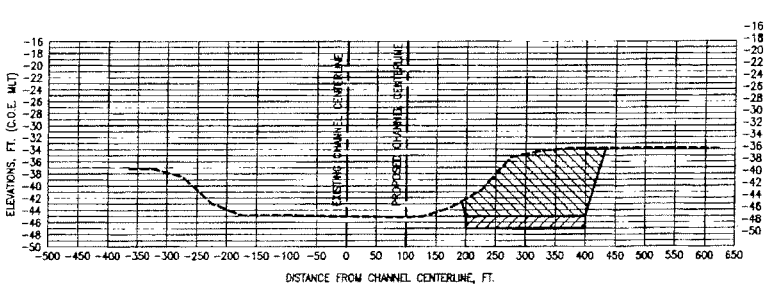

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NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

0 10' 20'
VERTICAL

0 100' 200'
HORIZONTAL

REV	DATE	DESCRIPTION	APP
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MS	FM	03/05
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PS		
CHK		GRAPHIC
SM		40233-00-E8
JM		200.40233.00

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FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS

ENTRANCE CHANNEL SECTIONS
STA. 0+00 - STA. 70+00

SHEET E8 OF 11 REV 0

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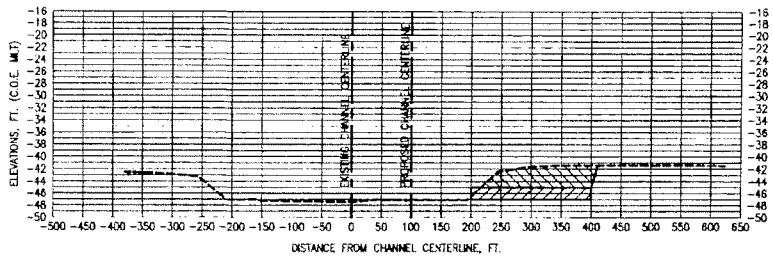

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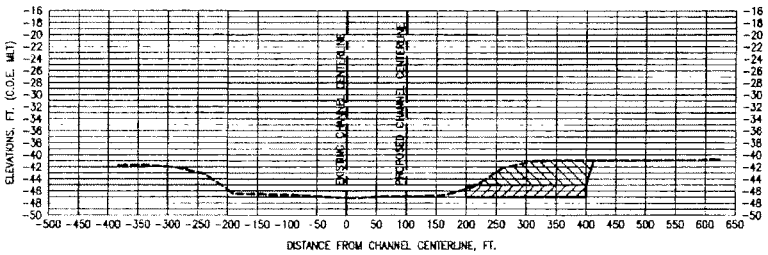

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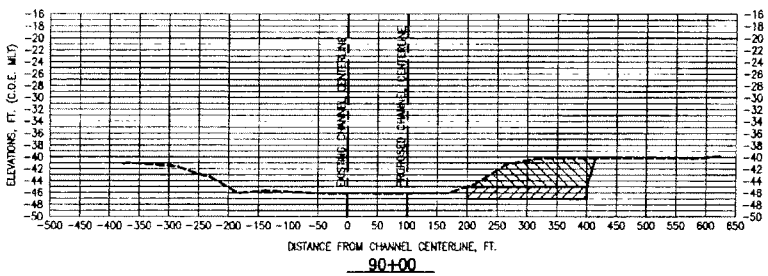

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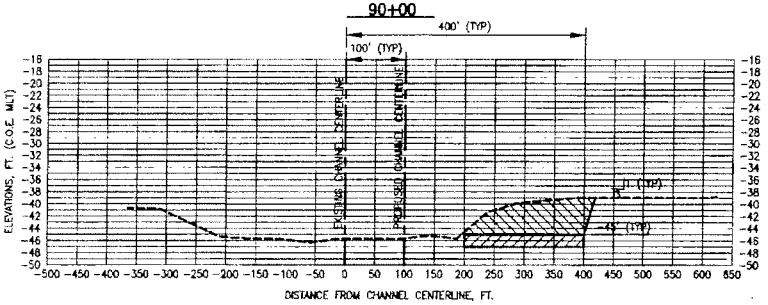

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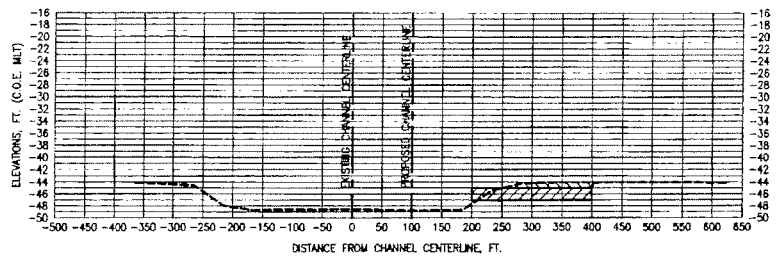

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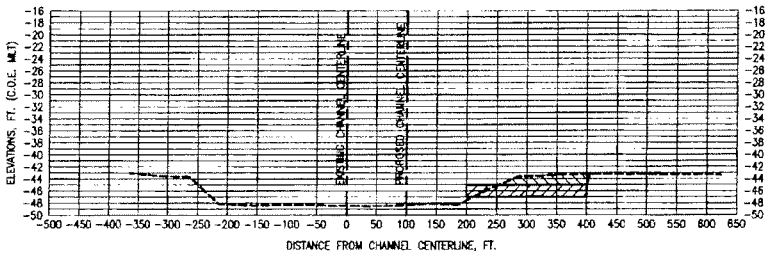

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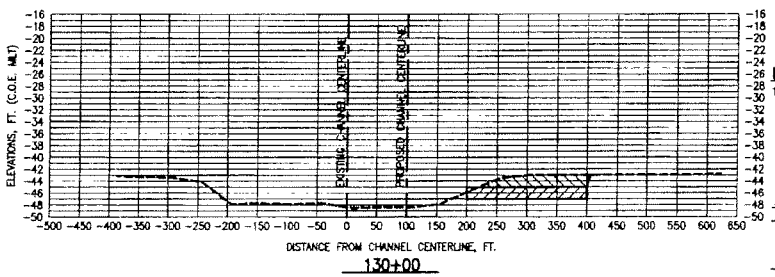

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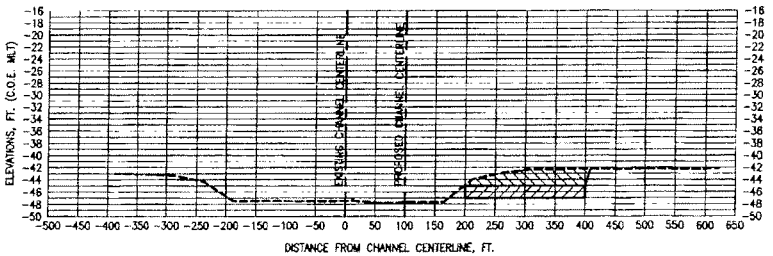

120+00

NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

0 10' 20' VERTICAL

0 100' 200' HORIZONTAL

REV	DATE	DESCRIPTION	APP
0			

FM 03/05

GRAPHIC

402.33-00-E9

200.40233.00

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS

FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS

FREEPORT TEXAS

ENTRANCE CHANNEL SECTIONS
STA. 80+00 - STA. 150+00

SHEET E9 OF 11 REV 0

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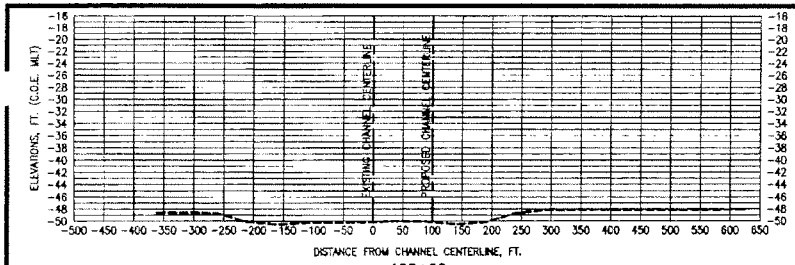

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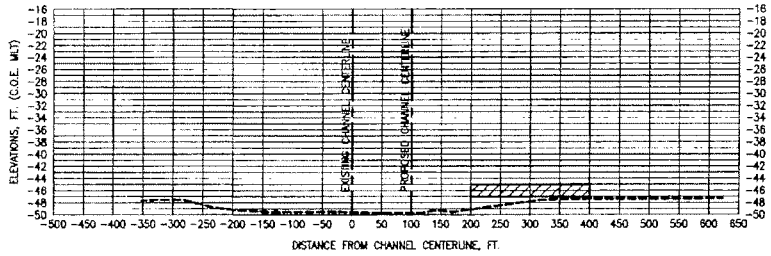

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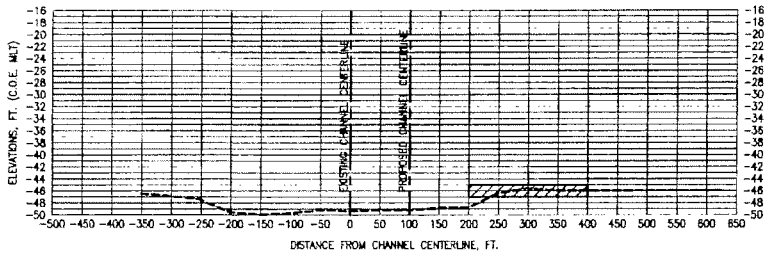

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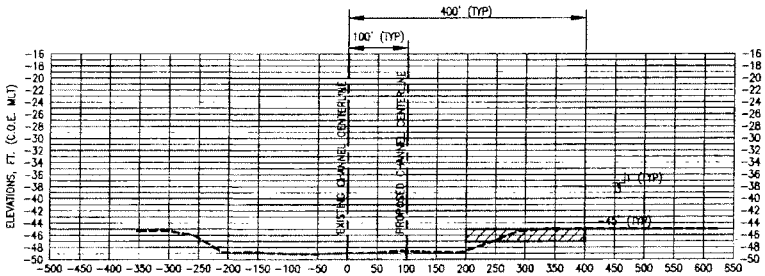

160+00

NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

0 10' 20'
VERTICAL

0 100' 200'
HORIZONTAL

REV	DATE	DESCRIPTION	APP
0			

FM	03/05	
		GRAPHIC
		40233-00-E10
		200.40233.00

SHINER, MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS

FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS

ENTRANCE CHANNEL SECTIONS
STA. 160+00 - STA. 190+00

SHEET
E10
OF 11 REV 0

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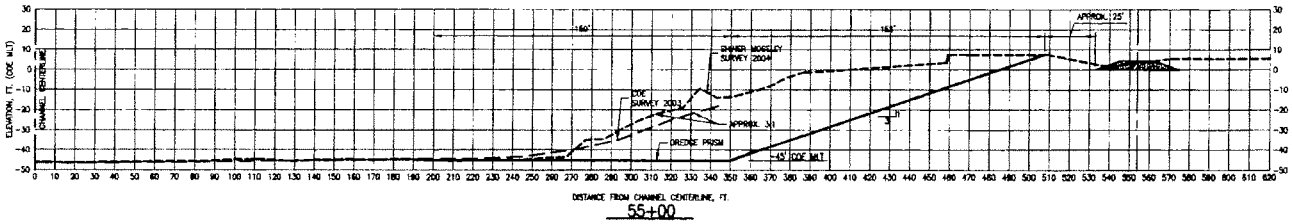
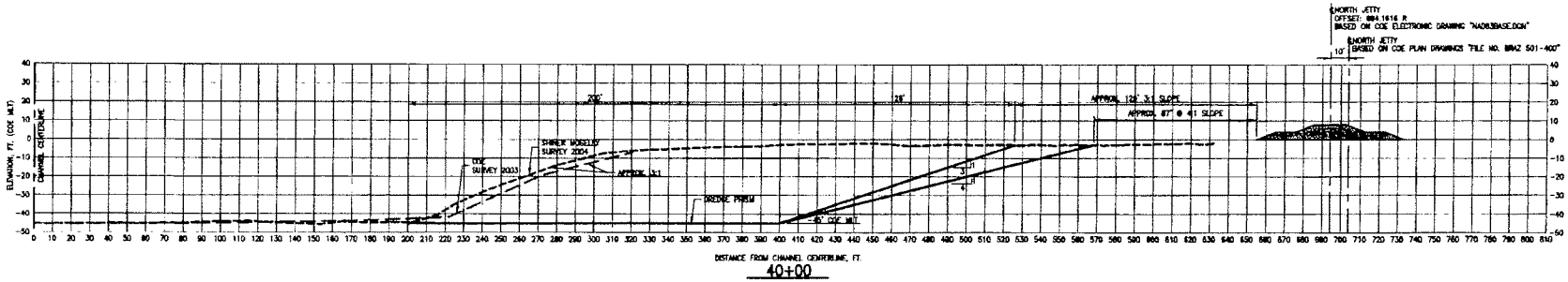


55+00



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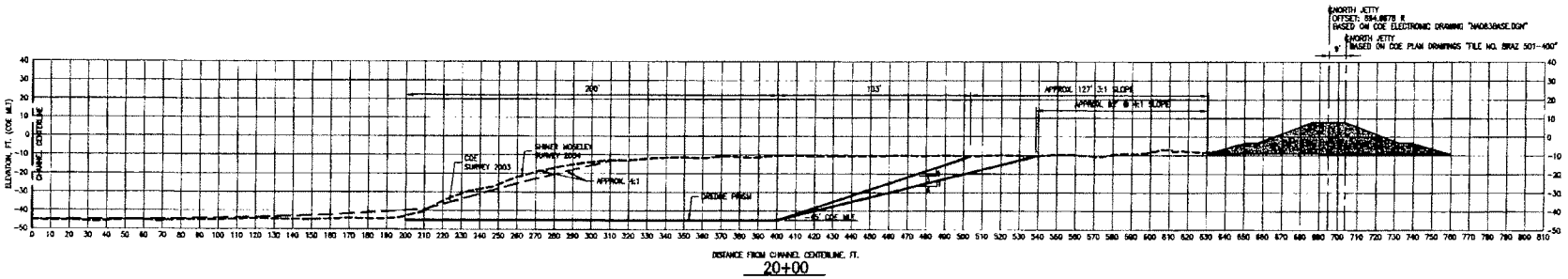
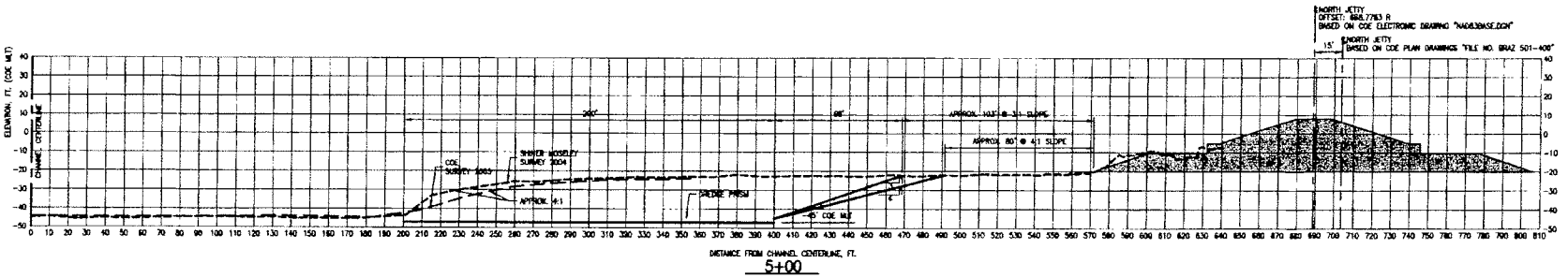


20+00



5+00

0 3' 6'
VERTICAL
0 30' 60'
HORIZONTAL

REV	DATE	DESCRIPTION	APP
0			

FM 03/05
GRAPHIC
40233-00-E11
200.40233.00

SHINER MOSELEY AND ASSOCIATES, INC.
CONSULTING ENGINEERS & CONSULTANTS
555 North Carancahua, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS
SIDE SLOPE SECTIONS
STA. 5+00, 20+00, 40+00, & 55+00

SHEET E11 OF 11 REV 0

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Table B.1: Jetty Channel Dredge Volumes Dredge Depth -45ft x 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		3,472		400	
	500		75,741		7,407
5+00		4,708		400	
	500		92,389		7,407
10+00		5,270		400	
	500		107,926		7,407
15+00		6,386		400	
	500		125,981		7,407
20+00		7,220		400	
	500		136,852		7,407
25+00		7,560		400	
	500		139,750		7,407
30+00		7,533		400	
	500		144,380		7,407
35+00		8,060		400	
	500		151,481		7,407
40+00		8,300		400	
	300		85,550		4,111
43+00		7,099		340	
	200		52,585		2,370
45+00		7,099		300	
	500		111,083		4,630
50+00		4,898		200	
	500		90,991		3,352
55+00		4,929		162	
	500		87,259		3,037
60+00		4,495		166	
	500		41,620		1,537
65+00		0		0	
		Subtotal	1,443,589		78,296
				TOTAL	1,521,885
				COMPUTER GENERATED VOLUME	1,452,022 CY
				ALLOWABLE OVERDEPTH VOLUME	78,296 CY
				TOTAL VOLUME	1,530,318 CY (+0.55%)

Table B.2: Entrance Channel Dredge Volume Dredge Depth -45ft + 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		3,124		380	
	400		40,541		5,630
4+00		2,349		380	
	200		17,881		2,815
6+00		2,479		380	
	400		31,556		5,630
10+00		1,781		380	
	400		31,185		5,630
14+00		2,429		380	
	200		17,222		2,815
16+00		2,221		380	
	400		33,148		5,630
20+00		2,254		380	
	400		32,333		5,630
24+00		2,111		380	
	200		15,670		2,815
26+00		2,120		380	
	400		30,200		5,630
30+00		1,957		380	
	400		29,030		5,630
34+00		1,962		380	
	200		14,459		2,815
36+00		1,942		380	
	400		28,548		5,630
40+00		1,912		380	
	400		25,793		5,630
44+00		1,570		380	
	200		12,204		2,815
46+00		1,725		380	
	400		24,296		5,630
50+00		1,555		380	
	400		22,407		5,630
54+00		1,470		380	
	200		10,115		2,815
56+00		1,261		380	
	400		19,459		5,556
60+00		1,366		370	
	400		18,481		5,556
64+00		1,129		380	
	200		8,363		2,778
66+00		1,129		370	
	400		16,689		5,556
70+00		1,124		380	
	400		16,644		5,630
74+00		1,123		380	
	200		7,911		2,815
76+00		1,013		380	
	400		13,778		5,556
80+00		847		370	
	400		10,970		5,481
84+00		634		370	
	200		4,770		2,741
86+00		654		370	
	400		10,096		5,481

Table B.2: Entrance Channel Dredge Volume Dredge Depth -45ft + 2ft Overdepth

STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
90+00		709		370	
	400		10,948		5,481
94+00		769		370	
	200		5,381		2,741
96+00		684		370	
	400		10,207		5,481
100+00		694		370	
	400		8,867		5,556
104+00		503		380	
	200		3,970		2,778
106+00		569		370	
	400		7,756		5,556
110+00		478		380	
	400		6,570		5,630
114+00		409		380	
	200		2,719		2,741
116+00		325		360	
	400		6,096		5,407
120+00		498		370	
	400		6,096		5,407
124+00		325		360	
	200		2,704		2,741
126+00		405		380	
	400		5,111		5,333
130+00		285		340	
	400		4,222		5,037
134+00		285		340	
	200		1,630		2,667
136+00		155		380	
	400		3,333		5,556
140+00		295		370	
	400		2,741		4,963
144+00		75		300	
	200		815		2,296
146+00		145		320	
	400		1,815		4,630
150+00		100		305	
	400		1,704		4,852
154+00		130		350	
	200		481		2,593
156+00		0		350	
	400		0		4,593
160+00		0		270	
	400		0		2,370
164+00		0		50	
	200		0		185
166+00		0		0	
		Subtotal	636,919		220,556
				TOTAL	857,474
				COMPUTER GENERATED VOLUME	672,589 CY
				ALLOWABLE OVERDEPTH VOLUME	220,556 CY
				TOTAL VOLUME	893,145 CY (+4.2%)

Table B.3: Jetty Channel Dredge Volume Dredge Depth -47ft + 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		4,079		400	
	500		85,139		7,407
5+00		5,116		400	
	500		101,167		7,407
10+00		5,810		400	
	500		108,769		7,407
15+00		5,937		400	
	500		125,694		7,407
20+00		7,638		400	
	500		146,222		7,407
25+00		8,154		400	
	500		150,824		7,407
30+00		8,135		400	
	500		155,657		7,407
35+00		8,676		400	
	500		166,463		7,407
40+00		9,302		400	
	300		95,261		4,111
43+00		7,845		340	
	200		57,863		2,370
45+00		7,778		300	
	500		128,287		4,630
50+00		6,077		200	
	500		105,194		3,352
55+00		5,284		162	
	500		94,444		3,037
60+00		4,916		166	
	500		45,519		1,537
65+00		0		0	
		Subtotal	1,566,504		78,296
				TOTAL	1,644,800
				COMPUTER GENERATED VOLUME	1,554,881 CY
				ALLOWABLE OVERDEPTH VOLUME	78,296 CY
				TOTAL VOLUME	1,633,177 CY (-0.7%)

Table B.4: Entrance Channel Dredge Volume Dredge Depth -49ft + 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		4,182		400	
	400		54,830		5,926
4+00		3,220		400	
	200		25,674		2,963
6+00		3,712		400	
	400		49,126		5,926
10+00		2,920		400	
	400		47,704		5,926
14+00		3,520		400	
	200		24,804		2,963
16+00		3,177		400	
	400		47,385		5,926
20+00		3,220		400	
	400		46,593		5,926
24+00		3,070		400	
	200		23,933		2,963
26+00		3,392		400	
	400		48,185		5,926
30+00		3,113		400	
	400		45,800		5,926
34+00		3,070		400	
	200		22,581		2,963
36+00		3,027		400	
	400		45,481		5,926
40+00		3,113		400	
	400		38,763		5,926
44+00		2,120		400	
	200		17,233		2,963
46+00		2,533		400	
	400		39,756		5,926
50+00		2,834		400	
	400		39,281		5,926
54+00		2,469		400	
	200		18,207		2,963
56+00		2,447		400	
	400		34,822		5,926
60+00		2,254		400	
	400		32,281		5,926
64+00		2,104		400	
	200		16,300		2,963
66+00		2,297		400	
	400		32,126		5,926
70+00		2,040		400	
	400		32,919		5,926
74+00		2,404		400	
	200		16,459		2,963
76+00		2,040		400	
	400		29,741		5,926
80+00		1,975		400	
	400		25,126		5,926
84+00		1,417		400	
	200		11,607		2,963
86+00		1,717		400	
	400		22,578		5,926
90+00		1,331		400	

	400		21,830		5,926
94+00		1,616		400	
	200		11,552		2,963
96+00		1,503		400	
	400		21,948		5,926
100+00		1,460		400	
	400		21,622		5,926
104+00		1,459		400	
	200		10,226		2,963
106+00		1,302		400	
	400		20,926		5,926
110+00		1,523		400	
	400		20,985		5,926
114+00		1,310		400	
	200		9,622		2,963
116+00		1,288		400	
	400		20,000		5,926
120+00		1,412		400	
	400		18,726		5,926
124+00		1,116		400	
	200		9,296		2,963
126+00		1,394		400	
	400		18,111		5,926
130+00		1,051		400	
	400		16,370		5,926
134+00		1,159		400	
	200		8,741		2,963
136+00		1,201		400	
	400		17,163		5,926
140+00		1,116		400	
	400		13,667		5,926
144+00		729		400	
	200		5,641		2,963
146+00		794		400	
	400		11,926		5,926
150+00		816		400	
	400		12,726		5,926
154+00		902		400	
	200		6,419		2,963
156+00		831		400	
	400		10,926		5,926
160+00		644		400	
	400		9,385		5,926
164+00		623		400	
	200		4,930		2,963
166+00		708		400	
	400		8,422		5,926
170+00		429		400	
	400		6,993		5,926
174+00		515		400	
	200		3,100		2,963
176+00		322		400	
	400		5,726		5,926
180+00		451		400	
	400		4,081		5,926
184+00		100		400	
	200		926		2,963
186+00		150		400	
	400		1,852		5,926
190+00		100		400	

	400		1,111		5,926
194+00		50		400	
	200		185		2,963
196+00		0		400	
	400		0		5,926
200+00		0		400	
	400		0		4,444
204+00		0		200	
	200		0		1,944
206+00		0		325	
	400		0		3,889
210+00		0		200	
	400		0		2,963
214+00		0		200	
	200		0		1,481
216+00		0		200	
	400		0		2,963
220+00		0		200	
	400		0		1,630
224+00		0		20	
	200		0		167
226+00		0		25	
	400		0		185
230+00				0	
		Subtotal	1,244,430		315,963
				TOTAL	**1,560,393**
				COMPUTER GENERATED VOLUME	**1,245,202 CY**
				ALLOWABLE OVERDEPTH VOLUME	**315,963 CY**
				TOTAL VOLUME	**1,561,165 CY (+0.05%)**

OPINION OF PROBABLE CONSTRUCTION COST FREEPORT CHANNEL WIDENING NORTH JETTY STABILITY ANALYSIS JETTY CHA. AT -45+2FT OD ENTRANCE CHA. AT -45FT+2FT OD	BUDGET REVIEW PREPARED FOR: ConocoPhillips Company 900 Threadneedle Houston, Texas 77252	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS PROJECT MANAGER: DCH EST. BY: SFB SMA PROJECT No.: J200.40233 UPDATED: June 27, 2005

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	UNIT COST	TOTAL	EXTENDED TOTALS
Dredging					$16,140,778
Mob/Demob	1	LS	$550,000	$550,000	
Pipelines	1	LS	$350,000	$350,000	
Dredging Required Depth	2,124,611	CY	$6.00	$12,747,666	
Dredging Over Depth	298,852	CY	$6.00	$1,793,112	
Disposal	2,423,463	CY	$0.00	$0	
Mitigation	4	AC	$50,000.00	$200,000	
Aids to Navigation	1	LS	$500,000	$500,000	
SUBTOTAL					**16140778**
Dredging Contingency	(5% of Dredging Subtotal)				$727,039
Fuel Cost Contingency	(20% of Dredging Subtotal)				$2,908,156
Hydrographic Surveys					$250,000
Construction Administration And Project Management	(2% of Subtotal)				$322,816
Engineering					$750,000
TOTAL PROJECT COST					**$21,098,789**

NOTES:

Entrance Channel quantities based on USACE posted data dated 2003.

Jetty Channel quantities based on SMA fieldwork dated October 10, 2004.

Aids to navigation for public waterways may qualify for federal funding.

Assume offshore placement of dredged material with no fees for disposal.

Diesel fuel cost can fluctuate greatly and can have large impacts on dredging cost.

Costs for removing existing debris or wrecks are not included in these costs.

OPINION OF PROBABLE CONSTRUCTION COST FREEPORT CHANNEL WIDENING NORTH JETTY STABILITY ANALYSIS JETTY CHA. AT-47FT+2FT OD ENTRANCE CHA. AT -49FT+2FT OD	BUDGET REVIEW PREPARED FOR: ConocoPhillips Company 900 Threadneedle Houston, Texas 77252	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS PROJECT MANAGER: DCH EST. BY: SFB SMA PROJECT No.: J200.40233 UPDATED: June 27, 2005

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	UNIT COST	TOTAL	EXTENDED TOTALS
Dredging					$20,766,052
Mob/Demob	1	LS	$550,000	$550,000	
Pipelines	1	LS	$350,000	$350,000	
Dredging Required Depth	2,800,083	CY	$6.00	$16,800,498	
Dredging Over Depth	394,259	CY	$6.00	$2,365,554	
Disposal	3,194,342	CY	$0.00	$0	
Mitigation	4	AC	$50,000.00	$200,000	
Aids to Navigation	1	LS	$500,000	$500,000	
SUBTOTAL					**20766052**
Dredging Contingency	(5% of Dredging Subtotal)				$958,303
Fuel Cost Contingency	(20% of Dredging Subtotal)				$3,833,210
Hydrographic Surveys					$250,000
Construction Administration And Project Management	(2% of Subtotal)				$415,321
Engineering					$750,000
TOTAL PROJECT COST					**$26,972,886**

NOTES:

Entrance Channel quantities based on USACE posted data dated 2003.

Jetty Channel quantities based on SMA fieldwork dated October 10, 2004.

Aids to navigation for public waterways may qualify for federal funding.

Assume offshore placement of dredged material with no fees for disposal.

Diesel fuel cost can fluctuate greatly and can have large impacts on dredging cost.

Costs for removing existing debris or wrecks are not included in these costs.

Appendix E

Public and Agency Coordination

Agency Correspondence

TEXAS HISTORICAL COMMISSION

The State Agency for Historic Preservation

RICK PERRY, GOVERNOR

JOHN L. NAU, III, CHAIRMAN

F. LAWERENCE OAKS, EXECUTIVE DIRECTOR

August 30, 2005 46/073.00

Mr. Doug Jones
PBS&J
6504 Bridge Point Parkway, Suite 200
Austin, TX 78730

Re: Project review under Section 106 of the National Historic Preservation Act of 1966 and the Antiquities Code of Texas
Draft Report, *Phase I Cultural Resources Nautical Archaeological Survey for the Proposed Widening and Ceepening of the Freeport Ship Channel, Barzori County, Texas*. THC Permit #3682

Dear Mr. Jones:

Thank you for your correspondence describing the above referenced project. This letter serves as comment on the proposed project from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission. As the state agency responsible for administering the Antiquities Code of Texas, these comments also provide recommendations on compliance with state antiquities laws and regulations.

The review staff, led by State Marine Archeologist Steven D. Hoyt, has completed its review. We concur with the findings and recommendations of the report's authors regarding anomaly avoidance or additional investigation as presented on pages 27-35. Please modify the title page to include the THC Permit Number.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this federal and state review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Steve Hoyt at 512/463-7188.**

Sincerely,

for
F. Lawerence Oaks, State Historic Preservation Officer

461073.00

TEXAS HISTORICAL COMMISSION

The State Agency for Historic Preservation

RICK PERRY, GOVERNOR

JOHN L. NAU, III, CHAIRMAN

F. LAWERENCE OAKS, EXECUTIVE DIRECTOR

February 2, 2006

Mr. Robert Gearhart
PBS&J
6504 Bridge Point Parkway, Suite 200
Austin, TX 78730

Re: Project review under the Antiquities Code of Texas
Final Report: *Phase I Cultural Resources Nautical Archaeological Survey for the Proposed Widening of the Freeport Ship Channel, Brazoria County, TX (Document No. 050118)*
Texas Antiquities Permit #3682
COMPLETED PERMIT

Dear Colleague:

Thank you for your correspondence describing the above referenced project. This letter presents the comments of the Executive Director of the Texas Historical Commission, the state agency responsible for administering the Antiquities Code of Texas.

The Archeology Division is in receipt of twenty copies of the final report and a completed *Abstracts in Texas Contract Archeology* form for the above referenced permit. The submission of twenty copies of the final report and abstract form demonstrates completion of your permit requirements under Permit #3682.

Thank you for your cooperation in this state review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Lillie Thompson at 512/463-1858.**

Sincerely,

for
F. Lawerence Oaks, State Historic Preservation Officer

FLO/lft

P.O. BOX 12276 · AUSTIN, TX 78711-2276 · 512/463-6100 · FAX 512/475-4872 · TDD 1-800/735-2989
www.thc.state.tx.us

441591.00

TEXAS HISTORICAL COMMISSION

The State Agency for Historic Preservation

RICK PERRY, GOVERNOR

JOHN L. NAU, III, CHAIRMAN

F. LAWERENCE OAKS, EXECUTIVE DIRECTOR

February 6, 2006

Ms. Amy Borgens
PBS&J
6504 Bridge Point Parkway, Ste. 200
Austin, TX 78730

Re: Project review under the Antiquities Code of Texas
Freeport Ship Channel Widening Close Order Survey, Brazoria County
Texas Antiquities Permit #4024

Dear Colleague:

Thank you for your Antiquities Permit Application for the above referenced project. This letter presents the final copy of the permit application from the Executive Director of the Texas Historical Commission, the state agency responsible for administering the Antiquities Code of Texas.

Please keep this copy for your records. Additionally, please note that the Antiquities Permit investigations require production of 20 copies of the final report and verification that any artifacts recovered and records produced during the investigations are curated at the repository listed in the permit.

If you have any questions concerning this permit or if we can be of further assistance, please contact Lillie Thompson at 512/463-1858. The reviewer for this project is Steve Hoyt, (463-6096).

Sincerely,

for
F. Lawerence Oaks, State Historic Preservation Officer

FLO/lft

Enclosure

Cc: Lisa McMichael, Brazos River Harbor Navigation Dist.
Larry Laine, GLO

TEXAS GENERAL LAND OFFICE
JERRY PATTERSON, COMMISSIONER

December 29, 2005

Via Electronic Mail

Bryan Herczeg
U.S. Army Corps of Engineers Galveston District
P.O. Box 1229
Galveston, Texas 77553-1229

re: Comments on proposed scope of the EIS for widening the Freeport Harbor Channel

Dear Mr. Herczeg:

The General Land Office has reviewed the proposed scope for the Environmental Impact Statement (EIS) to be prepared for the planned widening of the Entrance and Jetty Channel of the Freeport Harbor Channel.

Based on the information provided, discussions in the public scoping meeting, and interagency coordination meetings on this matter, we have the following comments:

- The Gulf of Mexico shoreline adjacent to the Freeport jetties at Surfside and Quintana experience some of the highest erosion rates on the Texas coast with long-term rates ranging from 9 to 16 feet per year. Although there are multiple causes of shoreline erosion in this area, vessel generated wakes and the presence of the channel and jetties are significant factors that contribute to the impacts of erosion. The EIS should address the shoreline erosion to determine the impact the proposed channel improvements will have on the surrounding shorelines. Recent EIS's for the improvements of the Corpus Christi Ship Channel and the Sabine-Neches Waterway have addressed this issue.
- It is our understanding that the Port of Freeport is attempting to construct the widening of the channel with Port and private funds. It is expected that USACE will perform the deepening of the channel at a later time as a federally cost-shared project. USACE Galveston District Planning Division indicated that an interagency coordination team (ICT) would be formed to address the deepening portion of the project. Although you have taken steps to form a coordination team for the widening EIS and development of a dredged material management plan, I urge USACE Galveston to coordinate between the Regulatory and Planning Divisions and form a single ICT to assist with all channel improvement aspects. A single ICT would reduce cost and redundancy for the Port, USACE and the resource agencies, and it would help ensure that the cumulative impacts for both the widening and deepening are adequately addressed in a streamlined manner.

If you have any questions or need additional details on this matter, please call me at (512) 475-3624 or email at ray.newby@glo.state.tx.us.

Sincerely,

Ray Newby
Coastal Stewardship Division

Stephen F. Austin Building • 1700 North Congress Avenue • Austin, Texas 78701-1495
Post Office Box 12873 • Austin, Texas 78711-2873
512-463-5001 • 800-998-4GLO
www.glo.state.tx.us

PBS&J

An employee-owned company

February 1, 2006

Rusty Swafford
National Marine Fisheries Service
Habitat Conservation Division
4700 Avenue U
Galveston, Texas 77551-5997

RE: Port of Freeport Project
PBS&J Job Number 441591

Dear Mr. Swafford:

PBS&J is preparing an Environmental Impact Statement (EIS) for a permit application filed by the Brazos River Harbor Navigation District for the Port of Freeport Project (project) located in Brazoria County, Texas. The Brazos River Harbor Navigation District is engaged in a potential widening of portions of the Freeport Harbor Ship Channel.

PBS&J is collecting data for the preparation the EIS for the project. The level of detail for our assessment will be as necessary to describe existing conditions and to provide analysis of future conditions due to project impacts. The project study area is in the vicinity of Freeport, Quintana, and Surfside, Texas and encompasses that portion of the Gulf of Mexico along the north side of the Freeport Harbor Channel between the Coast Guard Station and the offshore 51-foot contour and surrounding areas. The project potentially includes beach nourishment and offshore placement of construction and maintenance material.

PBS&J is submitting this letter to request information on Essential Fish Habitat occurring in the project area, which should be addressed for the project, and any conservation recommendations you may have. I am enclosing a copy of the permit application for your review. Please call me at (512) 342-3389 if you have any questions or need additional information.

Sincerely,

Lisa Vitale

Lisa Vitale, FP-C
Marine/Aquatic Biologist
LDV/lv

enclosure

6504 Bridge Point Parkway • Suite 200 • Austin, Texas 78730 • Telephone 512.327.6840 • Fax 512.327.2453 • www.pbsj.com

PBS&J

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February 1, 2006

Andreas Mager
National Marine Fisheries Service
Southeast Regional Office
9721 Executive Center Drive North
Saint Petersburg, Florida 33702-2449

RE: Port of Freeport Project
PBS&J Job Number 441591

Dear Mr. Mager:

PBS&J is preparing an Environmental Impact Statement (EIS) for a permit application filed by the Brazos River Harbor Navigation District for the Port of Freeport Project (project) located in Brazoria County, Texas. The Brazos River Harbor Navigation District is engaged in a potential widening of portions of the Freeport Harbor Ship Channel.

PBS&J is collecting data for the preparation the EIS for the project. The level of detail for our assessment will be as necessary to describe existing conditions and to provide analysis of future conditions due to project impacts. The project study area is in the vicinity of Freeport, Quintana, and Surfside, Texas and encompasses that portion of the Gulf of Mexico along the north side of the Freeport Harbor Channel between the Coast Guard Station and the offshore 51-foot contour and surrounding areas. The project potentially includes beach nourishment and offshore placement of construction and maintenance material.

PBS&J is submitting this letter to request information on threatened and endangered species occurring in the project area, which should be addressed for the project, and any conservation recommendations you may have. I am enclosing a copy of the permit application for your review. Please call me at (512) 342-3389 if you have any questions or need additional information.

Sincerely,

Lisa Vitale

Lisa Vitale, FP-C
Marine/Aquatic Biologist
LDV/lv

enclosure

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February 1, 2006

Carlos Mendoza
U.S. Fish and Wildlife Service
Division of Ecological Services
17629 El Camino Real, Suite 211
Houston, Texas 77058

RE: Port of Freeport Project
PBS&J Job Number 441591

Dear Mr. Mendoza:

PBS&J is preparing an Environmental Impact Statement (EIS) for a permit application filed by the Brazos River Harbor Navigation District for the Port of Freeport Project (project) located in Brazoria County, Texas. The Brazos River Harbor Navigation District is engaged in a potential widening of portions of the Freeport Harbor Ship Channel.

PBS&J is collecting data for the preparation the EIS for the project. The level of detail for our assessment will be as necessary to describe existing conditions and to provide analysis of future conditions due to project impacts. The project study area is in the vicinity of Freeport, Quintana, and Surfside, Texas and encompasses that portion of the Gulf of Mexico along the north side of the Freeport Harbor Channel between the Coast Guard Station and the offshore 51-foot contour and surrounding areas. The project potentially includes beach nourishment and offshore placement of construction and maintenance material.

PBS&J is submitting this letter to request information on threatened and endangered species occurring in the project area, which should be addressed for the project, and any conservation recommendations you may have. I am enclosing a copy of the permit application for your review. Please call me at (512) 342-3389 if you have any questions or need additional information.

Sincerely,

Lisa Vitale

Lisa Vitale, FP-C
Marine/Aquatic Biologist
LDV/lv

enclosure

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PBS&J

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May 2, 2006

Miles Croom
Assistant Regional Administrator
National Marine Fisheries Service
Habitat Conservation Division
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5511

RE: Port of Freeport Project
PBS&J Job Number 441591

Dear Mr. Croom:

PBS&J is preparing an Environmental Impact Statement (EIS) for a permit application filed by the Brazos River Harbor Navigation District for the Port of Freeport Project (project) located in Brazoria County, Texas. The Brazos River Harbor Navigation District is engaged in a potential widening of portions of the Freeport Harbor Ship Channel.

PBS&J is collecting data for the preparation the EIS for the project. The level of detail for our assessment will be as necessary to describe existing conditions and to provide analysis of future conditions due to project impacts. The project study area is in the vicinity of Freeport, Quintana, and Surfside, Texas and encompasses that portion of the Gulf of Mexico along the north side of the Freeport Harbor Channel between the Coast Guard Station and the offshore 51-foot contour and surrounding areas. The project potentially includes beach nourishment and offshore placement of construction and maintenance material.

PBS&J is submitting this letter to request information on threatened and endangered species occurring in the project area, which should be addressed for the project, and any conservation recommendations you may have. I am enclosing a copy of the permit application for your review. Please call me at (512) 342-3389 if you have any questions or need additional information.

Sincerely,

Lisa Vitale

Lisa Vitale, FP-C
Marine/Aquatic Biologist
LDV/lv

enclosure

6504 Bridge Point Parkway • Austin, TX. 78730 • Telephone 512.327.6840 • Fax 512.327.2453 • www.pbsj.com

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
(727) 824-5312, Fax 824-5309
http://sero.nmfs.noaa.gov

MAY 10 2006

Dear Colleague:

Pursuant to section 7(a)(2) of the Endangered Species Act (ESA), the Protected Resources Division of NOAA's National Marine Fisheries Service (NMFS) has reviewed your letter regarding the proposed project to widen portions of the Freeport Harbor Ship Channel (PBS&J Job Number 441591).

___**There are no ESA-listed species** or designated critical habitat under our purview in the action area.

___**We cannot determine** impacts to threatened or endangered species, or designated critical habitat, under NOAA Fisheries purview because the letter lacks sufficient information to evaluate the project.
Enclosed are guidelines to conduct a proper biological evaluation.

___**Please provide a letter** from the lead federal action agency designating you to conduct ESA section 7 consultation with this office.

_X__**Enclosed is a list** of federally-protected species under the jurisdiction of NMFS for the Gulf of Mexico. Biological information on federally-protected species and candidate species can be found at the following website addresses: http://www.nmfs.noaa.gov/prot_res/prot_res.html; http://www.cccturtle.org;. http://noflorida.fws.gov/SeaTurtles/seaturtle-info.htm); http://endangered.fws.gov/wildlife.html#Species; http://www.cmc-ocean.org/main.php3; http://floridaconservation.org/psm/turtles/turtle.htm; ttp://obis.env.duke.edu/data/sp_profiles.php; www.mote.org/~colins/Sawfish/SawfishHomePage.html; www.floridasawfish.com; www.flmnh.ufl.edu/fish/sharks/InNews/sawprop.htm; Gulf sturgeon critical habitat rule and maps (http://alabama.fws.gov/gs/).

__ **It is NMFS' opinion that the project will have no effect** on listed species or critical habitat protected by the ESA under NOAA Fisheries purview. No further consultation with NOAA Fisheries pursuant to section 7(a)(2) of the ESA is required unless the project description changes.

Consultation with NMFS' Habitat Conservation Division (HCD), pursuant to the Magnuson-Stevens Fishery Conservation and Management Acts requirements for essential fish habitat consultation, may be required. Please contact HCD at (727) 824-5317. If you have any ESA questions, please contact consulting biologist, _____, (727) 824- 5312 or by e-mail at _____ or our ESA section 7 coordinator, Eric Hawk, at the same number or by e-mail at eric.hawk@noaa.gov.

Sincerely,

Teletha Mincey

Teletha Mincey
Assistant Support Assistant
Protected Resources Division

File: 1514-22 b

Endangered and Threatened Species and Critical Habitats
under the Jurisdiction of the NOAA Fisheries

Gulf of Mexico

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
blue whale	*Balaenoptera musculus*	Endangered	12/02/70
finback whale	*Balaenoptera physalus*	Endangered	12/02/70
humpback whale	*Megaptera novaengliae*	Endangered	12/02/70
sei whale	*Balaenoptera borealis*	Endangered	12/02/70
sperm whale	*Physeter macrocephalus*	Endangered	12/02/70
Turtles			
green sea turtle	*Chelonia mydas*	Threatened[1]	07/28/78
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/70
leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/70
loggerhead sea turtle	*Caretta caretta*	Threatened	07/28/78
Fish			
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	09/30/91
smalltooth sawfish	*Pristis pectinata*	Endangered	04/01/03

Designated Critical Habitat
Gulf Sturgeon: A final rule designating Gulf sturgeon critical habitat was published on March 19, 2003 (68 FR 13370) and 14 geographic areas (units) among the Gulf of Mexico rivers and tributaries were identified. Maps and details regarding the final rule can be found at alabama.fws.gov/gs

Species Proposed for Listing
Acropora palmata (elkhorn coral)
Acropora cervicornis (staghorn coral)

Proposed Critical Habitat
None

[1] Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered

Gulf of Mexico

Candidate Species[2]	Scientific Name
none	

Species of Concern[3]	Scientific Name
Fish	
Alabama shad	*Alosa alabamae*
dusky shark	*Carcharhinus obscurus*
goliath grouper	*Epinephelus itajara*
largetooth sawfish	*Pristis pristis*
night shark	*Carcharinus signatus*
saltmarsh topminnow	*Fundulus jenkinsi*
sand tiger shark	*Odontaspis taurus*
speckled hind	*Epinephelus drummondhayi*
Warsaw grouper	*Epinephelus nigritus*
white marlin	*Tetrapturus albidus*
Invertebrates	
ivory bush coral	*Oculina varicosa*

[2] The Candidate Species List has been renamed the Species of Concern List. The term "candidate species" is limited to species that are the subject of a petition to list and for which NOAA Fisheries has determined that listing may be warranted (69 FR 19975).

[3] Species of Concern are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

Velasquez, Ruben I

From: Wade.Peggy@epamail.epa.gov
Sent: Tuesday, August 22, 2006 9:52 AM
To: Velasquez, Ruben I
Cc: Riley.Jeffrey@epamail.epa.gov; kgathrig@tceq.state.tx.us
Subject: Port of Freeport emissions analysis

Hi Ruben,

Thanks for providing the emissions analysis information for the Port of Freeport plan to widen the ship channel. Sorry for my delayed response.

I've reviewed the emission factors and methodolgy used to estimate the impact the Houston-Galveston-Brazoria airshed and have no specific comments on the data or assumptions used.

Please keep in mind a few things that we discussed at the interagency meeting held here at EPA on July 12, 2006:
1. Although the applicable SIPs for the HGB nonattainment area is currently the 2004 Rate of Progress SIP and 2000 Attainment Demonstration SIP (both of which contain inventories for 2007), EPA is finalizing our action on the HGB Mid-Course Review SIP and we anticipate publishing our action in the Federal Register soon. Once published, the HGB Mid-Course Review SIP will become the applicable SIP for purposes of general conformity; please keep an eye on this as you progress with the preparation of the conformity determination for this project.
2. Also, please keep in mind that EPA is concerned over the preliminary modeling conducted by TCEQ in preparation for the required 8-hour ozone SIP, which is due to EPA on June 15, 2007. If the state fails to meet this deadline and/or they cannot demonstrate attainment by the statutory date of 2009, the area may be subject to a "bump-up" where the classification may change from moderate to serious or even severe.
Becase the general conformity de minimis levels are based on the area's classification, any "bump-up" action by EPA could affect the conformity determination for this project.

Also, on another note, I will be turning over the Port of Freeport files to my colleague, Jeff Riley. Jeff has been with EPA for a number of years and recently joined the Air Planning Section. Jeff is now the EPA lead for general conformity issues, with the exception of LNG projects.
I'll retain the lead for those, and will also be Jeff's backup, of course. Once the conformity determination for this Port of Freeport project is complete, please forward it to Jeff's attention. His email is riley.jeffrey@epa.gov and his telephone is 214-665-8542.

Thanks,
-Peggy
214-665-7247

Scoping Meeting

Public Announcement

28 October 2005

U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT

INTRODUCTION: Notice is hereby given of a public workshop and scoping meeting to be conducted by the Galveston District, Corps of Engineers (Corps), at 5:00 PM on Tuesday, November 29, 2005 at the Freeport Community House, 130 W. 2nd, Freeport, Texas 77541.

BACKGROUND: The Corps is preparing an Environmental Impact Statement (EIS) for Department of the Army permit application **23752** for the Brazos River Harbor Navigation District's (Port of Freeport) proposed widening of the Freeport Harbor Ship Channel. The project involves widening the jetty and entrance channels of the Freeport Harbor Ship Channel. Port of Freeport proposes to widen the existing channel width of 400 feet to 600 feet in width.

Please see the attached "Information Paper" and proposed project plans for additional details on the proposed project.

To address the complex issues associated with the proposed project, we have invited the following Federal and state agencies to provide technical advice during preparation of the EIS:

- National Marine Fisheries Service
- United States Coast Guard
- United States Fish and Wildlife Service
- Environmental Protection Agency
- Texas Commission on Environmental Quality
- Texas General Land Office
- Texas Parks and Wildlife Department
- Texas Department of Transportation

PURPOSE OF THE WORKSHOP & SCOPING MEETING: An informal open house will be conducted between 5:00 PM and 7:00 PM, prior to the scoping meeting. The open house is to provide basic information to the public on the proposed project and the EIS process. The formal scoping meeting will begin at 7:00 PM and is to help the Corps identify environmental concerns, study efforts needed, and meet the National Environmental Policy Act requirements for preparing an EIS. Therefore, this meeting is to provide an opportunity for all interested persons to comment and provide information to the Corps for use in identifying problems associated with the project, conducting additional studies, and preparing the EIS.

Every effort will be made to address concerns/issues identified in the draft EIS. Following the issuance of the draft EIS the Corps plans to hold a public hearing where there will be an additional opportunity for the public to express their views. Please bring this notice to the attention of others known to be interested in the subject of the meeting.

If you need additional information or have questions concerning this notice, please contact Mr. Bryan Herczeg at 409-766-6389, or by e-mail at bryan.a.herczeg@usace.army.mil or you may write to U.S. Army Corps of Engineers, Regulatory Branch, ATTN: Mr. Bryan Herczeg, P.O. Box 1229, Galveston, Texas 77553-1229.

CONDUCT OF THE PUBLIC SCOPING MEETING: The District Engineer, Galveston District, Corps of Engineers, will serve as the presiding officer at the public scoping meeting. The District Engineer will take all actions necessary to conduct a fair, impartial, and orderly meeting. To this end, powers of the District Engineer include, but are not limited to the following:

a) To regulate the course of the meeting and conduct of the parties, their counsel, and the public in attendance.
b) To establish reasonable time limits for oral statements of parties, their counsel, or representatives.
c) To receive into evidence all written statements, charts, tabulations, and similar data.
d) To ask questions of speakers for purposes of clarification.

All persons will be given an opportunity to present oral and written statements, including documentary materials, at the public meeting. Any person will be entitled to be represented by, or speak through, legal counsel or other representative, to call witnesses who may present oral statements, and to present recommendations as to an appropriate study, or other considerations. Prior to the opening of the meeting, each person will be requested to complete an attendance card. The attendance card will contain information blocks on which persons attending the public meeting can give their name, address, and whether they wish to present an oral statement during the public meeting.

Statements and information may be provided without restriction by formal procedures and rules of evidence; however, all statements and information provided must concern the subject matter of the meeting.

All statements shall be addressed to the District Engineer. Cross-examination of any person addressing the public meeting, by any person in attendance, will not be allowed

The District Engineer or representative will be given the first opportunity to speak and will be allowed the necessary time to complete their oral statement. Other persons intending to address the public meeting will be called upon and should come prepared to complete their oral statement in not more than five minutes (subject to change based on attendance). Statements by any person that cannot be completed within the time allotment should be summarized orally, and the full text submitted in writing.

Written statements or information materials for inclusion in the record, including documentary materials, may be presented during the public meeting or may be mailed to the District Engineer, Galveston District, Corps of Engineers, at the following address:

U.S. ARMY ENGINEER DISTRICT, GALVESTON
ATTENTION: CESWG-PE-RB
P.O. BOX 1229
GALVESTON, TEXAS 77553-1229

All statements, both oral and written, will become part of the official record of the public scoping meeting and will be made available for public examination. Mailed statements to be included in the record must be mailed on or before December 29, 2005.

DISTRICT ENGINEER
GALVESTON DISTRICT
CORPS OF ENGINEERS

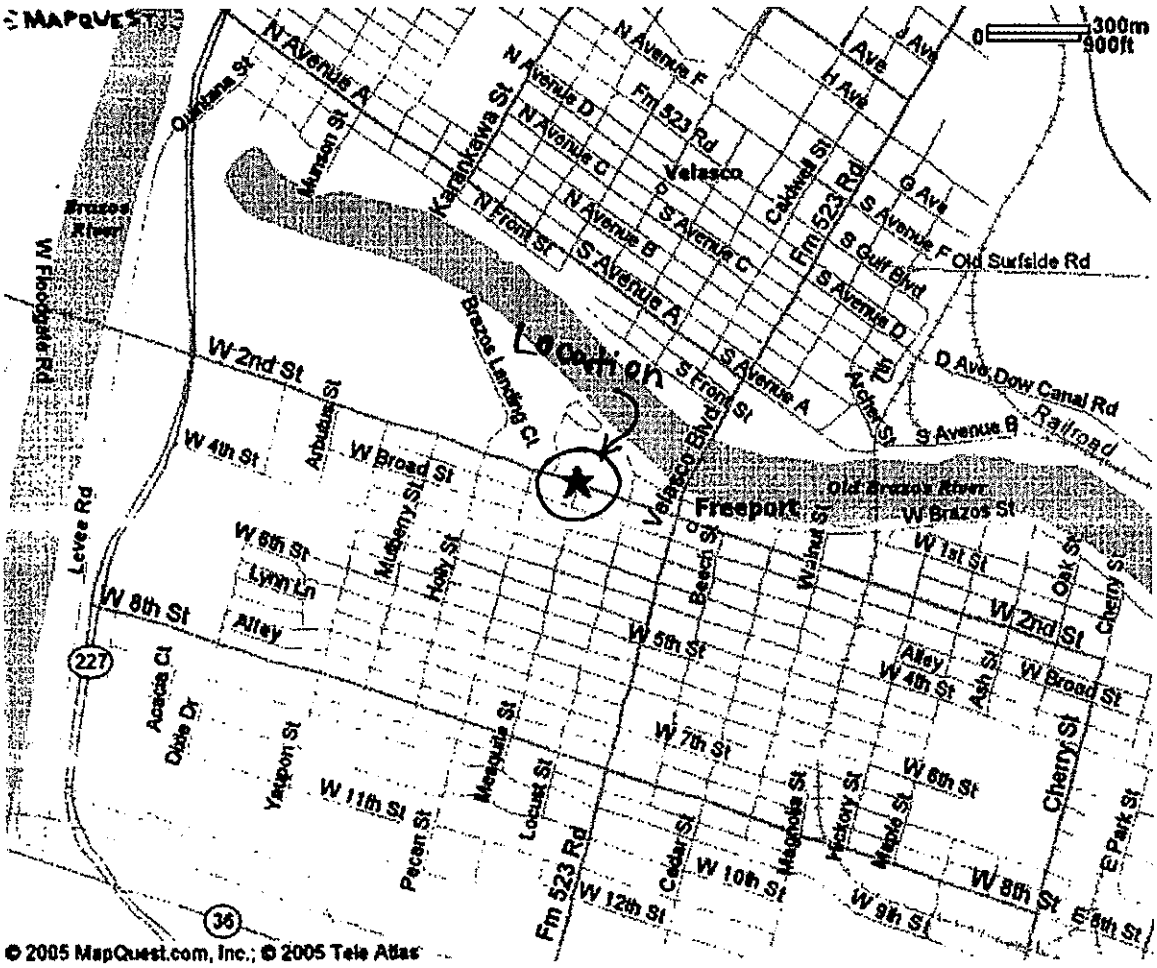
DEPARTMENT OF ARMY PERMIT APPLICATION # 23752

PROPOSED FREEPORT CHANNEL WIDENING PROJECT

SCOPING MEETING DATE AND LOCATION:

Tuesday, November 29, 2005
Open House – 5:00 – 7:00 PM
Formal Meeting – 7:00 PM

Freeport Community House
1300 W. 2nd St.
Freeport, TX 77541



systems with fourteen drainage structures, and nine closure structures, six of which incorporate limited road raisings.

FOR FURTHER INFORMATION CONTACT: Mr. Jeff Trulick, Study Manager, (410) 962–6715 or (800) 295–1610 or via e-mail at *jeff.trulick@usace.army.mil.*

SUPPLEMENTARY INFORMATION: The Town of Bloomsburg, PA, is located in Columbia County within the Middle Susquehanna River sub-basin. The Susquehanna River forms the Town's southern boundary, and Fishing Creek forms the northern and western boundary.

The primary water resources problem along the Susquehanna River at Bloomsburg is recurrent flooding. Recurrent flooding that occurs in the Bloomsburg study area is a result of the morphology of the Susquehanna River and the regional topography. When the Susquehanna River and a local tributary, Fishing Creek, simultaneously rise above flood stage, overbank flooding can cover up to 33 percent of the landmass within the Town of Bloomsburg's boundaries.

Flood damages are attributable to overbank flooding from the Susquehanna River and to flooding along Fishing Creek. Past flood events have resulted in extensive damages to structures and their contents and have threatened public safety. The Bloomsburg study area includes approximately 525 residential structures and 75 businesses.

The recommended flood damage reduction plan is the National Economic Development (NED) Plan with a Tropical Storm Agnes (440-year) level of protection from Susquehanna River flooding, and 100-year level of protection from Fishing Creek flooding. The alignment of the line of protection was refined based on physical, environmental, and economic criteria.

The project consists of a system of earthen levees, mechanically stabilized earth (MSE) floodwalls, concrete floodwalls, railroad and road closure structures and roadway relocations to provide ramps over the line of protection. Earthen levees are proposed for the majority of the line of protection, though MSE walls will be required along portions of Fishing Creek in both Bloomsburg and Fernville and a concrete floodwall (H-Pile wall) will be required along portions of Fishing Creek in Bloomsburg. Limited riprap will be used to protect the steep banks of Fishing Creek from bank crest to below the stream invert along the lower project reaches along Fishing Creek.

Permanent environmental impacts will include restricted views by the levee/floodwall system of Fishing Creek from Bloomsburg and Fernville, excavation and off-site disposal of approximately 4,500 cubic yards of hazardous, toxic and radioactive waste materials, conversion of approximately 11.5 acres of farmland designated as Prime Farmland or Additional Farmland of Statewide Importance to non-agricultural use, long-term loss of nearly 3,000 linear feet of riparian habitat along Fishing Creek, the loss of less than one acre of wetlands, and taking of residential homes and business structures within the levee/floodwall footprint.

USACE has distributed copies of the Final Integrated Feasibility Report and EIS to appropriate members of Congress, State and local government officials, Federal agencies, and other interested parties. Copies are available for public review at the following locations:

(1) Bloomsburg Public Library, 225 Market Street, Bloomsburg, PA 17815

(2) Bloomsburg University Library, 400 E. Second Street, Bloomsburg, PA 17815

You may also view the Final Integrated Feasibility Report and EIS in addition to related information on our Web page at *http://www.nab.usace.army.mil/publications/non-reg_pub.htm.*

The Final Integrated Feasibility Report and EIS has been prepared in accordance with (1) The National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.), (2) regulations of the Council on Environmental Quality for implementing the procedural provisions of NEPA (40 CFR parts 1500–1508), and (3) USACE regulations implementing NEPA (ER–200–2–2).

Jeff Trulick,

Study Manager, Civil Project Development Branch, Planning Division.

[FR Doc. 05–21522 Filed 10–27–05; 8:45 am]

BILLING CODE 3710–41–M

DEPARTMENT OF DEFENSE

Department of the Army; Corps of Engineers

Public Scoping Meeting and Preparation of Draft Environmental Impact Statement for Widening of the Freeport Ship Channel in Freeport, Brazoria County, TX

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DOD.

ACTION: Notice of intent.

SUMMARY: The U.S. Army Corps of Engineers, Galveston District intends to prepare a Draft Environmental Impact Statement (DEIS) to assess the social, economic and environmental effects of the proposed widening of portions of the Freeport Harbor Entrance and Jetty Channels. The DEIS will assess potential impacts of a range of alternatives, including the No Action and preferred alternatives. The Federal action is consideration of a Department of Army Permit application for work under section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), section 404 of the Clean Water Act (33 U.S.C. 1344) and section 103 of the Marine Protection Research and Sanctuary Act (33 U.S.C. 1413).

DATES: A public scoping meeting will be held on November 29, 2005 at 7 p.m.

ADDRESSES: The meeting will be held at the Freeport Community House, 1300 W. 2nd, Freeport, TX 77541.

FOR FURTHER INFORMATION CONTACT: Mr. Bryan Herczeg, Project Manager, by letter at U.S. Army Corps of Engineers, P.O. Box 1229, Galveston, Texas 77553, by telephone at (409) 766–6389, or by e-mail at *bryan.a.herczeg@usace.army.mil.*

SUPPLEMENTARY INFORMATION: The Galveston District intends to prepare a DEIS on the proposed channel widening of portions of the Freeport Harbor Channel, which leads to Freeport Harbor, Freeport, Brazoria County, TX. The Brazos River Harbor Navigation District (Port of Freeport) proposes this project.

1. *Description of the Proposed Project:* The Port of Freeport is proposing to widen the Freeport Harbor Channel as follows:

a. From Channel Station 63+35, near the U.S. Coast Guard Station, to Channel Station 45+00, the channel will be widened gradually an additional 0 to 150 feet;

b. From Channel Station 45+00 to Channel Station 40+00, the Channel will be widened an additional 150 to 200 feet;

c. From 40+00, in the Jetty Channel to the end of the existing Entrance Channel, the channel will be widened by 200 feet, from the existing channel width of 400 feet to 600 feet;

d. The depth of the channel will be as at present, 47 feet in the Jetty Channel (45 feet project depth plus 2 feet advanced maintenance) and 49 feet in the Entrance Channel (45 feet project depth plus 2 feet advanced maintenance plus 2 feet allowable overdraft);

e. Approximately 3.2 million cubic yards (mcy) of dredged material will be

generated from the widening project; and

f. Approximately 300,000 cubic yards of dredged material will be used beneficially for beach nourishment on Quintana Beach and the remainder of the dredged material will be placed offshore approximately 2.5 miles off Quintana in approximately 40 feet of water.

2. *Scoping and Public Involvement Process:* A scoping meeting to gather information on the subjects to be studied in detail in the DEIS will be conducted on (see **DATES**). An informal open house, allowing for review of the proposed project and questions and answers, will be conducted between 5 and 7 p.m., prior to the scoping meeting.

3. *Significant Issues:* Issues associated with the proposed project to be given significant analysis in the DEIS are likely to include, but may not be limited to, the potential impacts of the proposed dredging, dredged material placement, the beneficial uses of dredged material, water quality, fish and wildlife values including threatened and endangered species; air quality; environmental justice; socioeconomic environment; archaeological and cultural resources; recreation and recreational resources; energy supply and natural resources; hazardous waste and materials; aesthetics; public health and safety; navigation; shoreline erosion and accretion; cumulative impacts, and the needs and welfare of the people.

4. *Technical Review and Consultation:* Several State and Federal Agencies will be invited to provide technical review of the DEIS. Those agencies include: The Environmental Protection Agency, National Marine Fisheries Service, United States Fish and Wildlife Service, the United States Coast Guard, Texas Commission on Environmental Quality, Texas General Land Office, Texas Parks and Wildlife Department and the Texas Department of Transportation.

5. *Additional Review and Consultation:* Additional review and consultation that will be incorporated into the preparation of this DEIS will include: Compliance with the Texas Coastal Management Program; protection of cultural resources under Section 106 of the National Historic Preservation Act; protection of navigation under the Rivers and Harbors Act of 1899; protection of water quality under section 401 of the Clean Water Act; protection of air quality under the Clean Air Act; and protection of endangered and threatened species under section 7 of the Endangered Species Act.

6. *Availability of the DEIS:* The Draft Environmental Impact Statement is projected to be available in September 2006. At this time the Galveston District plans to conduct a Public Hearing following the release of the DEIS.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. 05–21521 Filed 10–27–05; 8:45 am]

BILLING CODE 3710–52–M

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

ENVIRONMENTAL PROTECTION AGENCY

DEPARTMENT OF THE INTERIOR

Office of Surface Mining

Fish and Wildlife Service

Final Programmatic Environmental Impact Statement for Mountaintop Mining and Valley Fills

AGENCIES: U.S. Army Corps of Engineers, Department of the Army, DOD; Environmental Protection Agency; Office of Surface Mining and Fish and Wildlife Service, Interior; and West Virginia Department of Environmental Protection.

ACTION: Announcement of availability of Final Programmatic Environmental Impact Statement (FPEIS).

SUMMARY: The above agencies announce the availability of the FPEIS that considers developing policies, guidance, and coordinated agency decision-making processes to minimize, to the maximum extent practicable, the adverse environmental effects to waters of the United States and to fish and wildlife resources affected by mountaintop mining operations, and to environmental resources that could be affected by the size and location of excess spoil-disposal sites in valley fills within the Appalachian study area in West Virginia, Kentucky, Virginia, and Tennessee. This FPEIS was prepared as part of a settlement agreement that resolved the Federal claims brought in *Bragg* v. *Robertson, Civ. No. 2:98–0636 (S.D.W.Va.).*

This FPEIS was prepared consistent with the provision set forth in 40 CFR 1503.4(c) of the Council on Environmental Quality regulations implementing NEPA, which allow the agencies to attach an errata sheet to the statement instead of rewriting the draft statement and to circulate the errata, comments, responses, and the changes, rather than the entire document. The agencies are filing the entire statement with a new cover sheet as the FPEIS. The FPEIS is being made available by mail and can be viewed on the Internet at *http://www.epa.gov/region3/mtntop/index.htm*. The FPEIS can also be viewed at local offices of the above agencies and at selected local libraries. Copies of the FPEIS may be obtained by writing to the address listed below.

ADDRESSES: Send written requests for copies of the FPEIS to John Forren, U.S. Environmental Protection Agency (3EA30), 1650 Arch Street, Philadelphia, PA 19103.

FOR FURTHER INFORMATION CONTACT: John Forren, U.S. Environmental Protection Agency, at (215) 814–2705; Katherine Trott, U.S. Army Corps of Engineers, at (202) 761–5542; Mike Robinson, U.S. Office of Surface Mining, at (412) 937–2882; Cindy Tibbott, U.S. Fish and Wildlife Service, at (814) 234–4090; or Russell Hunter, West Virginia Department of Environmental Protection, at (304) 926–0499.

Dated: October 20, 2005.

Gerald W. Barnes,

Chief, Operations, Directorate of Civil Works.

David Evans,

Director, Wetlands Division, Environmental Protection Agency.

Glenda H. Owens,

Deputy Director, Office of Surface Mining.

Marshall P. Jones, Jr.

Deputy Director, Fish and Wildlife Service.

[FR Doc. 05–21474 Filed 10–27–05; 8:45 am]

BILLING CODE 3710–92–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Hearings for a Draft Overseas Environmental Impact Statement/Environmental Impact Statement for the Undersea Warfare Training Range

AGENCY: Department of the Navy, DOD.

ACTION: Notice.

SUMMARY: Pursuant to Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, and Section 102(2) of the National Environmental Policy Act (NEPA) of 1969 as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500–1508), the Department of the Navy (Navy) has prepared and filed with the U.S. Environmental Protection Agency a Draft Overseas Environmental Impact Statement/ Environmental Impact Statement (Draft

INFORMATION PAPER

DEPARTMENT OF ARMY PERMIT APPLICATION # 23752

PROPOSED FREEPORT CHANNEL WIDENING PROJECT

APPLICANT: Brazos River Harbor Navigation District (Port of Freeport)
P.O. Box 615
Freeport, Texas 77542-0615
Telephone: 979-233-2667, ext. 4257
POC: David Knuckey

AGENT: Shiner Moseley and Associates, Inc.
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478-0010
Telephone: 361-857-2211
POC: Joe Moseley

PROJECT PURPOSE: The Port of Freeport stated purpose is to widen the channel to eliminate existing operation constraints that include: a) one-way traffic, b) daylight operations only for larger vessels, and c) restrictions that do not allow the larger vessels, requiring waivers to enter port when winds exceed 20 knots or cross-currents exceed 0.5 knots.

PROJECT NEED: The Port of Freeport's need for the project is to eliminate of the operational constraints to avoid delays, thereby reducing shipping costs and logistical problems.

LOCATION: The project is located in the Gulf of Mexico along the north side of the Freeport Harbor Channel between the lower turning basin and the offshore 51-foot contour, in Brazoria County, Texas. The project can be located on the U.S.G.S. quadrangle map entitled: Freeport, Texas. Approximate UTM Coordinates in NAD 27 (meters): Zone 15; Easting: 276374; Northing: 3202462.

PROJECT DESCRIPTION: Port Freeport proposes to widen of the Freeport Harbor Ship Channel from the outer turning basin to the sea buoy, a distance of approximately 5.6 miles. The proposed project involves widening the jetty and entrance channels from the existing 400-foot channel width up to 600-foot in width. The project will involve widening the Freeport Harbor Ship Channel as follows:

a. From Channel Station 63+35, near the U.S. Coast Guard Station, to Channel Station 45+00, the channel will be widened gradually an additional 0 to 150 feet;
b. From Channel Station 45+00 to Channel Station 40+00, the Channel will be widened an additional 150 to 200 feet;
c. From 40+00, in the Jetty Channel to the end of the existing Entrance Channel, the channel will be widened by 200 feet, from the existing channel width of 400 feet to 600 feet;
d. The depth of the channel will be as at present, 47 feet in the Jetty Channel (45 feet project depth plus 2 feet advanced maintenance) and 49 feet in the Entrance Channel (45 feet project depth plus 2 feet advanced maintenance plus 2 feet allowable overdraft).

A pipeline dredge and/or a hopper dredge will be used to perform the dredging. Approximately 3.2 million cubic yards of dredged material will be generated from the widening project. If economically recoverable quantities of beach quality material are located during dredging operations, up to 300,000 cubic yards of dredged material may be used beneficially for beach nourishment on Quintana Beach. The Port of Freeport proposes to construct an underwater berm offshore approximately 2.5 miles off Quintana in approximately 40 feet of water with the remainder of the dredged material. The dredge material will be used to build a berm approximately 8,000 feet long by 2,000 feet wide and 15 feet high. The Port of Freeport states that the primary benefit of the berm will be for fish habitat as a topographic feature and relatively hard substrate in an area that that is very flat and has very soft bottom conditions.

Appendix F

Draft General Conformity Determination and Air Emissions Estimates

U.S. Army Corps
of Engineers
Galveston District

U.S. Army Corps of Engineers
Galveston District
Draft
General Conformity Determination

for

Proposed Port Freeport Channel Widening
Brazoria County, Texas

November 2006

Professional Engineer Statement

The attached Draft General Conformity Determination Document and estimate of air contaminant emissions is released on October 18, 2006, under the authority of Ruben I. Velasquez, P.E., Registration No. 69126, for the purpose of evaluation and discussion. This preliminary document is not to be used for construction, bidding, or permitting purposes.

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Acronyms and Abbreviations

BRHND	Brazos River Harbor Navigation District
CAA	Federal Clean Air Act
CFR	Code of Federal Regulations
CY	cubic yards
DEIS	Draft Environmental Impact Statement
DOT	U.S. Department of Transportation
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
HGB	Houston/Galveston/Brazoria
LOA	length over all
MMCY	million cubic yards
MPRSA	Marine Protection and Sanctuaries Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides
SIP	Texas State Implementation Plan
TCEQ	Texas Commission on Environmental Quality
tpd	tons per day
tpy	tons per year
TxLED	Texas Low-Emission Diesel
U.S.	United States
UPCA	upland confined placement area
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1.0 INTRODUCTION

The Brazos River Harbor Navigation District (BRHND) of Brazoria County, Texas (also known as Port Freeport) applied to the U.S. Army Corps of Engineers (USACE), Galveston District, for a Clean Water Act Section 404 permit and Rivers and Harbors Act Section 10 permit for dredge and fill activities related to the widening of portions of the Freeport Ship Channel on 14 April 2005. Activities subject to the jurisdiction of the USACE would include dredging in navigable waters to widen portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Entrance Channel and placement of fill in waters of the United States (U.S.). Based on the Section 10/404 permit application submitted by Port Freeport, the USACE determined that the permitting action for the proposed dredge and fill activities constitutes a major Federal action. In accordance with the National Environmental Policy Act (NEPA), a Draft Environmental Impact Statement (DEIS) has been prepared to analyze and disclose the potential impacts of the proposed project and reasonable alternatives on the natural and human environment.

The project is located in the Freeport Harbor Channel, Brazoria County, Texas (Figure 1). Specifically, the project site is located along the northern edge of the Freeport Harbor Jetty and Entrance Channels, between the towns of Surfside and Quintana. The project can be located on the U.S. Geological Survey quadrangle map entitled Freeport, Texas. Approximate UTM Coordinates: NAD83, UTM 14N, 861095.730029, 3206475.762543.

Port Freeport proposes to widen portions of the Freeport Ship Channel. The project includes widening the Freeport Harbor Jetty Channel beginning at Channel Station 63+35 (see Figure 1) with a gradual widening, at the authorized depth, up to an additional 150 feet for about 1,835 feet to Channel Station 45+00. From that point to Channel Station 40+00 the widening would be less gradual from the additional 150 feet to an additional 200 feet. Through the rest of the Jetty Channel and to the end of the Freeport Harbor Entrance Channel (Channel Station -260+00), the channel would be widened an additional 200 feet. The length of channel proposed for widening is about 6.1 miles, of which 5.7 miles would be widened by 200 feet. The project depth will remain the same at 45 feet in the Jetty Channel and 47 feet in the Entrance Channel.

The widening would generate approximately 3.2 million cubic yards (MMCY) of new dredged material. Approximately 2.9 MMCY of the new work material would consist of clay material and about 300,000 cubic yards (CY) would consist of silty/sand material. If approved by EPA under Section 103 of Marine Protection and Sanctuaries Act (MPRSA) and by USACE for placement under Section 102 of MPRSA, an ODMDS previously designated as a one-time use site would be redesignated for placement of the 2.9 MMCY of clay/silt material. The 300,000 CY of silty/sand material would be used beneficially and placed on Quintana Beach in front of the Seaway upland confined placement area (UPCA). The beach on either side of this location has been enhanced through General Land Office or other programs, leaving a “gap” in front of the Seaway UPCA. Placement of the material in this location would fill the gap, allowing for continuous beach use and providing some protection from erosion for the Seaway UPCA.

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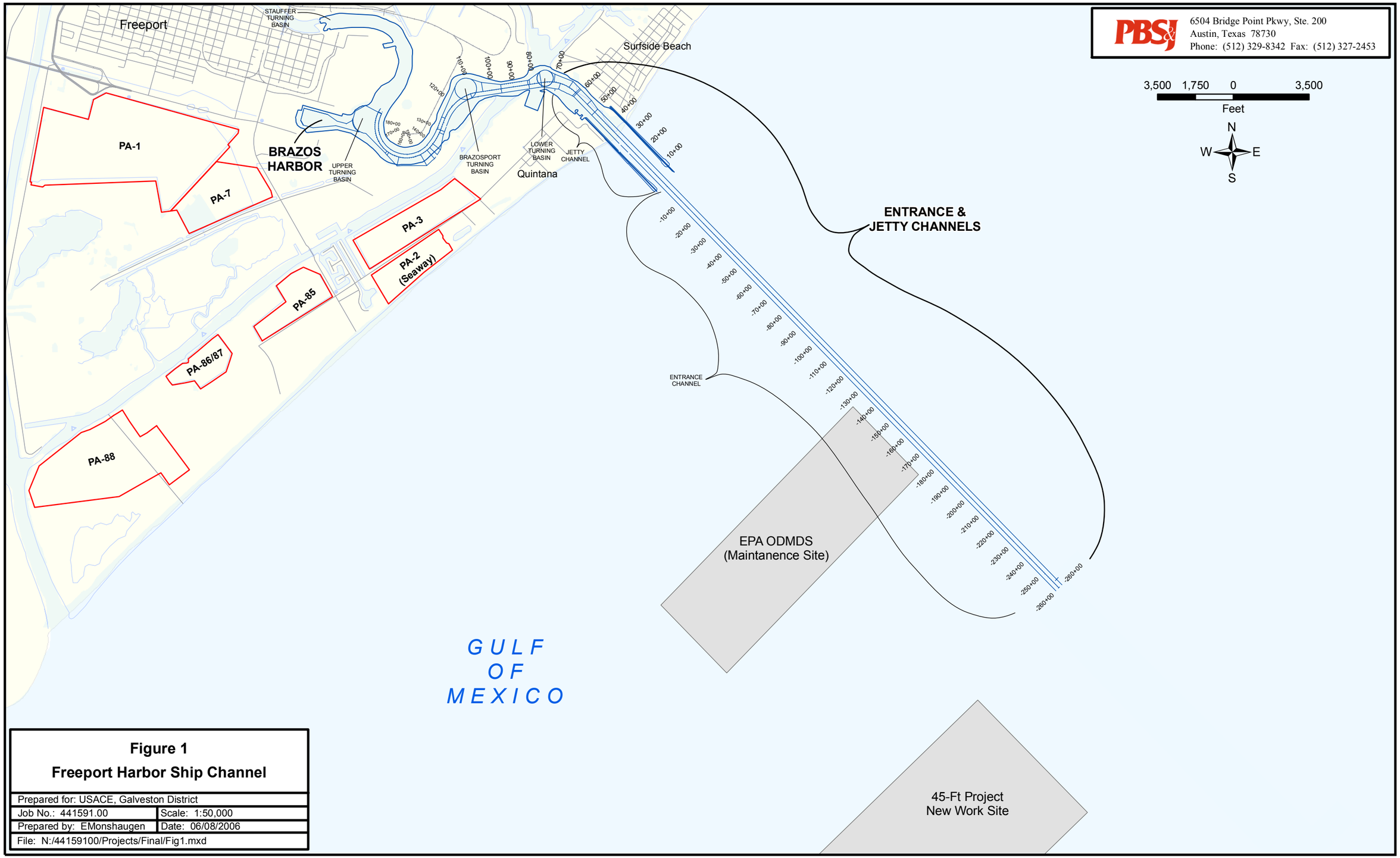

Figure 1
Freeport Harbor Ship Channel

Prepared for: USACE, Galveston District	
Job No.: 441591.00	Scale: 1:50,000
Prepared by: EMonshaugen	Date: 06/08/2006
File: N:/44159100/Projects/Final/Fig1.mxd	

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Additional information regarding the proposed project is presented in the DEIS.

1.1 PURPOSE

The purpose of the proposed project is to widen the channel to eliminate existing operational constraints that include (a) one-way traffic, (b) daylight-only operations for larger vessels, and (c) restrictions that do not allow the larger vessels to enter the Port when winds exceed 20 knots or crosscurrents exceed 0.5 knots. The maximum ship dimensions permitted by the pilots at Freeport Harbor are: 825-foot length over all (LOA), 145-foot maximum beam, and 42-foot draft. These problems are discussed in more detail below.

LOA Restrictions – The length limitation of 825 feet is enforced because cross winds and currents force tankers to "crab" at an angle through the entrance channel. Ships of greater length than 825 feet are not able to clear the jetties under adverse wind and current conditions. Waivers on ship length are granted on a case-by-case basis for ships as large as 900-foot LOA and 160-foot beam to transit the Freeport Harbor Channel, provided that wind is less than 15 knots and that there is no more than a 0.5 knot cross current at the mouth of the jetties. About three to four ships per month are granted these waivers. Numerous requests have been submitted for ships in the 920- to 950-foot LOA range to transit the Channel and these requests have been denied. When denied access to Freeport Harbor, these ships normally divert to Corpus Christi or New Orleans.

Beam Restrictions – The maximum beam permitted under normal operations is 145 feet. Vessels with larger beams will require waivers to enter the channel.

One-Way Traffic Restriction – Because of the 400-foot width of the entrance and main channels, one-way ship traffic is always in effect in the Freeport Harbor Channel. This can result in delays when ship schedules coincide.

Daylight-Only Operation Restriction – Because of channel dimensions as well as the nature of the cargo of ships calling at Freeport Harbor, daylight-only operation is enforced on all vessels greater than 750 feet LOA or over 107 feet wide. This can result in waiting time of up to 12 hours, if ship arrival/ departure occurs at dark.

1.2 NEED

The project need is the elimination of the operational constraints to allow vessels to avoid delays, thereby reducing shipping costs and logistical problems and increasing vessel safety.

As discussed in the DEIS, the USACE has previously noted the problems mentioned above; i.e., that the relatively narrow (400-foot wide) entrance and main channels limit the Freeport Harbor Channel to one-way for all vessels and daylight-only operation for the larger vessels. They also note that "the light-loading, one-way traffic, and daylight-only operation result in significantly higher costs to users of the

Port Freeport than would be experienced if the harbor were enlarged and deepened. The transportation savings that would result from improvements at Freeport Harbor would be an economic benefit to the nation." Thus the USACE has confirmed the need for the project and that the project serves the national interest.

1.3 GENERAL CONFORMITY

This project, as a Federal action, is subject to the General Conformity Rule promulgated by the U.S. Environmental Protection Agency (EPA). The rule mandates that the Federal government not engage in, support, or provide financial assistance for licensing or permitting, or approving any activity not conforming to an approved state implementation plan. In Texas, the applicable plan is the Texas State Implementation Plan (SIP), an EPA-approved plan for the regulation and enforcement of the National Ambient Air Quality Standards (NAAQS) in each air quality region within the state.

The General Conformity Rule is applicable only to nonattainment and maintenance areas. The Freeport Channel Widening Project would be located in Brazoria County, Texas. Brazoria County is included in the eight-county Houston/Galveston/Brazoria (HGB) ozone nonattainment area, which is classified as "moderate" in terms of its degree of compliance with the current 8-hour ozone standard. This classification affects facilities that generate the ozone precursors, oxides of nitrogen (NO_x), and volatile organic compounds (VOC).

Based on an evaluation of air contaminant emissions associated with this project, it has been determined that a General Conformity Determination for NO_x emissions would be required. Emissions of VOC for this project are exempt from a General Conformity Determination because they are below the emissions threshold requiring such an analysis.

The USACE, PBS&J, and representatives of the Port of Freeport have participated in meetings with the EPA on 12 July 2006, and with the TCEQ on 18 July 2006, to discuss the proposed Freeport Channel Widening Project and the initial approach to General Conformity Determination. During these meetings, the staff was informed of the project and provided with a preliminary estimate of construction and operating emissions.

This document represents the Draft General Conformity Determination prepared on behalf of the USACE, Galveston District, pursuant to the Clean Air Act (CAA), Section 176(c)(1), to assess whether the emissions that would result from the proposed Freeport Channel Widening Project are in conformity with the SIP for the HGB ozone nonattainment area.

2.0 REGULATORY BACKGROUND – GENERAL CONFORMITY

The General Conformity Rule establishes conformity in coordination with and as part of the NEPA process. The rule takes into account air pollution emissions associated with actions that are federally funded, licensed, permitted, or approved, and ensures emissions do not contribute to air quality degradation, thus preventing the achievement of State and Federal air quality goals. The EPA promulgated the General Conformity Rule on 30 November 1993 (EPA, 1993). The rule implements the CAA conformity provision in Title I, Section 176(c)(1), "Limitation on Certain Federal Assistance," which mandates that the Federal government not engage in, support, or provide financial assistance for licensing or permitting, or approving any activity not conforming to an approved implementation plan. In Texas, the applicable plan is the Texas SIP, an EPA-approved plan for the regulation and enforcement of the NAAQS in each air quality region within the state. This rule is designed to ensure that Federal actions do not cause or contribute to air quality violations in areas that do not meet the NAAQS. The General Conformity Rule is codified at Title 40 Code of Federal Regulations (CFR) Part 51, Subpart W, and Title 40 CFR Part 93, "Determining Conformity of Federal Actions to State or Federal Implementation Plans."

The Texas Commission on Environmental Quality (TCEQ), has promulgated its own corresponding regulations under 30 TAC § 101.30, "Conformity of General Federal Actions to State Implementation Plans" (TCEQ, 1999). Unless specifically exempted, this rule applies to all Federal actions except programs and projects requiring funding or approval from the U.S. Department of Transportation (DOT), the Federal Highway Administration (FHWA), the Federal Transit Administration, or the Metropolitan Planning Organization. These types of programs and projects must instead comply with the conformity provisions implemented in the Transportation Conformity Rule issued by the DOT on 24 November 1993.

Title I, Section 176(c)(1) of the CAA defines conformity to an implementation plan as the upholding of "an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards and achieving expeditious attainment of such standards." Conforming activities or actions should not, through additional air pollutant emissions, result in the following:

- Cause or contribute to new violation of any NAAQS in any area;
- Increase the frequency or severity of any existing violation of any NAAQS in any area; or
- Delay timely attainment of any NAAQS or interim emission reductions or other milestones in any area.

In short, general conformity refers to the process of evaluating plans, programs, and projects to determine and demonstrate they meet the requirements of the CAA and the SIP. The purpose of this General Conformity requirement is to assure Federal agencies consult with state and local air quality districts to

assure these regulatory entities know about the expected impacts of a Federal action and would include expected emissions in their SIP emissions budget.

Pursuant to the General Conformity Rule, a Federal agency; e.g., the USACE, must make a General Conformity Determination for all Federal actions in nonattainment or maintenance areas where the total of direct and indirect emissions of a nonattainment pollutant or its precursors exceeds levels established by the regulations. For the HGB nonattainment area, the threshold level is 100 tons per year (tpy) for either NO_x or VOC. In addition, even if the total of direct and indirect emissions of VOC or NO_x do not exceed the 100 tpy threshold levels, when the total of direct and indirect emissions of any pollutant from the Federal action represents 10% or more of a nonattainment or maintenance area's total emissions of those pollutants, then the action is defined as a regionally significant action and a conformity determination would still be applicable.

3.0 APPLICABILITY

Consistent with Section 176(c)(1) of the CAA, a Federal action is generally defined as any activity engaged in or supported in any way by any department, agency, or instrumentality of the Federal government (40 CFR 51.852). Federal actions include providing Federal financial assistance or issuing a Federal license, permit, or approval. Where the Federal Action is a permit, license, or other approval for some aspect of a non-Federal undertaking, the relevant activity is the part, portion, or phase of the non-Federal undertaking that requires the Federal Permit, license, or approval.

The proposed Freeport Channel Widening Project will require USACE approval under the Clean Water Act Section 404 permit and Rivers and Harbors Act Section 10 permit for dredge and fill activities related to the widening of portions of the Freeport Ship Channel. Activities subject to the jurisdiction of the USACE would include dredging in navigable waters to widen portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Entrance Channel and placement of fill in waters of the U.S. Based on the Section 10/404 permit application submitted by Port Freeport to the USACE in April 2005, the USACE determined that the permitting action for the proposed dredge and fill activities constitutes a major Federal action.

The Port of Freeport is in Brazoria County, within the HGB ozone nonattainment area, which is classified as “moderate” in terms of its degree of compliance with the current 8-hour ozone standard. This area is in attainment or is unclassified in terms of attainment for all other criteria pollutants. Pursuant to the General Conformity Rule, a General Conformity Determination is required for each year where the total of direct or indirect emissions caused by the Freeport Channel Widening Project would equal or exceed 100 tpy of NO_x or 100 tpy of VOC (40 CFR 51.853). The rule does not apply (i.e., a General Conformity Determination is not required) to actions where the total of direct or indirect emissions is below these emissions levels. In addition, even if the total of direct and indirect emissions of VOC or NO_x do not exceed the 100 tpy threshold levels, when the total of direct and indirect emissions of any pollutant from the Federal action represents 10% or more of a nonattainment or maintenance area’s total emissions of those pollutants, then the action is defined as a regionally significant action and a conformity determination would be still be applicable.

The general conformity regulations require the inclusion of direct and indirect impacts of the Federal action in the conformity applicability analysis if those impacts are reasonably foreseeable and subject to continuing agency responsibility. Only those air emissions of NO_x and VOC related to the Federal action; i.e., those considered to be jurisdictional by the USACE, should be considered in this General Conformity Determination.

The proposed Freeport Channel Widening Project has been evaluated in terms of the USACE’s continuing program responsibility, and the relevant direct and indirect emissions are those associated with the widening of the Freeport Entrance Channel and Jetty Channels such as emissions from dredging,

dredge support equipment, construction equipment used in the placement of dredged material, and employee vehicles used to commute to and from the work sites.

4.0 AIR EMISSIONS INVENTORY

For purposes of this Draft General Conformity Determination, an air emissions inventory was prepared for project-related activities based on the schedule and other assumptions as provided by the project sponsors. Air emissions estimates were calculated using techniques appropriate for a specific emissions generating activity or source. The basis, emission factors, and summary of emissions are provided in Appendix A of this document.

4.1 PROJECT EMISSIONS

The emission sources for the Freeport Channel Widening Project consist of marine and land-based mobile sources that will be utilized as scheduled for the one-year duration of the project. The marine emission sources will include three types of dredges; clamshell, hydraulic, and hopper, as well as support equipment such as tugboats, tenders, runabouts, and shrimp boats. The land-based emission sources will include both off-road equipment consisting of the bulldozers utilized for dredged material placement sites and on-road vehicles for employees commuting to and from the work site. The marine emission sources and off-road equipment will consist primarily of diesel-powered engines. The on-road employee vehicles will consist primarily of gas powered vehicles.

Project emissions were estimated for the projected years of construction, starting during the fourth quarter of 2007 through to the end of 2008. These emissions were based on projected equipment use and scheduling provided by the project sponsors. Engine load factors and emission factors were determined using EPA guidelines (EPA, 2000, 2004). Emissions of NO_x and VOC were estimated in tons per year for each piece of equipment. The emissions were then categorized and totaled and broken out on annual basis for each year for which dredging is projected to occur. The project emissions inventory included the following air emissions sources:

- Nonroad Mobile Equipment including:
  - Dredging Activities – dredges and support marine vessels
  - Land-side Dredged Material Placement – bulldozing equipment; and
- On-Road Mobile Sources – employee commuter vehicles

4.1.1 Dredging Activities

Air emissions directly related with the dredging equipment including the main propulsion engine, generators used to drive the dredge pumps, and emissions from support equipment such as tugs and runabouts were calculated on an annual basis based on the anticipated type of activity, engine use, horsepower, load factor, and anticipated hours of operation during the construction period. It was assumed that the widening project would occur in three phases:

- Phase 1 – A 24-inch hydraulic cutter dredge would be used for pumping and on-shore placement of 300,000 cubic yards (CY) of silt and sandy material;
- Phase 2 – A bucket crane dredge would be used to mechanically dredge 150,000 CY of clay material onto a barge for future on-shore placement; and
- Phase 3 – A hopper dredge would be used to dredge 2,750,000 CY of clay material for placement at Dredged Material Placement areas.

When not dredging, air contaminant emissions were also estimated from dredging vessels when sailing as ocean going vessels; e.g., during periods of mobilization to the dredging site or during transport and placement of the dredged material.

Estimated emissions from the use of dredging equipment and from use of tug boats and miscellaneous marine vessels in support of the dredging activities were based on the emission factor algorithms referenced from EPA's technical report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data," EPA 420-R-00-002, February 2000. This technical report is a compilation of engine and fuel usage test data from various types of marine vessels including bulk carriers, container ships, dredges, tankers, and tugboats. As presented in this document, emission factors may be determined based on an emission factor algorithm that is applicable to all marine engine sizes since, according to the EPA's document, the emissions data showed no statistically significant difference across engine sizes.

4.1.2 Land-side Dredged Material Placement – Bulldozing Equipment

It is anticipated that land-side dredged material placement activities would occur only in support of the Phase I activities in the year 2007 and would include working and compacting of the dredged material on-shore within a localized area of placement using bulldozing equipment. Air contaminant emissions from the combustion of diesel fuel in the bulldozing equipment were calculated on an annual basis based on the anticipated type horsepower, load factor, anticipated hours of operation, and emission factors generated using the EPA's NONROAD 2005 model. This computer model may be used to calculate emissions for many nonroad equipment types, categorizing them by horsepower rating and fuel type available for specific years, for a specific geographic area, state or county. The NONROAD 2005 model was utilized to provide emission factors for the bulldozers that may be available for use in Brazoria County for the model year 2007.

It is expected that Texas Low-Emission Diesel (TxLED) will be available for use in nonroad equipment such as bulldozers during the proposed construction period pursuant to the TxLED requirements of the SIP. However, for conservatism, a reduction in NO_x emissions was not assumed in the final summary of emissions for this equipment in support of this project.

4.1.3 On-Road Mobile – Employee Commuter Vehicles

Mobile source emissions associated with the Freeport Channel Widening Project construction would be generated from employee commuter vehicles to and from the worksite. It was assumed that commuter

vehicles would include a mix of cars and light-duty trucks burning primarily gasoline. Mobile source emission factors were estimated using the EPA's mobile-source emissions model, MOBILE6.2 based on vehicle information and other input options specific to Brazoria County as provided by the TCEQ's Air Quality Planning and Implementation Division.

MOBILE6.2 is an emission factor model that may be used to calculate emission factors, in grams per mile, for different vehicle types under various operating conditions. These emission factors were multiplied by the type and number of vehicles and the estimated number of miles traveled to and from the worksite to estimate the annual emissions resulting from employee vehicles.

4.2 SUMMARY OF NO_X AND VOC Emissions

For comparison with the thresholds defined in the General Conformity Rule, the estimated annual emissions of NO_x and VOC are summarized in Tables 1 and 2 for each year of anticipated construction activities. Emissions of carbon monoxide, sulfur dioxide, and particulate matter are not considered in the General Conformity evaluation as this area is unclassified or in attainment with the NAAQS for each of those pollutants.

TABLE 1

SUMMARY OF NO_x EMISSIONS
(tpy)

Activity	2007	2008
Dredging Activities – Dredging Vessel Equipment and Dredging Support Vessels	84.98	196.21
Dredging Vessel Propulsion in Transit During Mobilization or Placement of Dredged Material	75.61	72.65
Land-side Dredged Material Placement – Bulldozing Equipment	0.51	–
On-Road – Employee Commuter Vehicles	0.02	0.02
Totals	**161.13**	**268.88**

As shown in Table 1, the estimate of NO_x emissions for the project would exceed the conformity threshold; i.e., greater than 100 tpy, for the years 2007 and 2008. Therefore, a General Conformity Determination for NO_x emissions would be required for each of these years.

TABLE 2

SUMMARY OF VOC EMISSIONS
(tpy)

Activity	2007	2008
Dredging Activities – Dredging Vessel Equipment and Dredging Support Vessels	1.10	2.50
Dredging Vessels in Transit During Mobilization or Placement of Dredged Material	0.71	0.64
Land-side Dredged Material Placement – Bulldozing Equipment	0.04	--
On-Road – Employee Commuter Vehicles	0.03	0.03
Totals	**1.88**	**3.17**

As shown in Table 2, the estimate of VOC emissions for the project would be exempt from a General Conformity Determination because they are below the 100 tpy threshold for the year 2007 and 2008.

5.0 PRELIMINARY GENERAL CONFORMITY DETERMINATION

The proposed Freeport Channel Widening Project would conform to the applicable SIP if, for each pollutant that exceeds the threshold rates (100 tpy of NO_x or VOC), the total of direct and indirect emissions from the action is in compliance or consistent with all relevant requirements and milestones contained in the applicable SIP. Under the TCEQ General Air Quality Rules 30 TAC § 101.30, "Conformity of General Federal Actions to State Implementation Plan," a Federal action required to have a conformity determination for a specific pollutant would be determined to conform to the SIP if it meets one of several requirements in 30 TAC §101.30(h), "Criteria for Determining Conformity of General Federal Actions" (TCEQ, 1999).

Based on available information, it is believed that the USACE action in approving the Freeport Channel Widening Project can meet the requirements of TCEQ Chapter 101, § 101.30(h)(1)(E)(i)(I). This section of the TCEQ's General Conformity Rule applies to an ozone nonattainment area; i.e., NO_x or VOC emissions, where the EPA has approved a revision to an area's attainment demonstration after 1990 and the state makes a determination that "the total of direct and indirect emissions from the action, or portion thereof, is determined and documented by the TCEQ to result in a level of emissions, which, together with all other emissions in the nonattainment area, would not exceed the emissions budgets specified in the SIP."

The emissions budget for General Conformity purposes is defined in the TCEQ General Air Quality Rules §101.30(8). In summary, the emissions budget is that portion of the total allowable emissions used as a basis for the latest approved revision of the SIP that is allocated to mobile sources; any stationary source or class of stationary sources; to any federal action or class of actions; to any class of area sources; or to any subcategory of the emissions inventory. According to a letter from the EPA to the Federal Energy Regulatory Commission dated 24 August 2005 (copy in Appendix B), the EPA revoked the 1-hour ozone standard on 15 June 2005, and thus, this standard in no longer in effect for the Houston-Galveston Area. Any General Conformity Determination must be based on the new 8-hour ozone standard and the corresponding attainment dates and de minimis levels.

For the HGB nonattainment area, the most recently approved SIP revision is the 2004 Mid-Course Review SIP (TCEQ, 2004), based on attainment of the 1-hour ozone standard, and associated emissions trading programs approved by the EPA on 6 September 2006 (EPA, 2006). In this SIP, the emissions budgets for NO_x and VOC are based on emissions inventories for 1999 updated for the year 2000, where appropriate, and projected 2007. For moderate nonattainment areas, such as the HGB nonattainment area, the attainment year under the 8-hour ozone standard should be 2009. However, the emissions inventory in the most recently approved SIP is based on the attainment year 2007, and thus, the budgets in the applicable categories and subcategories of the emissions inventory for 2007 were used in this analysis to represent the emissions budgets for the attainment year 2009.

The inventory of emissions of NO_x and VOC is summarized in the SIP from the emissions inventories for the five general categories of emission sources: stationary point, area, on-road mobile, nonroad mobile, and biogenics. As discussed in the 2004 SIP revision, nonroad mobile sources are a subset of the area source category. This subcategory includes aircraft operations, marine vessels, recreational boats, railroad locomotives, and a very broad category of nonroad equipment that includes engines mounted on construction equipment.

Based on information provided in the 2004 SIP revision, the motor vehicle emissions budget for 2007 is 186.13 tons per day (tpd) of NO_x and 89.99 tpd of VOC. The area source emissions weekday budget for 2007 is 144.86 tpd day of NO_x and 234.49 tpd of VOC. This area source emissions budget is further broken out in the SIP as shown on Table 3:

TABLE 3

SIP 2007 WEEKDAY HGB NONATTAINMENT AREA SOURCE EMISSIONS SUMMARY[1]
(tpd)

SIP Area Source Emissions Categories	NO_x	VOC
Low-level Nonroad Mobile (not including ships)	64.53	50.62
2007 HGB Ships	40.03	0.96
Area Sources (other than nonroad mobile sources and ships)	40.3	182.86
TOTALS	144.86	234.49

[1]TCEQ, 2004.

The 2007 HGB Ship emissions inventory is based on the 1997 Houston Galveston Area Vessel Emissions Inventory data from a detailed shipping emissions project described in the previous December 2000 SIP revision and follow-on work performed under the same project (TCEQ, 2000). This vessel emissions inventory includes emissions from ocean-going vessels, dredges (main engine, generators, and auxiliary engines), tugboats, towboats, and other commercial marine vessels. The Nonroad Mobile emissions inventory includes emissions from equipment associated with agricultural, aircraft, commercial, construction, ground support (airport), industrial, lawn and garden, railroad maintenance, logging, locomotives, oil and gas, recreational, and recreational marine equipment.

As shown on Table 1, the highest estimated annual emissions of NO_x during the Freeport Channel Widening Project are 268.88 tpy in 2008. For comparison to the SIP Area Source Emissions budget, the highest annual NO_x emission rate for the proposed project may be broken out as shown on Table 4.

TABLE 4

PROJECT NO_X EMISSIONS COMPARED TO SIP 2007
WEEKDAY AREA SOURCE EMISSIONS BUDGET[1]

SIP Area Source Emissions Categories	Project Activity	Maximum Annual NO_x Emissions (tpy)	Maximum Annual NO_x Emissions (tpd)	SIP Emissions Budget (tpd)	% of SIP Emissions Budget
HGB Ships	Dredging Activities – Dredging Vessel Equipment and Dredging Support Vessels including Transit and Mobilization	268.86 (2008)	0.74	40.03	1.8
Nonroad Mobile	Land-side Dredged Material Placement – Bulldozing Equipment	0.51 (2007)	0.021	64.53	0.03
Area Source (All)	Total Dredging and Nonroad Equipment	269.37	0.76	144.86	0.5
On-Road Mobile	On-Road – Employee Commuter Vehicles	0.02 (2007 or 2008)	0.0008	186.13	0.0004

[1]TCEQ, 2004.

As shown on Table 4, NO_x emissions from the project dredging activities during 2008 would represent less than 2% of the 2007 HGB Ship emissions budget. The project nonroad mobile equipment emissions during the year 2007 would represent about 0.03% of the SIP 2007 Nonroad Emissions Budget for NO_x. Combined emissions from project nonroad mobile sources including emissions from dredging activities and land-side equipment would represent about 0.5% of the total SIP 2007 Area Source Emissions Budget. Air emissions from employee commuter vehicles would represent about 0.0004% of the SIP 2007 Motor Vehicle Emissions Budget.

Based on an evaluation of the proposed project emissions and consideration of the interaction and information exchanged during the meetings with the TCEQ and the EPA, it is believed that the total of direct and indirect emissions of NO_x resulting from the USACE action subject to this general conformity evaluation would result in a level of emissions that are well within the 2007 Area Source Category Emissions Budget and within the emissions budget for the 2007 HGB Ships and Nonroad Mobile subcategories in the most recently approved SIP revision. As the Freeport Channel Widening Project is not unusual in scope for an area like the HGB, it is anticipated that emissions from each year of the

project will be less than an increase of 10% of the VOC and NO_x emissions inventories for the entire HGB nonattainment area. Therefore, emissions from the activities subject to the USACE action would not be considered regionally significant for purposes of General Conformity. Because of this, it is expected that emissions from the project construction would not:

- Cause or contribute to new violation of any NAAQS in any area;
- Increase the frequency or severity of any existing violation of any NAAQS in any area; or
- Delay timely attainment of any NAAQS or interim emission reductions or other milestones in any area.

Pursuant to the General Conformity Rule (40 CFR 51.855), this Draft General Conformity Determination is being provided to demonstrate that the proposed Freeport Channel Widening Project would comply with the requirements of the General Conformity Rule and would be in conformity with the SIP. As specified in the TCEQ General Rules, Chapter 101, 101.30(h)(1)(E)(i)(I), the state must make a determination and document that the total of direct and indirect emissions from the action, or portion thereof, would result in a level of emissions which, together with all other emissions in the HGB nonattainment area, would not exceed the emissions budgets specified in the SIP. Therefore, it is requested that the TCEQ review this draft and provide a formal determination and confirmation. Once written confirmation is received, this information will be relied upon by the USACE as a basis for making a Final General Conformity Determination for the proposed Freeport Channel Widening Project.

6.0 REFERENCES

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Appendix A

Summary of Estimated Air Emissions

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Table 1. Summary of Emissions by Engine Type and by Activity
Freeport Channel Widening Project

Engine Type - Activity	Emissions by Engine Type (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Propulsion - Dredging	19.66	149.42	3.40	3.59	25.02	2.13
Dredge Pumps - Dredging	3.97	40.23	0.91	0.96	6.63	0.35
Main Engine - Crane Dredging	0.12	1.19	0.03	0.03	0.20	0.01
Secondary - Dredging	10.42	90.34	2.05	2.16	14.98	1.11
Propulsion - Oceangoing	7.99	78.82	1.78	1.88	13.00	0.73
Secondary - Oceangoing	6.91	69.44	1.57	1.65	11.44	0.62
Vehicles	0.66	0.05	0.001	0.002	0.001	0.06
Construction	0.14	0.51	0.02	0.02	0.02	0.04
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**

Table 2. Summary of Emissions from Propulsion Engines During Dredging Activities
Freeport Channel Widening Project

	Emissions from Propulsion Engines (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	--	--	--	--	--	--
Anchor Tender	0.017	0.086	0.002	0.002	0.015	0.002
Runabout	0.017	0.086	0.002	0.002	0.015	0.002
Small Tug	0.124	0.648	0.015	0.016	0.112	0.016
Large Tug	0.248	1.296	0.030	0.032	0.223	0.031
Dozers	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Bucket Crane	--	--	--	--	--	--
Runabout	0.012	0.062	0.001	0.002	0.011	0.001
Large Tug	0.419	4.248	0.096	0.101	0.699	0.037
Employee Vehicles	--	--	--	--	--	--
Hopper	9.065	91.969	2.074	2.188	15.144	0.807
Runabout	0.938	4.901	0.113	0.120	0.845	0.118
Shrimpboat	8.826	46.123	1.068	1.126	7.955	1.111
Employee Vehicles	--	--	--	--	--	--
Total from Propulsion Engine During Dredging	**19.66**	**149.42**	**3.40**	**3.59**	**25.02**	**2.13**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Propulsion Engines During Dredging	**39.4%**	**34.7%**	**34.9%**	**34.9%**	**35.1%**	**42.1%**

Table 3. Summary of Emissions from Dredge Pumps During Dredging Activities
Freeport Channel Widening Project

	Emissions from Dredge Pumps (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	0.423	4.293	0.097	0.102	0.707	0.038
Anchor Tender	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Small Tug	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Dozers	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Bucket Crane	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Hopper	3.543	35.942	0.811	0.855	5.918	0.315
Runabout	--	--	--	--	--	--
Shrimpboat	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Total from Pump Engine During Dredging	**3.97**	**40.23**	**0.91**	**0.96**	**6.63**	**0.35**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Dredge Pumps During Dredging	**8.0%**	**9.4%**	**9.3%**	**9.3%**	**9.3%**	**7.0%**

Table 4. Summary of Emissions from Main Crane Engine During Dredging Activities
Freeport Channel Widening Project

	Emissions from Main Crane Engine (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	--	--	--	--	--	--
Anchor Tender	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Small Tug	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Dozers	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Bucket Crane	0.118	1.195	0.027	0.028	0.197	0.010
Runabout	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Hopper	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Shrimpboat	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Total from Crane Engine During Dredging	**0.12**	**1.19**	**0.03**	**0.03**	**0.20**	**0.01**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Main Crane Engine During Dredging	**0.2%**	**0.3%**	**0.3%**	**0.3%**	**0.3%**	**0.2%**

Table 5. Summary of Emissions from Secondary and/or Auxiliary Engines During Dredging Activities
Freeport Channel Widening Project

	Emissions from Secondary Engines During Dredging (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	0.294	1.537	0.036	0.038	0.265	0.037
Anchor Tender	0.004	0.010	0.0003	0.0003	0.002	0.001
Runabout	0.006	0.016	0.0004	0.0004	0.003	0.001
Small Tug	0.011	0.031	0.001	0.001	0.006	0.002
Large Tug	0.011	0.031	0.001	0.001	0.006	0.002
Dozers	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Bucket Crane	0.048	0.252	0.006	0.006	0.044	0.006
Runabout	0.004	0.011	0.000	0.000	0.002	0.001
Large Tug	0.014	0.073	0.002	0.002	0.013	0.002
Employee Vehicles	--	--	--	--	--	--
Hopper	8.201	83.201	1.877	1.980	13.700	0.730
Runabout	0.064	0.180	0.004	0.005	0.033	0.011
Shrimpboat	1.765	4.995	0.123	0.130	0.912	0.314
Employee Vehicles	**--**	**--**	**--**	**--**	**--**	**--**
Total from Secondary Engine During Dredging	**10.42**	**90.34**	**2.05**	**2.16**	**14.98**	**1.11**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Secondary Engines During Dredging	**20.9%**	**21.0%**	**21.0%**	**21.0%**	**21.0%**	**21.9%**

Table 6. Summary of Emissions from Propulsion Engines During Ocean-going Activities
Freeport Channel Widening Project

	Emissions from Propulsion Engines (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	--	--	--	--	--	--
Anchor Tender	0.007	0.035	0.001	0.001	0.006	0.001
Runabout	0.000	0.000	0.000	0.000	0.000	0.000
Small Tug	0.124	0.648	0.015	0.016	0.112	0.016
Large Tug	0.248	1.296	0.030	0.032	0.223	0.031
Dozers	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Bucket Crane	--	--	--	--	--	--
Runabout	0.002	0.009	0.0002	0.0002	0.001	0.0002
Large Tug	0.066	0.345	0.0080	0.0084	0.060	0.008
Employee Vehicles	--	--	--	--	--	--
Hopper	7.539	76.493	1.725	1.820	12.595	0.671
Runabout	--	--	--	--	--	--
Shrimpboat	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Total from Propulsion Engine During Ocean-going	**7.99**	**78.82**	**1.78**	**1.88**	**13.00**	**0.73**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Propulsion Engines During Ocean-going	**16.0%**	**18.3%**	**18.2%**	**18.2%**	**18.2%**	**14.4%**

Table 7. Summary of Emissions from Secondary and/or Auxiliary Engines During Ocean-going Activities
Freeport Channel Widening Project

	Emissions from Secondary and/or Auxiliary Engines (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	0.100	0.522	0.012	0.013	0.090	0.013
Anchor Tender	0.001	0.004	0.0001	0.0001	0.0000	0.0003
Runabout	0.000	0.000	0.000	0.000	0.000	0.000
Small Tug	0.011	0.031	0.001	0.001	0.006	0.002
Large Tug	0.011	0.031	0.001	0.001	0.006	0.002
Dozers	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Bucket Crane	0.007	0.035	0.0008	0.0009	0.006	0.001
Runabout	0.001	0.002	0.00004	0.00004	0.0003	0.0001
Large Tug	0.002	0.006	0.0002	0.0002	0.001	0.0004
Employee Vehicles	--	--	--	--	--	--
Hopper	6.782	68.804	1.552	1.637	11.329	0.604
Runabout	**--**	**--**	**--**	**--**	**--**	**--**
Shrimpboat	**--**	**--**	**--**	**--**	**--**	**--**
Employee Vehicles	**--**	**--**	**--**	**--**	**--**	**--**
Total from Secondary Engine During Ocean-going	**6.91**	**69.44**	**1.57**	**1.65**	**11.44**	**0.62**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Secondary Engines During Ocean-going	**13.9%**	**16.1%**	**16.1%**	**16.1%**	**16.0%**	**12.3%**

Table 8. Summary of Emissions from Employee Vehicles
Freeport Channel Widening Project

	Emissions from Employee Vechicles (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	--	--	--	--	--	--
Anchor Tender	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Small Tug	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Dozers	--	--	--	--	--	--
Employee Vehicles	0.189	0.014	0.0003	0.0007	0.0002	0.018
Bucket Crane	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Employee Vehicles	0.030	0.002	0.00005	0.0001	0.00003	0.003
Hopper	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Shrimpboat	--	--	--	--	--	--
Employee Vehicles	0.442	0.033	0.0007	0.0016	0.0005	0.042
Vehicles Total	**0.66**	**0.05**	**0.001**	**0.002**	**0.001**	**0.06**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Employee Vehicles	**1.3%**	**0.01%**	**0.01%**	**0.02%**	**0.001%**	**1.3%**

Table 9. Summary of Emissions from Construction Equipment
Freeport Channel Widening Project

	Emissions from Nonroad Construction Equipment Engine (tons)					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Cutterhead	--	--	--	--	--	--
Anchor Tender	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Small Tug	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Dozers	0.14	0.51	0.02	0.02	0.02	0.04
Employee Vehicles	--	--	--	--	--	--
Bucket Crane	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Large Tug	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Hopper	--	--	--	--	--	--
Runabout	--	--	--	--	--	--
Shrimpboat	--	--	--	--	--	--
Employee Vehicles	--	--	--	--	--	--
Construction Total	**0.14**	**0.51**	**0.02**	**0.02**	**0.02**	**0.04**
Project Total	**49.87**	**430.01**	**9.76**	**10.29**	**71.28**	**5.05**
% of Project Total from Construction Equipment Engine	**0.3%**	**0.1%**	**0.2%**	**0.2%**	**0.0%**	**0.8%**

Table 10. General Conformity Emissions Summary
Freeport Channel Widening Project

		Tons per Year			
		NO_x		VOC	
		2007	2008	2007	2008
Marine Vessels - Dredging	Dredges	63.43	154.96	0.58	1.36
	Anchor Tender	0.097	--	0.003	--
	Runabouts	1.53	3.73	0.040	0.095
	Tugs	6.33	--	0.09	--
	Shrimpboat	13.60	37.52	0.38	1.05
	Subtotal	84.98	196.21	1.10	2.50
Marine Vessels - Oceangoing	Dredges	73.21	72.65	0.65	0.64
	Anchor Tender	0.039	--	0.001	--
	Runabouts	0.01	--	0.00	--
	Tugs	2.36	--	0.06	--
	Shrimpboat	--	--	--	--
	Subtotal	75.61	72.65	0.71	0.64
Construction	Dozers	0.51	--	0.04	--
Employee	Vehicles	0.02	0.02	0.03	0.03
	Total	**161.13**	**268.88**	**1.88**	**3.17**

Table A-1. Assumptions for Phase 1 Marine Equipment Engine HP, Load Factor, and Hours of Operation

Activity	Equipment Type	Quantity	Total Installed Power (hp)	Engine Type	Engine Fuel Type	Engine Load Factor	Engine hp (hp)	Hours of Operation per day (hrs/day)	Daily Engine Usage (%)	Total Days of Operation (days)	Total Engine Hours of Operation (hrs)
Dredge	24" Cutterhead Discharge	1	4,000	Main Pump	Diesel	0.8	2,560	20	100%	12	240
				Secondary	Diesel	0.4	160	20	100%	12	240
				Auxiliary	Diesel	0.4	1,350	24	100%	12	288
	Work Tug (small)	1	750	Propulsion	Diesel	0.4	750	20	100%	12	240
				Auxiliary	Diesel	0.2	67	20	100%	12	240
	Crew/Survey Boat (Runabouts)	2	50	Propulsion	Diesel	0.4	50	20	100%	12	480
				Auxiliary	Diesel	0.2	17	20	100%	12	480
	Anchor Tender	1	100	Propulsion	Diesel	0.4	100	20	100%	12	240
				Auxiliary	Diesel	0.2	22	20	100%	12	240
	Towing Tug (Large)	1	1,500	Propulsion	Diesel	0.4	1,500	20	100%	12	240
				Auxiliary	Diesel	0.2	67	20	100%	12	240
Mobilization / Demobilization	24" Cutterhead Discharge	1	4,000	Main Pump	Diesel	0.8	2,560		0%		0
				Secondary	Diesel	0.4	160	24	100%	4	96
				Auxiliary	Diesel	0.4	1,350	24	100%	4	96
	Work Tug (small)	1	750	Propulsion	Diesel	0.4	750	20	100%	12	240
				Auxiliary	Diesel	0.2	67	20	100%	12	240
	Crew/Survey Boat (Runabouts)	2	50	Propulsion	Diesel	0.4	50		0%		0
				Auxiliary	Diesel	0.2	17		0%		0
	Anchor Tender	1	100	Propulsion	Diesel	0.4	100	24	100%	4	96
				Auxiliary	Diesel	0.2	22	24	100%	4	96
	Towing Tug (Large)	1	1,500	Main Engine	Diesel	0.4	1,500	20	100%	12	240
				Auxiliary	Diesel	0.2	67	20	100%	12	240
Total Engine Hours in Phase 1											4,512
Total Engine Hours for all Phases											58,326
Percent of Total Engine Hours - Phase 1 Engine Hours											7.7%

Notes:

1. Hours of operation for Cutterhead dredge pump and cutter based on 20 hours/day and total phase duration of 12 days at rate of 25,000 CY per day.
2. Mobilization/Demobilization of pipeline using Large and Small Tug is assumed to be 12 days at a operating rate of 20 hrs/day. Mobilzation/Demobilzation of Cutterhead due to travel via interstate waterways into Houston-Galveston area is assumed to be 4 days total.
3. Cutterhead dredge is assumed to have a pontoon hull structure without propulsion. Dredge type and engine horsepower break-down is based on specifications for Ellicott's "Super-Dragon" Model Series 4170, available at www.dredge.com/specs/printer-friendly/4170.htm
4. Support equipment vessel (i.e. tugs, tenders, and crew boats) engine horsepower break-down based on main engine and auxiliary engine data found in Table 3.1 and Table 3.2 of Starcrest Consulting Group's *Port of Los Angeles Baseline Air Emissions Inventory - 2001* , prepared for the Port of Los Angeles, July 2005. Available online at http://www.portoflosangeles.org/DOC/REPORT_Final_BAEI.pdf.

Table A-2. Assumptions for Phase 2 Marine Equipment Engine HP, Load Factor, and Hours of Operation

Activity	Equipment Type	Quantity	Total Installed Power (hp)	Engine Type	Engine Fuel Type	Engine Load Factor	Engine hp (hp)	Hours of Operation per day (hrs/day)	Daily Engine Usage %	Total Days of Operation (days)	Total Engine Hours of Operation (hrs)
Dredge	Bucket Crane	1	500	Main Engine	Diesel	0.8	500	18	100%	19	342
				Auxiliary	Diesel	0.4	205	18	100%	19	342
	Crew/Survey Vessel (Runabout)	1	50	Propulsion	Diesel	0.4	50	18	100%	19	342
				Auxiliary	Diesel	0.2	17	18	100%	19	342
	Towing Vessel (Large Tug)	1	2,000	Propulsion	Diesel	0.8	2,000	16	100%	19	304
				Auxiliary	Diesel	0.4	67	16	100%	19	304
Mobilization / Demobilization	Bucket Crane	1	500	Main Engine	Diesel	0.8	500	0	0%	0	0
				Auxiliary	Diesel	0.4	205	24	100%	2	48
	Crew/Survey Vessel (Runabout)	1	50	Propulsion	Diesel	0.4	50	24	100%	2	48
				Auxiliary	Diesel	0.2	17	24	100%	2	48
	Towing Vessel (Large Tug)	1	2,000	Propulsion	Diesel	0.4	2,000	24	100%	2	48
				Auxiliary	Diesel	0.2	67	24	100%	2	48
Total Engine Hours in Phase 2											2,216
Total Engine Hours for all Phases											58,326
Percent of Total Engine Hours - Phase 2 Engine Hours											3.8%

Notes:
1. Hours of operation for Bucket Crane dredge based on 18 hours/day and total phase duration of 19 days at rate of 8,000 CY per day.
2. Mobilization/Demobilization setup for all equipment assumed to be 48 hours.
3. The main engine of the bucket crane dredge is not a propulsion engine but is used to power the bucket during dredging. The auxillary engine for the bucket dredge was based on the minimum auxiliary horsepower cited in Starcrest's *Port of Los Angeles Baseline Air Emissions Inventory - 2001* , prepared for the Port of Los Angeles, July 2005, page 156. Available online at http://www.portoflosangeles.org/DOC/REPORT_Final_BAEI.pdf.
4. Support equipment vessel (i.e. tugs and crew boats) engine horsepower break-down based on main engine and auxiliary engine data found in Table 3.1 and Table 3.2 of Starcrest Consulting Group's *Port of Los Angeles Baseline Air Emissions Inventory - 2001* , prepared for the Port of Los Angeles, July 2005. Available online at http://www.portoflosangeles.org/DOC/REPORT_Final_BAEI.pdf.

Table A-3. Assumptions for Phase 3 Marine Equipment Engine HP, Load Factor, and Hours of Operation

Activity	Equipment Type	Quantity	Total Installed Power (hp)	Engine Type	Engine Fuel Type	Engine Load Factor	Engine hp (hp)	Hours of Operation per day (hr/day)	Daily Engine Usage (%)	Total Days of Operation (days)	Total Engine Hours of Operation (hrs)
Dredge	Generic Large Hopper Dredge	1	9,395	Propulsion - Oceangoing	Diesel	0.8	4,350	20.4	44%	267	2,421
				Propulsion - Dredging	Diesel	0.8	4,350	20.4	56%	267	3,026
				Dredge Pump(s)	Diesel	0.8	1,700	20.4	56%	267	3,026
				Auxiliary - Oceangoing	Diesel	0.8	3,345	24	44%	267	2,848
				Auxiliary - Dredging	Diesel	0.8	3,345	24	56%	267	3,560
	Crew/Survey Boat (Runabout)	1	250	Propulsion	Diesel	0.4	250	20.4	100%	267	5,447
				Auxiliary	Diesel	0.2	17	20.4	100%	267	5,447
	Shrimp Boat	2	1,000	Propulsion	Diesel	0.4	1,000	24	100%	267	12,816
				Auxiliary	Diesel	0.2	200	24	100%	267	12,816
Mobilization / Demobilization	Generic Large Hopper Dredge	1	9,395	Propulsion - Oceangoing	Diesel	0.8	4,350	24	100%	4	96
				Auxillary - Oceangoing	Diesel	0.8	3,345	24	100%	4	96
Total Engine Hours in Phase 3											51,598
Total Engine Hours for all Phases											58,326
Percent of Total Engine Hours - Phase 3 Engine Hours											88.5%

Notes:

1. Total cycle time for Hopper Dredge is assumed to be 81 minutes and hopper dredge downtime is assumed to be 15%.
   Minute break-down of hopper dredge cycle is as follows:
   - Load time with dredge pumps on is 45 minutes.
   - Propulsion engine operate continously during entire cycle time of 81 minutes.
   - Bottom dumping without pumpout pumps takes 5 minutes.
   - Auxillary engines operate continuously, 24 hours per day.
2. Mobilization/Demobilization of Hopper due travel via interstate waterways into Houston-Galveston area is assumed to be 4 days total.
3. Hopper Dredge engine horsepower breakdown is based on specification for Great Lakes Dredge & Dock Company "Sugar Island Trailing Suction Hopper Dredge" with 3,600 yd^3 hopper capacity and total installed power of 9,395 hp. Specification is available at http://www.gldd.com/upload/zip/fleet/SUGAR_ISLAND_FLEET_SHEET.pdf.
4. Support equipment vessel (i.e. crew boat and shripm boat) engine horsepower break-down based on main engine and auxiliary engine data found in Table 3.1 and Table 3.2 of Starcrest Consulting Group's *Port of Los Angeles Baseline Air Emissions Inventory - 2001*, prepared for the Port of Los Angeles, July 2005.
   Available online at http://www.portoflosangeles.org/DOC/REPORT_Final_BAEI.pdf.

Table A-4. Marine Engine Emission Factors and Fuel Consumption Algorithms
(in g/kW-hr, for all marine engines)

Statistical Parameter	Exponent (x)	Intercept (b)	Coefficient (a)
CO	1	0	0.8378
NO_X	1.5	10.4496	0.1255
PM	1.5	0.2551	0.0059
PM2.5	1.5	0.2551	0.0059
PM10	1.5	0.2551	0.0059
SO_X	n/a	0	2.3735
VOC (HC)	1.5	0	0.0667

Notes:

1.) All regressions but SO_2 are in the form of:

Emissions Rate (g/hp-hr) = (a*(Fractional Load)$^{-x}$ + b) * 0.7457
where the conversion factor of 0.7457 kW/hp is used to calculate the emission factor in g/hp-hr

2.) Fractional Load is equal to actual engine output divided by rated engine output.

3.) The SO_2 regression is the form of:

Emissions Rate (g/hp-hr) = a*(Fuel Sulfur Flow in g/hp-hr) + b
where Fuel Sulfur Flow is the Fuel Consumption times the sulfur content of the fuel;
The sulfur content for the fuel consumption regression was set to 3300 parts per million (0.33 wt%)

4.) **Fuel Consumption (g/hp-hr) = (14.12 / (Fractional Load) + 205.717) * 0.7457**

5.) n/a is not applicable, n/s is not statistically significant.

6.) All information shown above is detailed in Table 5-1 of the EPA technical report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", EPA 420-R-00-002, February 2000.

Table B-1. Phase 1 Marine Equipment Emission Factors and Emission Rates - Cutterhead
Freeport Channel Widening Project

	Dredge											Mob/Demob										
	24" Cutter Discharge			Work Tug (small)		Crew/Survey Boat (Runabouts)		Anchor Tender		Towing Tug (Large)		24" Cutter Discharge			Work Tug (small)		Crew/Survey Boat (Runabouts)		Anchor Tender		Towing Tug (Large)	
	Main Pump	Secondary	Auxiliary & Misc.	Propulsion	Secondary	Propulsion	Secondary	Propulsion	Secondary	Propulsion	Secondary	Main Pump	Seconday	Auxiliary & Misc.	Propulsion	Secondary	Propulsion	Secondary	Propulsion	Secondary	Main Engine	Secondary
hp	2,560	160	1,350	750	67	50	17	100	22	1,500	67	2,560	160	1,350	750	67	50	17	100	22	1,500	67
Fuel Type	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Load Factor	0.8	0.4	0.4	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.8	0.4	0.4	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2
Age Factor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Emission Factors (Gram/hp-hr)																						
CO	0.780934	1.561869	1.561869	1.561869	3.123737	1.561869	3.123737	1.561869	3.123737	1.561869	3.123737	0.780934	1.561869	1.561869	1.561869	3.123737	1.561869	3.123737	1.561869	3.123737	1.561869	3.123737
NO_X	7.923056	8.162195	8.162195	8.162195	8.838583	8.162195	8.838583	8.162195	8.838583	8.162195	8.838583	7.923056	8.162195	8.162195	8.162195	8.838583	8.162195	8.838583	8.162195	8.838583	8.162195	8.838583
PM	0.196377	0.207619	0.207619	0.207619	0.239417	0.207619	0.239417	0.207619	0.239417	0.207619	0.239417	0.196377	0.207619	0.207619	0.207619	0.239417	0.207619	0.239417	0.207619	0.239417	0.207619	0.239417
PM2.5	0.178703	0.188933	0.188933	0.188933	0.217870	0.188933	0.217870	0.188933	0.217870	0.188933	0.217870	0.178703	0.188933	0.188933	0.188933	0.217870	0.188933	0.217870	0.188933	0.217870	0.188933	0.217870
PM10	0.188522	0.199314	0.199314	0.199314	0.229841	0.199314	0.229841	0.199314	0.229841	0.199314	0.229841	0.188522	0.199314	0.199314	0.199314	0.229841	0.199314	0.229841	0.199314	0.229841	0.199314	0.229841
SO_X	1.304627	1.407716	1.407716	1.407716	1.613894	1.407716	1.613894	1.407716	1.613894	1.407716	1.613894	1.304627	1.407716	1.407716	1.407716	1.613894	1.407716	1.613894	1.407716	1.613894	1.407716	1.613894
VOC (HC)	0.069511	0.196607	0.196607	0.196607	0.556090	0.196607	0.556090	0.196607	0.556090	0.196607	0.556090	0.069511	0.196607	0.196607	0.196607	0.556090	0.196607	0.556090	0.196607	0.556090	0.196607	0.556090
Emission Rate (tons/hr)																						
CO	0.001763	0.000110	0.000930	0.000516	0.000046	0.000034	0.000012	0.000069	0.000015	0.001033	0.000046	0.001763	0.000110	0.000930	0.000516	0.000046	0.000034	0.000012	0.000069	0.000015	0.001033	0.000046
NO_X	0.017886	0.000576	0.004858	0.002699	0.000131	0.000180	0.000033	0.000360	0.000043	0.005398	0.000131	0.017886	0.000576	0.004858	0.002699	0.000131	0.000180	0.000033	0.000360	0.000043	0.005398	0.000131
PM	0.000443	0.000015	0.000124	0.000069	0.000004	0.000005	0.000001	0.000009	0.000001	0.000137	0.000004	0.000443	0.000015	0.000124	0.000069	0.000004	0.000005	0.000001	0.000009	0.000001	0.000137	0.000004
PM2.5	0.000403	0.000013	0.000112	0.000062	0.000003	0.000004	0.000001	0.000008	0.000001	0.000125	0.000003	0.000403	0.000013	0.000112	0.000062	0.000003	0.000004	0.000001	0.000008	0.000001	0.000125	0.000003
PM10	0.000426	0.000014	0.000119	0.000066	0.000003	0.000004	0.000001	0.000009	0.000001	0.000132	0.000003	0.000426	0.000014	0.000119	0.000066	0.000003	0.000004	0.000001	0.000009	0.000001	0.000132	0.000003
SO_X	0.002945	0.000099	0.000838	0.000466	0.000024	0.000031	0.000006	0.000062	0.000008	0.000931	0.000024	0.002945	0.000099	0.000838	0.000466	0.000024	0.000031	0.000006	0.000062	0.000008	0.000931	0.000024
VOC (HC)	0.000157	0.000014	0.000117	0.000065	0.000008	0.000004	0.000002	0.000009	0.000003	0.000130	0.000008	0.000157	0.000014	0.000117	0.000065	0.000008	0.000004	0.000002	0.000009	0.000003	0.000130	0.000008

Notes:

1.) The dredge type, engine type, horsepower, and fuel type were based on information provided by project sponsors.

2.) The engine load factors for the dredges and support equipment were determined from Table 5-2 of the EPA Report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", February 2000.
A survey of dredge engine sizes along with input from project sponsors was used to determine which operating mode and hence which load factor applied to each engine.
The following assumptions applied to the load factor determination during dredging operations:
A.) The main engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.8 load factor.
B.) The secondary engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.4 load factor for the entire dredging cycle time.
C.) The generic large hopper dredge was assumed to utilize a 0.8 load factor for all of the engines based on the specific operation for each engine type (e.g. propulsion, dredge pumps, and auxiliary).
D.) The propulsion engines on the support equipment vessels were assumed to operate at intermittent times during the dredging operations and were also determined to operate at the 0.4 "slow cruise" load factor.
E.) The secondary engines on the support equipment were assumed to be auxiliary engines that operate sparingly during support equipment operations and were determined to operate at the 0.2 "maneuvering" load factor.
The following assumptions applied to the load factor determination during ocean-going (mobilization/demobilization) operations:
A.) The main engines on the Cutterhead and Bucket Crane dredges were assumed to be non-operational.
B.) The secondary engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.4 load factor.
C.) The generic large hopper dredge was assumed to utilize a 0.8 load factor for propulsion and auxiliary engines.
D.) The propulsion engines on the support equipment vessels were to operate at the 0.4 "slow cruise" load factor.
E.) The secondary engines on the support equipment were assumed to be auxiliary engines that operate sparingly during support equipment operations and were determined to operate at the 0.2 "maneuvering" load factor.

3.) The emission factors were calculated according to the algorithm table and formulas detailed on page 5-3 of the EPA report. The emissions rate formula and algorithm table are also shown on Table A-4, "Marine Engine Emission Factor and Fuel Consumption Algorithms".

4.) The Emission Rate in tons/hr is based on the following formula: Emission Rate = hp*LF*EF*(0.0022046 lbs/gram)*(1 ton/2000 lbs).

Table B-2. Phase 2 Marine Equipment Emission Factors and Emission Rates - Bucket Crane
Freeport Channel Widening Project

	Dredge						Mob/Demob Setup					
	Bucket Crane		Crew/Survey Vessel (Runabout)		Towing Vessel (Large Tug)		Bucket Crane		Crew/Survey Vessel (Runabout)		Towing Vessel (Large Tug)	
	Main Engine	Auxiliary	Propulsion	Secondary	Propulsion	Secondary	Main Engine	Auxiliary	Propulsion	Secondary	Propulsion	Secondary
hp	500	205	50	17	2,000	67	500	205	50	17	2,000	67
Fuel Type	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Load Factor	0.8	0.4	0.4	0.2	0.8	0.4	0.8	0.4	0.4	0.2	0.4	0.2
Age Factor	-	-	-	-	-	-	-	-	-	-	-	-
Emission Factors (Gram/hp-hr)												
CO	0.780934	1.561869	1.561869	3.123737	0.780934	1.561869	0.780934	1.561869	1.561869	3.123737	1.561869	3.123737
NO_X	7.923056	8.162195	8.162195	8.838583	7.923056	8.162195	7.923056	8.162195	8.162195	8.838583	8.162195	8.838583
PM	0.196377	0.207619	0.207619	0.239417	0.196377	0.207619	0.196377	0.207619	0.207619	0.239417	0.207619	0.239417
PM2.5	0.178703	0.188933	0.188933	0.217870	0.178703	0.188933	0.178703	0.188933	0.188933	0.217870	0.188933	0.217870
PM10	0.188522	0.199314	0.199314	0.229841	0.188522	0.199314	0.188522	0.199314	0.199314	0.229841	0.199314	0.229841
SO_X	1.304627	1.407716	1.407716	1.613894	1.304627	1.407716	1.304627	1.407716	1.407716	1.613894	1.407716	1.613894
VOC (HC)	0.069511	0.196607	0.196607	0.556090	0.069511	0.196607	0.069511	0.196607	0.196607	0.556090	0.196607	0.556090
Emission Rate (tons/hr)												
CO	0.000344	0.000141	0.000034	0.000012	0.001377	0.000046	0.000344	0.000141	0.000034	0.000012	0.001377	0.000046
NO_X	0.003493	0.000738	0.000180	0.000033	0.013974	0.000241	0.003493	0.000738	0.000180	0.000033	0.007198	0.000131
PM	0.000087	0.000019	0.000005	0.000001	0.000346	0.000006	0.000087	0.000019	0.000005	0.000001	0.000183	0.000004
PM2.5	0.000079	0.000017	0.000004	0.000001	0.000315	0.000006	0.000079	0.000017	0.000004	0.000001	0.000167	0.000003
PM10	0.000083	0.000018	0.000004	0.000001	0.000332	0.000006	0.000083	0.000018	0.000004	0.000001	0.000176	0.000003
SO_X	0.000575	0.000127	0.000031	0.000006	0.002301	0.000042	0.000575	0.000127	0.000031	0.000006	0.001241	0.000024
VOC (HC)	0.000031	0.000018	0.000004	0.000002	0.000123	0.000006	0.000031	0.000018	0.000004	0.000002	0.000173	0.000008

Notes:

1.) The dredge type, engine type, horsepower, and fuel type were based on information provided by project sponsors.

2.) The engine load factors for the dredges and support equipment were determined from Table 5-2 of the EPA Report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", February 2000.

A survey of dredge engine sizes along with input from project sponsors was used to determine which operating mode and hence which load factor applied to each engine.

The following assumptions applied to the load factor determination during dredging operations:

A.) The main engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.8 load factor.

B.) The secondary engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.4 load factor for the entire dredging cycle time.

C.) The generic large hopper dredge was assumed to utilize a 0.8 load factor for all of the engines based on the specific operation for each engine type (e.g. propulsion, dredge pumps, and auxiliary).

D.) The propulsion engines on the support equipment vessels were assumed to operate at intermittent times during the dredging operations and were also determined to operate at the 0.4 "slow cruise" load factor.

E.) The secondary engines on the support equipment were assumed to be auxiliary engines that operate sparingly during support equipment operations and were determined to operate at the 0.2 "maneuvering" load factor.

The following assumptions applied to the load factor determination during ocean-going (mobilization/demobilization) operations:

A.) The main engines on the Cutterhead and Bucket Crane dredges were assumed to be non-operational.

B.) The secondary engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.4 load factor.

C.) The generic large hopper dredge was assumed to utilize a 0.8 load factor for propulsion and auxiliary engines.

D.) The propulsion engines on the support equipment vessels were to operate at the 0.4 "slow cruise" load factor.

E.) The secondary engines on the support equipment were assumed to be auxiliary engines that operate sparingly during support equipment operations and were determined to operate at the 0.2 "maneuvering" load factor.

3.) The emission factors were calculated according to the algorithm table and formulas detailed on page 5-3 of the EPA report. The emissions rate formula and algorithm table are also shown on Table A-4, "Marine Engine Emission Factor and Fuel Consumption Algorithms".

4.) The Emission Rate in tons/hr is based on the following formula: Emission Rate = hp*LF*EF*(0.0022046 lbs/gram)*(1 ton/2000 lbs).

Table B-3. Phase 3 Marine Equipment Emission Factors and Emission Rates - Hopper
Freeport Channel Widening Project

	Dredge									Mob/Demob Towing	
	Generic Large Hopper Dredge					Crew/Survey Boat (Runabout)		Shrimp Boat		Generic Large Hopper Dredge	
	Propulsion Oceangoing	Propulsion - Dredging	Dredge Pump(s)	Auxiliary - Oceangoing	Auxiliary - Dredging	Propulsion	Secondary	Propulsion	Secondary	Propulsion - Oceangoing	Auxiliary - Oceangoing
hp	4,350	4,350	1,700	3,345	3,345	250	17	1,000	200	4,350	3,345
Fuel Type	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Load Factor	0.8	0.8	0.8	0.8	0.8	0.4	0.2	0.4	0.2	0.8	0.8
Age Factor	-	-	-	-	-	-	-	-	-	-	-
Emission Factors (Gram/hp-hr)											
CO	0.780934	0.780934	0.780934	0.780934	0.780934	1.561869	3.123737	1.561869	3.123737	0.780934	0.780934
NO_X	7.923056	7.923056	7.923056	7.923056	7.923056	8.162195	8.838583	8.162195	8.838583	7.923056	7.923056
PM	0.196377	0.196377	0.196377	0.196377	0.196377	0.207619	0.239417	0.207619	0.239417	0.196377	0.196377
PM2.5	0.178703	0.178703	0.178703	0.178703	0.178703	0.188933	0.217870	0.188933	0.217870	0.178703	0.178703
PM10	0.188522	0.188522	0.188522	0.188522	0.188522	0.199314	0.229841	0.199314	0.229841	0.188522	0.188522
SO_X	1.304627	1.304627	1.304627	1.304627	1.304627	1.407716	1.613894	1.407716	1.613894	1.304627	1.304627
VOC (HC)	0.069511	0.069511	0.069511	0.069511	0.069511	0.196607	0.556090	0.196607	0.556090	0.069511	0.069511
Emission Rate (tons/hr)											
CO	0.002996	0.002996	0.001171	0.002304	0.002304	0.000172	0.000012	0.000689	0.000138	0.002996	0.002304
NO_X	0.030393	0.030393	0.011878	0.023371	0.023371	0.000900	0.000033	0.003599	0.000390	0.030393	0.023371
PM	0.000753	0.000753	0.000294	0.000579	0.000579	0.000023	0.000001	0.000092	0.000011	0.000753	0.000579
PM2.5	0.000686	0.000686	0.000268	0.000527	0.000527	0.000021	0.000001	0.000083	0.000010	0.000686	0.000527
PM10	0.000723	0.000723	0.000283	0.000556	0.000556	0.000022	0.000001	0.000088	0.000010	0.000723	0.000556
SO_X	0.005005	0.005005	0.001956	0.003848	0.003848	0.000155	0.000006	0.000621	0.000071	0.005005	0.003848
VOC (HC)	0.000267	0.000267	0.000104	0.000205	0.000205	0.000022	0.000002	0.000087	0.000025	0.000267	0.000205

Notes:

1.) The dredge type, engine type, horsepower, and fuel type were based on information provided by project sponsors.

2.) The engine load factors for the dredges and support equipment were determined from Table 5-2 of the EPA Report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", February 2000.

A survey of dredge engine sizes along with input from project sponsors was used to determine which operating mode and hence which load factor applied to each engine.

The following assumptions applied to the load factor determination during dredging operations:

A.) The main engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.8 load factor.

B.) The secondary engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.4 load factor for the entire dredging cycle time.

C.) The generic large hopper dredge was assumed to utilize a 0.8 load factor for all of the engines based on the specific operation for each engine type (e.g. propulsion, dredge pumps, and auxiliary).

D.) The propulsion engines on the support equipment vessels were assumed to operate at intermittent times during the dredging operations and were also determined to operate at the 0.4 "slow cruise" load factor.

E.) The secondary engines on the support equipment were assumed to be auxiliary engines that operate sparingly during support equipment operations and were determined to operate at the 0.2 "maneuvering" load factor.

The following assumptions applied to the load factor determination during ocean-going (mobilization/demobilization) operations:

A.) The main engines on the Cutterhead and Bucket Crane dredges were assumed to be non-operational.

B.) The secondary engines on the Cutterhead and Bucket Crane dredges were assumed to operate at 0.4 load factor.

C.) The generic large hopper dredge was assumed to utilize a 0.8 load factor for propulsion and auxiliary engines.

D.) The propulsion engines on the support equipment vessels were to operate at the 0.4 "slow cruise" load factor.

E.) The secondary engines on the support equipment were assumed to be auxiliary engines that operate sparingly during support equipment operations and were determined to operate at the 0.2 "maneuvering" load factor.

3.) The emission factors were calculated according to the algorithm table and formulas detailed on page 5-3 of the EPA report. The emissions rate formula and algorithm table are also shown on Table A-4, "Marine Engine Emission Factor and Fuel Consumption Algorithms".

4.) The Emission Rate in tons/hr is based on the following formula: Emission Rate = hp*LF*EF*(0.0022046 lbs/gram)*(1 ton/2000 lbs).

Table C-1. Marine Equipment Estimated Emissions for Phase 1 - Cutterhead
(tons per year)

Phase No.	Pollutant	Dredge	Dredge											Mobilization / Demobilization											Total Phase Emissions
			24" Cutter Discharge			Work Tug (small)		Crew/Survey Boat		Anchor Tender		Towing Tug (Large)		24" Cutter Discharge			Work Tug (small)		Crew/Survey Boat		Anchor Tender		Towing Tug (Large)		
			Main Pump	Secondary	Auxillary & Misc.	Propulsion	Auxiliary	Propulsion	Auxiliary	Propulsion	Auxiliary	Propulsion	Auxiliary	Main Pump	Secondary	Auxillary & Misc.	Propulsion	Auxiliary	Propulsion	Auxiliary	Propulsion	Auxiliary	Main Engine	Auxiliary	
1	CO	Hydraulic	0.4231	0.0264	0.2678	0.1240	0.0111	0.0165	0.0056	0.0165	0.0036	0.2479	0.0111	0.0000	0.0106	0.0893	0.1240	0.0111	0.0000	0.0000	0.0066	0.0015	0.2479	0.0111	1.66
1	NOX	Hydraulic	4.2927	0.1382	1.3992	0.6478	0.0313	0.0864	0.0159	0.0864	0.0103	1.2956	0.0313	0.0000	0.0553	0.4664	0.6478	0.0313	0.0000	0.0000	0.0345	0.0041	1.2956	0.0313	10.60
1	PM2.5	Hydraulic	0.0968	0.0032	0.0324	0.0150	0.0008	0.0020	0.0004	0.0020	0.0003	0.0300	0.0008	0.0000	0.0013	0.0108	0.0150	0.0008	0.0000	0.0000	0.0008	0.0001	0.0300	0.0008	0.24
1	PM10	Hydraulic	0.1021	0.0034	0.0342	0.0158	0.0008	0.0021	0.0004	0.0021	0.0003	0.0316	0.0008	0.0000	0.0013	0.0114	0.0158	0.0008	0.0000	0.0000	0.0008	0.0001	0.0316	0.0008	0.26
1	SOX	Hydraulic	0.7069	0.0238	0.2413	0.1117	0.0057	0.0149	0.0029	0.0149	0.0019	0.2234	0.0057	0.0000	0.0095	0.0804	0.1117	0.0057	0.0000	0.0000	0.0060	0.0008	0.2234	0.0057	1.80
1	VOC	Hydraulic	0.0377	0.0033	0.0337	0.0156	0.0020	0.0021	0.0010	0.0021	0.0006	0.0312	0.0020	0.0000	0.0013	0.0112	0.0156	0.0020	0.0000	0.0000	0.0008	0.0003	0.0312	0.0020	0.20

Table C-2. Marine Equipment Estimated Emissions for Phase 2 - Bucket Crane
(tons per year)

			Dredge						**Mobilization / Demobilization**						Total Phase Emissions
			Bucket Crane		Crew/Survey Vessel (Runabout)		Large Tug		Bucket Crane		Crew/Survey Vessel (Runabout)		Large Tug		
Phase No.	**Pollutant**	**Dredge**	Main Engine	Auxiliary	Propulsion	Auxiliary	Propulsion	Auxiliary	Main Engine	Auxiliary	Propulsion	Auxiliary	Propulsion	Auxiliary	
2	CO	Bucket Crane	0.1178	0.0483	0.0118	0.0040	0.4187	0.0140	0.0000	0.0068	0.0017	0.0006	0.0661	0.0022	0.69
2	NOX	Bucket Crane	1.1948	0.2523	0.0615	0.0113	4.2480	0.0733	0.0000	0.0354	0.0086	0.0016	0.3455	0.0063	6.24
2	PM2.5	Bucket Crane	0.0269	0.0058	0.0014	0.0003	0.0958	0.0017	0.0000	0.0008	0.0002	0.0000	0.0080	0.0002	0.14
2	PM10	Bucket Crane	0.0284	0.0062	0.0015	0.0003	0.1011	0.0018	0.0000	0.0009	0.0002	0.0000	0.0084	0.0002	0.15
2	SOX	Bucket Crane	0.1967	0.0435	0.0106	0.0021	0.6995	0.0126	0.0000	0.0061	0.0015	0.0003	0.0596	0.0011	1.03
2	VOC	Bucket Crane	0.0105	0.0061	0.0015	0.0007	0.0373	0.0018	0.0000	0.0009	0.0002	0.0001	0.0083	0.0004	0.07

Table C-3. Marine Equipment Estimated Emissions for Phase 3 - Hopper
(tons per year)

Phase No.	Pollutant	Dredge	Dredge									Mobilization / Demobilization		Total Phase Emissions
			Generic Large Hopper Dredge					Crew/Survey Boat		Shrimp Boat		Generic Large Hopper		
			Propulsion Oceangoing	Propulsion - Dredging	Dredge Pump(s)	Auxiliary - Oceangoing	Auxillary - Dredging	Propulsion	Auxiliary	Propulsion	Auxiliary	Propulsion - Oceangoing	Auxiliary - Oceangoing	
3	CO	Hopper	7.2519	9.0649	3.5426	6.5606	8.2007	0.9377	0.0638	8.8259	1.7652	0.2876	0.2211	46.72
3	NOX	Hopper	73.5751	91.9688	35.9418	66.5608	83.2010	4.9006	0.1804	46.1232	4.9945	2.9177	2.2436	412.61
3	PM2.5	Hopper	1.6595	2.0743	0.8107	1.5013	1.8766	0.1134	0.0044	1.0676	0.1231	0.0658	0.0506	9.35
3	PM10	Hopper	1.7506	2.1883	0.8552	1.5838	1.9797	0.1197	0.0047	1.1263	0.1299	0.0694	0.0534	9.86
3	SOX	Hopper	12.1150	15.1438	5.9183	10.9600	13.7001	0.8452	0.0329	7.9548	0.9120	0.4804	0.3694	68.43
3	VOC	Hopper	0.6455	0.8069	0.3153	0.5840	0.7299	0.1180	0.0114	1.1110	0.3142	0.0256	0.0197	4.68

Table C-4. Total Emissions from Marine Equipment
Freeport Channel Widening Project
(Tons per Year)

Phase	Location/Disposal Site	Dredge Type	CO	NO_X	$PM_{2.5}$	PM_{10}	SO_X	VOC
1	300,000 CY of Silty Sand (placed on beach)	Cutterhead	1.66	10.60	0.24	0.26	1.80	0.20
2	150,000 CY of Clay (placed in ODMDS)	Bucket Crane	0.69	6.24	0.14	0.15	1.03	0.07
3	2,750,000 CY of Clay (placed in ODMDS)	Hopper	46.72	412.61	9.35	9.86	68.43	4.68
		TOTAL	49.07	429.45	9.73	10.27	71.26	4.94

Table D-1. Dozer Emission Factors from NONROAD Model
(2007 Model Year)
Freeport Channel Widening Project

Range	HP	SCC	EQUIP	CLASSIFICATION	Engine Type	Fuel Type	VOC exhaust g/HP-hr	PM10 exhaust g/HP-hr	PM25 exhaust g/HP-hr	VOCCrank case g/HP-hr	CO exhaust g/HP-hr	NOx exhaust g/HP-hr	SO2 exhaust g/HP-hr
50 < HP <= 75	75	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.5376	0.4198	0.4072	0.0108	3.7378	5.0503	0.1822
75 < HP <= 100	100	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.5376	0.4198	0.4072	0.0108	3.7378	5.0503	0.1822
100 < HP <= 175	175	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.3678	0.2424	0.2351	0.0074	1.4623	4.6212	0.1642
175 < HP <= 300	300	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.3203	0.1984	0.1924	0.0064	1.2348	4.3835	0.1642
300 < HP <= 600	600	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.2798	0.1978	0.1919	0.0056	1.9510	5.0130	0.1642
600 < HP <= 750	750	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.2556	0.2100	0.2037	0.0051	2.3285	5.0029	0.1643
750 < HP <= 1000	1000	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.4649	0.2592	0.2514	0.0093	2.2777	6.4108	0.1641
1000 < HP <= 1200	1200	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.4649	0.2592	0.2514	0.0093	2.2777	6.4108	0.1641
1200 < HP <= 2000	2000	2270002069	Crawler Tractor/Dozers	Construction and Mining Equipment	Diesel	Diesel	0.4649	0.2592	0.2514	0.0093	2.2777	6.4108	0.1641

Note:
1. Emission factors generated from EPA NONROAD 2005 model run for bulldozers in Brazoria County for the model year 2007.

Table D-2. Phase 1 NONROAD Emissions
Freeport Channel Widening Project

CO

Equipment	HP	Load Factor	No. of Each	Hrs./Day	Hours in Contract	Contract Duration (Days)	Emission Factor (g/HP-hr)	Total Equipment Emissions Tons	Total Equipment Emissions Tons/Day
Dozer	300	0.59	1	15	360	24.00	1.23	0.087	0.004
Dozer	200	0.59	1	15	360	24.00	1.23	0.058	0.002
							Contract Total	**0.145**	**0.006**

NO_x

Equipment	HP	Load Factor	No. of Each	Hrs./Day	Hours in Contract	Contract Duration (Days)	Emission Factor (g/HP-hr)	Total Equipment Emissions Tons	Total Equipment Emissions Tons/Day
Dozer	300	0.59	1	15	360	24.00	4.38	0.308	0.013
Dozer	200	0.59	1	15	360	24.00	4.38	0.205	0.009
							Contract Total	**0.513**	**0.021**

$PM_{2.5}$

Equipment	HP	Load Factor	No. of Each	Hrs./Day	Hours in Contract	Contract Duration (Days)	Emission Factor (g/HP-hr)	Total Equipment Emissions Tons	Total Equipment Emissions Tons/Day
Dozer	300	0.59	1	15	360	24.00	0.192	0.014	0.001
Dozer	200	0.59	1	15	360	24.00	0.192	0.009	0.000
							Contract Total	**0.023**	**0.001**

PM_{10}

Equipment	HP	Load Factor	No. of Each	Hrs./Day	Hours in Contract	Contract Duration (Days)	Emission Factor (g/HP-hr)	Total Equipment Emissions Tons	Total Equipment Emissions Tons/Day
Dozer	300	0.59	1	15	360	24.00	0.198	0.014	0.001
Dozer	200	0.59	1	15	360	24.00	0.198	0.009	0.000
							Contract Total	**0.023**	**0.001**

SO_x

Equipment	HP	Load Factor	No. of Each	Hrs./Day	Hours in Contract	Contract Duration (Days)	Emission Factor (g/HP-hr)	Total Equipment Emissions Tons	Total Equipment Emissions Tons/Day
Dozer	300	0.59	1	15	360	24.00	0.164	0.012	0.000
Dozer	200	0.59	1	15	360	24.00	0.164	0.008	0.000
							Contract Total	**0.019**	**0.001**

VOC

Equipment	HP	Load Factor	No. of Each	Hrs./Day	Hours in Contract	Contract Duration (Days)	Emission Factor (g/HP-hr)	Total Equipment Emissions Tons	Total Equipment Emissions Tons/Day
Dozer	300	0.59	1	15	360	24.00	0.33	0.023	0.001
Dozer	200	0.59	1	15	360	24.00	0.33	0.015	0.001
							Contract Total	**0.038**	**0.002**

Note:
1. Emission factors generated from EPA NONROAD 2005 model run for bulldozers in Brazoria County for the model year 2007.
2. Load factors from Appendix A of Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, EPA Office of Air and Radiation Report Number NR-005c, April 2004.

Table D-3. Total Emissions from NONROAD Equipment
FREEPORT CHANNEL WIDENING PROJECT

CONSTRUCTION PERIOD
(TONS OF EMISSIONS)

Pollutant	Phase 1	Phase 2	Phase 3
CO	0.145	n/a	n/a
NO_x	0.513	n/a	n/a
$PM_{2.5}$	0.023	n/a	n/a
PM_{10}	0.023	n/a	n/a
SO_x	0.019	n/a	n/a
VOC	0.038	n/a	n/a
TOTALS	0.761	**n/a**	**n/a**

Notes:

1. NONROAD Equipment for Phase 1 include the following:
   - 200 HP Diesel Bulldozer
   - 300 HP Diesel Bulldozer
2. No NONROAD Equipment used in Phase 2 or Phase 3.

Table E-1. Emission Factors for Employee Vehicles
Freeport Channel Widening Project

Fleet Year	Type of Vehicle	EPA Category[1]	Emisson Factor (g/mile)					
			CO[2]	NOx[2]	PM2.5[3]	PM10[3]	SO2[3]	VOC[2]
1	Cars	LDGV	6.8379	0.5163	0.0114	0.0249	0.0068	0.6596
	Pickups	LDGT1	7.3724	0.5176	0.0116	0.0252	0.0088	0.6988
2	Cars	LDGV	6.8379	0.5163	0.0114	0.0249	0.0068	0.6596
	Pickups	LDGT1	7.3724	0.5176	0.0116	0.0252	0.0088	0.6988
3	Cars	LDGV	6.8379	0.5163	0.0114	0.0249	0.0068	0.6596
	Pickups	LDGT1	7.3724	0.5176	0.0116	0.0252	0.0088	0.6988

Notes:
1. LDGV=light duty gasoline-fueled vehicles designated for transport of up to 12 people
   LDGT1=light duty gasoline-fueled trucks with a gross vehicle weight (GVW) rating of 6000 pounds or less
2. Emission factors for CO, NOx, and VOC are from MOBILE6.2 run using Brazoria County input file, "30aug2007brazi1a0", which can be found on the TCEQ FTP site: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/Mobile_EI/HGB/m62/2007/.
3. Emission factors for $PM_{2.5}$, PM_{10}, and SO_2 are from MOBILE6.2 run using Statewide PM1 and PM2 input files, "2007_wk_pm1_d13c5r4ihu.in" and "2007_wk_pm2_d13c5r4ihu.in", which can be found on the TCEQ FTP site: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/Mobile_EI/Statewide/m62/2007/.

Table E-2. Total Emissions from Employee Vehicles
Freeport Channel Widening Project

Phase	Type of Vehicle	EPA Category	Daily Vehicles (/day)	Daily Travel - Per Vehicle On-Site[1] (VMT)	Off-Site[2] (VMT)	Total (VMT)	Travel Days[3] (days/yr)	Annual Travel[4] (VMT/yr)	Annual Emissions[5] (tpy) CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	Cars	LDGV	14	1	50.0	51.0	24	17,136	0.1292	0.0098	0.00022	0.00047	0.00013	0.0125
	Pickups	LDGT1	6	1	50.0	51.0	24	7,344	0.0597	0.0042	0.00009	0.00020	0.00007	0.0057
2	Cars	LDGV	3	1	50.0	51.0	19	2,907	0.0219	0.0017	0.00004	0.00008	0.00002	0.0021
	Pickups	LDGT1	1	1	50.0	51.0	19	969	0.0079	0.0006	0.00001	0.00003	0.00001	0.0007
3	Cars	LDGV	20	0	50.0	50.0	38	38,143	0.2875	0.0217	0.00048	0.00105	0.00029	0.0277
	Pickups	LDGT1	10	0	50.0	50.0	38	19,071	0.1550	0.0109	0.00024	0.00053	0.00018	0.0147
								Total Car Emissions	0.4386	0.0331	0.0007	0.0016	0.0004	0.0423
								Total Pickup Emissions	0.2225	0.0156	0.0004	0.0008	0.0003	0.0211
								TOTAL MOBILE EMISSIONS	**0.661**	**0.049**	**0.0011**	**0.0024**	**0.0007**	**0.063**

Notes:
1. Daily on-site VMT is estimated based on very minimal use of personal vehicles at the site.
2. Off-Plant VMT is assumed to be 50 miles/day round trip.
3. Travel days for Phase 1 and 2 is assumed to be daily for the duration of the phase. Travel for Phase 3 is assumed to be weekly for the duration of the phase.
4. Annual travel = Daily vehicles * Total VMT * Travel days/yr.
5. Annual emissions = Emission factor * Annual travel * 1lb/453.6 grams * 1ton/2000lb

Appendix B

EPA General Conformity Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

DEC 0 3 2004

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Conformity After the 1-hour Ozone Standards Revocation

FROM: Lydia N. Wegman, Director
Air Quality Strategies and Standards Division, OAQPS

TO: Steve Rothblatt, Director
Air and Radiation Division, Region V

This is in response to your electronic correspondence of November 23, 2004, requesting clarification on our policy for conformity determinations before the adoption of the State Implementation Plan (SIP), for the 8-Hour Ozone National Ambient Air Quality Standard. You stated that you need a written statement before December 10, 2004.

The General Conformity Regulations (40 C.F.R. 93.150-160) provide several options for Federal agencies to demonstrate conformity. One of the options in ozone nonattainment areas is to have the State document and determine that the emissions from the action, along with all other emissions in the area, will not exceed the emission budget in the applicable SIP. Since the conformity determination is expected to occur after June 15, 2005 (the date of the revocation of the 1-hour ozone standard) and before the adoption of the SIP for the 8-hour ozone standard, you asked if the existing 1-hour SIP could be considered the applicable SIP for the determination. Even after EPA revokes the 1-hour ozone standard for the area, the 1-hour ozone SIP would remain in place until it is revised. Therefore, we believe that the emission budgets in the 1-hour SIP would be applicable for the O'Hare project conformity determination. We expect that all parties will work together to ensure that the emissions from the airport and the expansion will be included in the 8-hour ozone SIP.

If you have further questions, please contact David Stonefield at (919) 541-5350.

Appendix G

Biological Assessment

Biological Assessment for the
Proposed Port Freeport Channel Widening Project
Brazoria County, Texas

Document No. 060301
PBS&J Job No. 441591

BIOLOGICAL ASSESSMENT FOR THE PORT FREEPORT CHANNEL WIDENING PROJECT BRAZORIA COUNTY, TEXAS

Prepared for:

U.S. Army Corps of Engineers
Galveston District
2000 Fort Point Road
Galveston, Texas 77550

Prepared by:

PBS&J
6504 Bridge Point Parkway
Suite 200
Austin, Texas 78730

August 2006

Printed on recycled paper

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Acronyms and Abbreviations

°C	degrees Celsius
AOU	American Ornithologist's Union
BA	Biological Assessment
BU	beneficial use
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FM	Farm-to-Market Road
ft	feet/foot
FWS	U.S. Fish and Wildlife Service
GIWW	Gulf Intracoastal Water Way
GLO	General Land Office
GSMFC	Gulf States Marine Fisheries Commission
Gulf	Gulf of Mexico
HDR/SMA	HDR/Shiner, Moseley & Associates, Inc.
km	kilometers
km^2	square kilometer
mcy	million cubic yards
MLLW	mean low low water
NDD	Natural Diversity Database
NFWL	National Fish and Wildlife Laboratories
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRC	National Research Council
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
ODMDS	Ocean Dredged Material Disposal Site
PA	placement area
TCEQ	Texas Commission on Environmental Quality
TED	turtle excluder devices
TOS	Texas Ornithological Society
TPWD	Texas Parks and Wildlife Department
UCPA	Upland Confined Placement Area
USACE	U.S. Army Corps of Engineer

1.0 INTRODUCTION

1.1 PURPOSE OF THE BIOLOGICAL ASSESSMENT

This Biological Assessment (BA) is being prepared to fulfill the U.S. Army Corps of Engineer's (USACE) requirements as outlined under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended. The proposed federal action requiring this assessment is the USACE's verification and authorization under Section 10 of the Rivers and Harbors Act of 1899 for the widening of Port Freeport in Brazoria County, Texas. This BA evaluates the potential impacts the Project may have on Federally listed endangered and threatened species. Table 1 presents a list of Federally listed endangered and threatened species that are addressed in this BA. This BA also describes the avoidance, minimization and conservation measures proposed by Port Freeport. For the purposes of this BA, the study area encompasses Brazoria County and a 10-mile radius into the Gulf of Mexico (Gulf) (Figure 1). The project area is defined as the areas where actual dredging would take place, proposed placement areas, and the proposed beneficial use (BU) sites where impacts might be expected (Figure 2).

This BA is offered to assist the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) personnel in fulfilling their obligations under the ESA. An Environmental Impact Statement (EIS) is being prepared to address the impacts of the Project.

1.2 ALTERNATIVES CONSIDERED

This section discusses alternatives considered during the preparation of the EIS. The proposed project involves the widening of the Freeport Harbor Jetty Channel using a combination of mechanical, pipeline, and hopper dredges; total channel length proposed for widening is 32,335 feet (ft) (6.1 miles).

While alternate sites might be considered alternatives for some projects that address a national or statewide-need, such is not the case for the Project. The alternatives addressed were channel widening alternatives and dredged material placement alternatives at the project location. The No-Action alternative always remains an alternative to the proposed action (i.e., widening of portions of the Freeport Harbor Jetty and Entrance Channels).

1.2.1 Channel-Widening Alternatives

Two possible alternative channel widths were evaluated for the proposed project; 500 and 600 ft. Studies suggest that in order to maintain jetty stability the maximum channel width should not exceed 600 ft (Fugro Consultants, Inc, 2005). Since the USACE had selected 600 ft as the maximum width alternative, 600 ft was the maximum width examined. The existing channel width of 400 ft is marginal for usage by 145-ft beam vessels, even with one-way traffic and under ideal conditions (i.e., less than 0.5 knot cross current). A channel width of 500 ft allows two-way traffic only for the 107-ft beam vessels under ideal

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Legend

Freeport Channel Widening Project Area

Study Area

N W E S

10 5 0 10 Miles

PBSJ
6504 Bridge Point Pkwy, Ste. 200
Austin, Texas 78730
Phone: (512) 329-8342 Fax: (512) 327-2453

Figure 1
Port Freeport Channel Widening Study Area

Prepared for: Martin Arhelger	
Job No.: 441591	
Prepared by: Emons	Date: 08/23/2006
File: N:/44159100/Projects/Appendix/AppG_Fig1.mxd	

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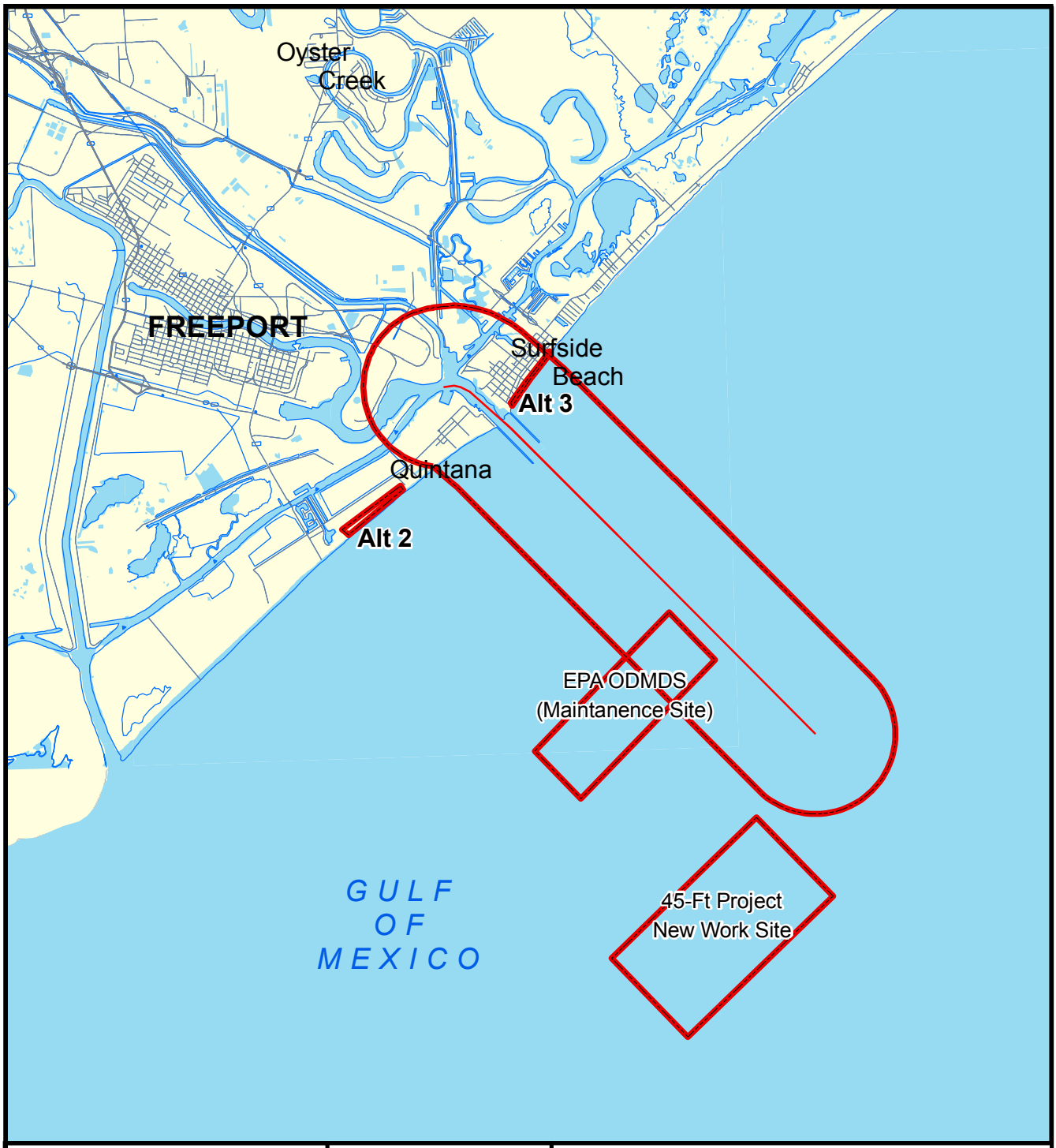

Legend

Channel Centerline

Project Area Components

N
W E
S

0 0.5 1 2
Miles

PBSJ
6504 Bridge Point Pkwy, Ste. 200
Austin, Texas 78730
Phone: (512) 329-8342 Fax: (512) 327-2453

Figure 2
Port Freeport
Channel Widening
Project Area

Prepared for: Martin Arhelger	
Job No.: 441591	
Prepared by: TBrown/A Pugh	Date: 08/30/2006
File: N:/44159100/Projects/Appendix/AppG_Fig2.mxd	

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conditions, while a 600-ft channel allows two-way traffic for vessels up to 133-ft beam under ideal conditions and one-way traffic for 148-ft beam vessels, even with a 3 knot cross current.

Since the benefits from the widening are directly related to reducing limitations on transits, the 600-ft width is the preferred alternative, and the 500-ft width was eliminated from further consideration because it does not effectively meet the purpose and need for the Project.

1.2.2 Beneficial Use Dredged Material Placement Area Alternatives

The following provides descriptions of the alternatives evaluated in this EIS; the No-Action alternative and the proposed action with two alternative BU placement areas. The proposed action would result in approximately 3.2 million cubic yards (mcy) of new work dredged material consisting of approximately 2.9 mcy of clay/silt material and about 300,000 cy of silty/sand material. If approved by the Environmental Protection Agency (EPA), the clay/silt material would be placed in an Ocean Dredged Material Disposal Site (ODMDS) that would be redesignated for use by EPA under USACE authority. Additional alternatives to the ODMDS were considered by the Dredged Material Management Plan (DMMP) Workgroup, which consisted of representatives from USACE, NMFS, FWS, Texas Parks and Wildlife Department (TPWD), Texas General Land Office (GLO), Texas Commission on Environmental Quality (TCEQ), Port of Freeport representatives, HDR/Shiner, Moseley & Associates, Inc. (HDR/SMA), and PBS&J. These alternatives included upland confined placement areas, beach nourishment, marsh restoration, upland BU, and offshore BU. Five types of BU placement options (habitat berm, feeder berm, energy dissipating berm, beach nourishment, and marsh restoration) were subjected to a preliminary feasibility analysis. Ultimately it was determined that beach nourishment, either at Surfside beach or Quintana beach in front of the Seaway Placement Area (PA) was the most practical and feasible BU alternative.

1.2.2.1 No-Action Alternative

Under the No-Action alternative, current navigation restrictions would continue and the Port of Freeport would not benefit from the elimination of those operational constraints. Vessels entering the Port of Freeport would continue to be delayed by one-way traffic and daylight-only restrictions, and vessel safety would not be improved.

1.2.2.2 Proposed Action with Placement At Quintana

Under this alternative, the 300,000 cy of silty/sand material would be used beneficially and placed on Quintana Beach. The beach on either side the preferred location (in front of the Seaway PA) has been enhanced through GLO or other programs, leaving a gap. Placement of material in this location would fill the gap, allowing for continuous beach use and providing some protection from erosion.

1.2.2.3 Proposed Action with Placement at Surfside

Under this alternative, the 300,000 cy of silty/sand material would be placed on Surfside Beach. Placement of the material in this area would provide some protection from erosion for homes located along the beach.

1.3 Project Area Habitat Description

For the purposes of this BA, the project area is limited to the immediate area of the Port Freeport Ship Channel and Jetties and includes the Freeport Harbor Jetty and Entrance Channels, totaling approximately 6.3 miles in length, as well as placement areas (see Figure 2). Placement of resulting dredged material may impact areas within and immediately adjacent to the project area.

The communities of Surfside and Quintana Beach, to the northeast and southwest of the Entrance Channel, respectively, are adjacent to the Port of Freeport Ship Channel. There is very little undeveloped area in the immediate vicinity of the ship channel other than the beach and dunes complex. This includes the beaches and dunes of the Gulf shoreline and interior wetlands that are hydrologically connected to the ship channel via natural and man-made (e.g., GIWW) channels.

The Project is located within Upper Coast division (Hatch et al., 1999) of the Gulf Coast Prairies and Marshes Ecoregion (Gould, 1975). This ecoregion is a nearly level plain less than 250 ft in elevation, covering approximately 10 million acres. The Gulf Coast Prairies include the coastal plain that extends approximately 30–80 miles inland while the Gulf Marshes are located in a narrow strip of lowlands that are adjacent to the coast and barrier islands (Hatch et al., 1999).

2.0 STATUS OF THE LISTED SPECIES

To assess the potential impacts of the proposed Project on Federal endangered and threatened species, PBS&J personnel: (1) conducted a review of the Natural Diversity Database (NDD) prepared by TPWD, FWS literature, and searched for other scientific data to determine species distributions, habitat needs and other biological requirements; (2) interviewed recognized experts on the listed species, including local and regional authorities and Federal and State wildlife personnel; and (3) conducted an on-site evaluation of the biological resources within the project area.

Literature sources consulted for this report include the FWS series on endangered species of the seacoast of the U.S. (National Fish and Wildlife Laboratories [NFWL], 1980), Federal status reports and recovery plans, job reports of the TPWD, peer-reviewed journals, and other standard references. Habitat assessments were initially based on aerial photography and National Wetlands Inventory (NWI) mapping and then field-verified. Field visits were conducted on various occasions by PBS&J ecologists and members of the DMMP. Input was also solicited from State and Federal Resource Agency personnel. Table 1 presents a list of federally protected species that have the potential to occur within Brazoria County, Texas.

2.1 LOGGERHEAD SEA TURTLE

2.1.1 Reasons for Status

The loggerhead turtle (*Caretta caretta*) was listed by the FWS as threatened throughout its range on 28 July 1978 (43 FR 32808). The decline of the loggerhead, like that of most sea turtles, is the result of overexploitation by man, inadvertent mortality associated with fishing and trawling activities, and natural predation. The most significant threats to its population are coastal development, commercial fisheries, and pollution (NMFS, 2006a).

2.1.2 Habitat

The loggerhead turtle occurs in the open seas as far as 500 miles from shore, but mainly over the continental shelf, and in bays, estuaries, lagoons, creeks, and mouths of rivers. It favors warm temperate and subtropical regions not far from shorelines. The adults occupy various habitats, from turbid bays to clear waters of reefs. Subadults occur mainly in nearshore and estuarine waters. Hatchlings move directly to sea after hatching, and often float in masses of sargassum. They may remain associated with sargassum for perhaps 3 to 5 years (NMFS and FWS, 1991a).

Commensurate with their use of varied habitats, loggerheads consume a wide variety of both benthic and pelagic food items, which they crush before swallowing. Conches, shellfish, horseshoe crabs, prawns and other crustacea, squid, sponges, jellyfish, basket starts, fish (carrion or slow-moving species), and even hatchling loggerheads have all been recorded as loggerhead prey (Rebel, 1974; Hughes, 1974; Mortimer,

TABLE 1

FEDERALLY LISTED ENDANGERED AND THREATENED
FISH AND WILDLIFE SPECIES OF POSSIBLE OCCURRENCE IN
BRAZORIA COUNTY, TEXAS[1]

Common Name[2]	Scientific Name[2]	Status[3] FWS
REPTILES		
Leatherback sea turtle	*Dermochelys coriacea*	E
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Loggerhead sea turtle	*Caretta caretta*	E
Green sea turtle	*Chelonia mydas*	T
BIRDS		
Brown pelican	*Pelecanus occidentalis*	E
Whooping crane	*Grus americana*	E
Bald eagle	*Haliaeetus leucocephalus*	T-PDL
Piping plover	*Charadrius melodus*	T w/CH
MAMMALS		
Sei whale	*Balaenoptera borealis*	E
Blue whale	*Balaenoptera musculus*	E
Finback whale	*Balaenoptera physalus*	E
Humpback whale	*Megaptera novaeangliae*	E
Sperm whale	*Physeter macrocephalus*	E
Louisiana black bear	*Ursus americanus luteolus*	T
FISHES		
Smalltooth sawfish	*Pristis pectinata*	E
Gulf sturgeon	*Acipenser oxyrhinchus desotoi*	T

[1] According to Natural Diversity Database (NDD, 2005), NMFS (2006), FWS (2005, 2006).

[2] Nomenclature follows American Ornithologist's Union (AOU, 1998, 2000, 2002, 2003, 2004, 2005, and 2006), Crother et al. (2000, 2001, and 2003), NDD (2005), and FWS (2005 and 2006).

[3] FWS – U.S. Fish and Wildlife Service; TPWD – Texas Parks and Wildlife Department.

E – Endangered; T – Threatened; DL – Federally delisted; PDL – Proposed for delisting; C – Candidate for listing; NL – Not listed

1982). Adults forage primarily on the bottom, but also take jellyfish from the surface. The young feed on prey concentrated at the surface, such as gastropods, fragments of crustaceans, and sargassum.

Nesting occurs usually on open sandy beaches above the high-tide mark and seaward of well-developed dunes. They nest primarily on high-energy beaches on barrier islands adjacent to continental land masses in warm-temperate and subtropical regions. Steeply sloped beaches with gradually sloped offshore approaches are favored. In Florida, nesting on urban beaches was strongly correlated with the presence of tall objects (trees or buildings), which apparently shield the beach from city lights (Salmon et al., 1995).

2.1.3 Range

The loggerhead is widely distributed in tropical and subtropical seas, being found in the Atlantic Ocean from Nova Scotia to Argentina, Gulf of Mexico, Indian and Pacific oceans (although it is rare in the eastern and central Pacific) and the Mediterranean Sea (Rebel, 1974; Ross, 1982; Iverson, 1986). In the continental U.S., loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey (Musick, 1979) and sporadically along the Gulf Coast. In recent years, a few have nested on barrier islands along the Texas coast. The loggerhead is the most abundant sea turtle species in U.S. coastal waters (NMFS, 2006a).

2.1.4 Distribution in Texas

The loggerhead is the most abundant turtle in Texas marine waters, preferring shallow inner continental shelf waters and occurring only very infrequently in the bays. It often occurs near offshore oil rig platforms, reefs, and jetties. Loggerheads are probably present year-round but are most noticeable in the spring when a favored food item, the Portuguese man-of-war (*Physalia physalis*), is abundant. Loggerheads constitute a major portion of the dead or moribund turtles washed ashore (stranded) on the Texas coast each year. A large proportion of these deaths are the result of accidental capture by shrimp trawlers, where caught turtles drown and their bodies dumped overboard. Before 1977, no positive documentation of loggerhead nests in Texas existed (Hildebrand, 1982). Since that time, several nests have been recorded along the Texas coast. In 1999, two loggerhead nests were confirmed in Texas, while in 2000, five loggerhead nests were confirmed (Shaver, 2000). For the last 5 years, up to five nests per year have been recorded from the Texas coast (Shaver, 2006). Like the worldwide population, the population of loggerheads in Texas has declined. Prior to World War I, the species was taken in Texas for local consumption and a few were marketed (Hildebrand, 1982). Today, even without protection, insufficient loggerheads exist to support a fishery.

2.1.5 Presence in the Project Area

This species has been recorded from the study area. Between 1995 and 2000, eight loggerheads were caught in Freeport Harbor and during the Freeport Harbor Project (13 July to 24 September 2002), one loggerhead was captured by a relocation trawler (NMFS, 2003).

2.2 KEMP'S RIDLEY SEA TURTLE

2.2.1 Reasons for Status

Kemp's ridley sea turtle (*Lepidochelys kempii*) was listed as endangered throughout its range on 2 December 1970 (35 FR 18320). Populations of this species have declined since 1947, when an estimated 42,000 females nested in one day (Hildebrand, 1963), to a total nesting population of approximately 1,000 in the mid-1980s. The decline of this species was primarily due to human activities including collection of eggs, fishing for juveniles and adults, killing adults for meat and other products, and direct take for indigenous use. In addition to these sources of mortality, Kemp's ridleys have been subject to high levels of incidental take by shrimp trawlers (FWS and NMFS, 1992; NMFS, 2006a). The National Research Council's (NRC) Committee on Sea Turtle Conservation estimated in 1990 that 86% of the human-caused deaths of juvenile and adult loggerheads and Kemp's ridleys resulted from shrimp trawling (Campbell, 1995). It is estimated that before the implementation of turtle excluder devices (TED) the commercial shrimp fleet killed between 500 and 5,000 Kemp's ridleys each year (NMFS, 2006a). Kemp's ridleys have also been taken by pound nets, gill nets, hook and line, crab traps, and longlines.

Another problem shared by adult and juvenile sea turtles is the ingestion of manmade debris and garbage. Postmortem examinations of sea turtles found stranded on the south Texas coast from 1986 through 1988 revealed 54% (60 of the 111 examined) of the sea turtles had eaten some type of marine debris. Plastic materials were most frequently ingested and included pieces of plastic bags, styrofoam, plastic pellets, balloons, rope, and fishing line. Nonplastic debris such as glass, tar, and aluminum foil were also ingested by the sea turtles examined. Much of this debris comes from offshore oil rigs, cargo ships, commercial and recreational fishing boats, research vessels, naval ships, and other vessels operating in the Gulf. Laws enacted during the late-1980s to regulate this dumping are difficult to enforce over vast expanses of water. In addition to trash, pollution from heavy spills of oil or waste products poses additional threats (Campbell, 1995).

Further threats to this species include collisions with boats, explosives used to remove oil rigs, and entrapment in coastal power plant intake pipes (Campbell, 1995). Dredging operations affect Kemp's ridley turtles through incidental take and by degrading the habitat. Incidental take of ridleys has been documented with hopper dredges. In addition to direct take, channelization of the inshore and nearshore areas can degrade foraging and migratory habitat through spoil dumping, degraded water quality/clarity and altered current flow (FWS and NMFS, 1992).

Sea turtles are especially subject to human impacts during the time the females come ashore for nesting. Modifications to nesting areas can have a devastating effect on sea turtle populations. In many cases, prime sea turtle nesting sites are also prime real estate. If a nesting site has been disturbed or destroyed, female turtles may nest in inferior locations where the hatchlings are less likely to survive, or they may not lay any eggs at all. Artificial lighting from developed beachfront areas often disorients nesting

females and hatchling sea turtles, causing them to head inland by mistake, often with fatal results. Adult females also may avoid brightly lit areas that would otherwise provide suitable nesting sites.

Kemp's ridley appears to be in the earliest stages of recovery. Approximately 6,000 Kemp's ridley nests were recorded on Mexican beaches during the 2000 nesting season (Shaver, 2000); just over 10,000 nests were recorded there during the 2005 nesting season (Shaver, 2006). Similarly, increased nesting activity has been recorded on the Texas beaches in the last decade or so from four nests in 1995 to 51 nests in 2005 (National Park Service [NPS], 2006; Shaver, 2006). Some of these nests were from headstarted ridleys. Of 46 Kemp's ridley nests encountered in the continental U.S. during 2004, 42 were on Texas beaches (NPS, 2006). The increase likely can be attributed to two primary factors: full protection of nesting females and their nests in Mexico, and the requirement to use TEDs in shrimp trawls both in the U.S. and in Mexico (NMFS, 2006a).

2.2.2 Habitat

Kemp's ridleys inhabit shallow coastal and estuarine waters, usually over sand or mud bottoms. Adults are primarily shallow-water benthic feeders that specialize on crabs, especially portunid crabs, while juveniles feed on sargassum (*Sargassum* sp.) and associated infauna, and other epipelagic species of the Gulf (FWS and NMFS, 1992). In some regions the blue crab (*Callinectes sapidus*) is the most common food item of adults and juveniles. Other food items include shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and occasional marine plants (Pritchard and Marquez, 1973; Shaver, 1991; Campbell, 1995).

2.2.3 Range

Adults are primarily restricted to the Gulf, although juveniles may range throughout the Atlantic Ocean since they have been observed as far north as Nova Scotia (Musick, 1979) and in coastal waters of Europe (Brongersma, 1972). Important foraging areas include Campeche Bay, Mexico, and Louisiana coastal waters.

Almost the entire population of Kemp's ridleys nests on an 11-mile stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, approximately 190 miles south of the Rio Grande. A secondary nesting area occurs at Tuxpan, Veracruz, and sporadic nesting has been reported from Mustang Island, Texas, southward to Isla Aquada, Campeche. Several scattered isolated nesting attempts have occurred from North Carolina to Colombia.

Because of the dangerous population decline at the time, a head-starting program was carried out from 1978 to 1988. Eggs were collected from Rancho Nuevo and placed into polystyrene foam boxes containing Padre Island sand so that the eggs never touched the Ranch Nuevo sand. The eggs were flown to the U.S. and placed in a hatchery on Padre Island and incubated. The resulting hatchlings were allowed to crawl over the Padre Island beaches into the surf for imprinting purposes before being recovered from the surf and taken to Galveston for rearing. They were fed a diet of high-protein commercial floating

pellets for 7 to 15 months before being released into Texas (mainly) or Florida waters (Caillouet et al., 1995). This program has shown some results. The first nesting from one of these head-started individuals occurred at Padre Island in 1996, and more nesting has occurred since (Shaver, 2000).

2.2.4 Distribution in Texas

Kemp's ridley occurs in Texas in small numbers and in many cases may well be in transit between crustacean-rich feeding areas in the northern Gulf and breeding grounds in Mexico. It has nested sporadically in Texas in the last 50 years. Nests were found near Yarborough Pass in 1948 and 1950, and in 1960 a single nest was located at Port Aransas. The number of nestings, however, has increased in recent years: 1995 (4 nests); 1996 (6 nests); 1997 (9 nests); 1998 (13 nests); 1999 (16 nests); 2000 (12 nests); 2001 (8 nests); 2002 (38 nests); 2003 (19 nests); 2004 (42 nests); and 2005 (51 nests) (Shaver, 2000, 2006; NPS, 2006). As noted above, some of these nests were from headstarted ridleys. Of the 51 Kemp's ridley nests recorded for Texas in 2005, 28 were at the Padre Island National Seashore (Shaver, 2006). Such nestings, together with the proximity of the Rancho Nuevo rookery, probably accounts for the occurrence of hatchlings and subadults in Texas. According to Hildebrand (1982, 1986, 1987), sporadic ridley nesting in Texas has always been the case. This is in direct contradiction, however, to Lund (1974), who believed that Padre Island historically supported large numbers of nesting Kemp's ridleys, but that the population became extirpated because of excessive egg collection.

2.2.5 Presence in the Project Area

Kemp's ridley has been recorded from the study area. In 1994, a headstarted ridley was accidentally caught by a fisherman on a rod and reel in the GIWW and released alive (NDD, 2006). This species has also nested in the study area. One nest was found on Quintana Beach in 2002 and another was found near Surfside Beach in 2003 (Yeargan, 2006).

2.3 HAWKSBILL SEA TURTLE

2.3.1 Reasons for Status

The hawksbill sea turtle (*Eretmochelys imbricata*) was Federally listed as endangered on 2 June 1970 (35 FR 8495) with critical habitat designated in Puerto Rico on 24 May 1978 (43 FR 22224). The greatest threat to this species is harvest to supply the market for tortoiseshell and stuffed turtle curios (Meylan and Donnelly, 1999). Hawksbill shell (bekko) commands high prices. Japanese imports of raw bekko between 1970 and 1989 totaled 713,850 kilograms, representing more than 670,000 turtles. The hawksbill is also used in the manufacture of leather, oil, perfume, and cosmetics (NMFS, 2006a).

Other threats include destruction of breeding locations by beach development, incidental take in lobster and Caribbean reef fish fisheries, pollution by petroleum products (especially oil tanker discharges), entanglement in persistent marine debris (Meylan, 1992), and predation on eggs and hatchlings. In American Samoa, most sea turtles and eggs encountered by villagers are harvested (Tuato`o-Bartley et al.,

1993). See FWS (1998) for detailed information on certain threats, including beach erosion, beach armoring, beach nourishment, sand mining, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, predation, and poaching.

In 1998, NMFS designated critical habitat near Isla Mona and Isla Monito, Puerto Rico, seaward to 5.6 kilometers (km) (63 FR 46693–46701).

2.3.2 Habitat

Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they occur at depths of less than 70 ft. Like some other sea turtle species, hatchlings are sometimes found floating in masses of marine plants (e.g., sargassum rafts) in the open ocean (NFWL, 1980). Hawksbills reenter coastal waters when they reach a carapace length of approximately 20 to 25 centimeters. Coral reefs are widely recognized as the resident foraging habitat of juveniles, subadults, and adults. This habitat association is undoubtedly related to their diet of sponges, which need solid substrate for attachment. Hawksbills also occur around rocky outcrops and high-energy shoals, which are also optimum sites for sponge growth. In Texas, juvenile hawksbills are associated with stone jetties (NMFS, 2006a).

While this species is omnivorous, it prefers invertebrates, especially encrusting organisms, such as sponges, tunicates, bryozoans, mollusks, corals, barnacles, and sea urchins. Pelagic species consumed include jellyfish and fish, and plant material such as algae, sea grasses and mangroves, has been reported as food items for this turtle (Carr, 1952; Rebel, 1974; Pritchard, 1977; Musick, 1979; Mortimer, 1982). The young are reported to be somewhat more herbivorous than adults are (Ernst and Barbour, 1972).

Terrestrial habitat is typically limited to nesting activities. The hawksbill, which is typically a solitary nester, nests on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls. Typically, the sand beaches are low energy, with woody vegetation, such as sea grape (*Coccoloba uvifera*), near the waterline (NRC, 1990).

2.3.3 Range

The hawksbill is circumtropical, occurring in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans (Witzell, 1983). This species is probably the most tropical of all marine turtles, although it does occur in many temperate regions. The hawksbill sea turtle is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf (especially Texas), south to Brazil (NMFS, 2006a). In the continental U.S., the hawksbill largely nests in Florida where it is sporadic at best (NFWL, 1980). However, a major nesting beach exists on Mona Island, Puerto Rico. Elsewhere in the western Atlantic, hawksbills nest in small numbers along the Gulf Coast of Mexico, the West Indies, and along the Caribbean coasts of Central and South America (Musick, 1979).

2.3.4 Distribution in Texas

Texas is the only State outside of Florida where hawksbills are sighted with any regularity. Most of these sightings involve posthatchlings and juveniles, and are primarily associated with stone jetties. These small turtles are believed to originate from nesting beaches in Mexico (NMFS, 2006a). On 13 June 1998, the first hawksbill nest recorded on the Texas coast was found at Padre Island National Seashore. This nest remains the only documented hawksbill nest on the Texas coast (NPS, 2006; Shaver, 2006).

2.3.5 Presence in the Project Area

No documented records of hawksbills exist from Brazoria County, Texas (Dixon, 2000); however, this species is of potential occurrence in the study area.

2.4 GREEN SEA TURTLE

2.4.1 Reasons for Status

The green turtle (*Chelonia mydas*) was listed on 28 July 1978 as threatened except for Florida and the Pacific Coast of Mexico (including the Gulf of California) where it was listed as endangered (43 FR 32808). The greatest cause of decline in green turtle populations is commercial harvest for eggs and food. Other turtle parts are used for leather and jewelry, and small turtles are sometimes stuffed for curios. Incidental catch during commercial shrimp trawling is a continued source of mortality that adversely affects recovery. It is estimated that before the implementation of TED requirements, the offshore commercial shrimp fleet captured about 925 green turtles a year, of which approximately 225 would die. Most turtles killed are juveniles and subadults. Various other fishing operations also negatively affect this species (NMFS, 2006a). Epidemic outbreaks of fibropapilloma or “tumor” infections recently have occurred on green sea turtles, especially in Hawaii and Florida, posing a severe threat. The cause of these outbreaks is largely unknown, but it could be caused by a viral infection (Barrett, 1996). This species is also subject to various negative impacts shared by sea turtles in general.

2.4.2 Habitat

The green turtle primarily utilizes shallow habitats such as lagoons, bays, inlets, shoals, estuaries, and other areas with an abundance of marine algae and seagrasses. Individuals observed in the open ocean are believed to be migrants en route to feeding grounds or nesting beaches (Meylan, 1982). Hatchlings often float in masses of sea plants (e.g., rafts of sargassum) in convergence zones. Coral reefs and rocky outcrops near feeding pastures often are used as resting areas. The adults are primarily herbivorous, while the juveniles consume more invertebrates. Foods consumed include seagrasses, macroalgae and other marine plants, mollusks, sponges, crustaceans, and jellyfish (Mortimer, 1982; Green, D., unpubl. data).

Terrestrial habitat is typically limited to nesting activities, although in some areas, such as Hawaii and the Galápagos Islands, they will bask on beaches (Balazs, 1980; Green, unpubl. data). They prefer high-

energy beaches with deep sand, which may be coarse to fine, with little organic content. At least in some regions, they generally nest consistently at the same beach, which is apparently their natal beach (Meylan et al., 1990; Allard et al., 1994), although an individual might switch to a different nesting beach within a single nesting season (Green, D., unpubl. data).

2.4.3 Range

The green turtle is a circumglobal species in tropical and subtropical waters. In U.S. Atlantic waters, it occurs around the U.S. Virgin Islands, Puerto Rico, and continental U.S. from Massachusetts to Texas. Major nesting activity occurs on Ascension Island, Aves Island (Venezuela), Costa Rica, and in Surinam. Relatively small numbers nest in Florida, with even smaller numbers in Georgia, North Carolina, and Texas (NMFS and FWS, 1991b; Hirth, 1997).

2.4.4 Distribution in Texas

The green turtle in Texas inhabits shallow bays and estuaries where its principal foods, the various marine grasses, grow (Bartlett and Bartlett, 1999). Its population in Texas has suffered a decline similar to that of its world population. In the mid- to late-nineteenth century, Texas waters supported a green turtle fishery. Most of the turtles were caught in Matagorda Bay, Aransas Bay, and the lower Laguna Madre, although a few also came from Galveston Bay. Many live turtles were shipped to places such as New Orleans or New York and from there to other areas. Others were processed into canned products such as meat or soup prior to shipment. By 1900, however, the fishery had virtually ceased to exist. Turtles continued to be hunted sporadically for a while, the last Texas turtler hanging up his nets in 1935. Incidental catches by anglers and shrimpers were sometimes marked prior to 1963, when it became illegal to do so (Hildebrand, 1982).

Green turtles still occur in these same bays today but in much-reduced numbers (Hildebrand, 1982). While green turtles prefer to inhabit bays with seagrass meadows, they may also be found in bays that are devoid of seagrasses. The green turtles in these Texas bays are mainly small juveniles. Adults, juveniles, and even hatchlings are occasionally caught on trotlines or by offshore shrimpers or are washed ashore in a moribund condition.

Green turtle nests are rare in Texas. Five nests were recorded at the Padre Island National Seashore in 1998, none in 1999, and one in 2000 (Shaver, 2000; NPS, 2006). For the last 5 years, up to five nests per year have been recorded from the Texas coast (Shaver, 2006). Green turtles, however, nest more in Florida and in Mexico. Since long migrations of green turtles from their nesting beaches to distant feedings grounds are well documented (Meylan, 1982; Green, 1984), the adult green turtles occurring in Texas may be either at their feeding grounds or in the process of migrating to or from their nesting beaches. The juveniles frequenting the seagrass meadows of the bay areas may remain there until they move to other feeding grounds or, perhaps, once having attained sexual maturity, return to their natal beaches outside of Texas to nest.

2.4.5 Presence in the Project area

No documented records of hawksbills exist from Brazoria County, Texas (Dixon, 2000); however, this species is of potential occurrence in the study area.

2.5 LEATHERBACK SEA TURTLE

2.5.1 Reasons for Status

The leatherback sea turtle (*Dermochelys coriacea*) was listed as endangered throughout its range on 2 June 1970 (35 FR 8495), with critical habitat designated in the U.S. Virgin Islands on 26 September 1978 and 23 March 1979 (43 FR 43688–43689 and 44 FR 17710–17712, respectively). Its decline is attributable to overexploitation by man and incidental mortality associated with commercial shrimping and fishing activities. Use of turtle meat for fish bait and the consumption of litter by turtles are also causes of mortality, the latter phenomenon apparently occurring when plastic is mistaken for jellyfish (Rebel, 1974). Nesting populations of leatherback sea turtles are especially difficult to estimate because the females frequently change nesting beaches; however, Spotila et al. (1996) estimated the 1995 worldwide population of nesting female leatherbacks at 26,000 to 42,000. The major threat is egg collecting, although they are jeopardized to some extent by destruction or degradation of nesting habitat (NatureServe, 2006). This species is probably more susceptible than other turtles to drowning in shrimp trawlers equipped with TEDs because adult leatherbacks are too large to pass through the TED exit opening. Because leatherbacks nest in the tropics during hurricane season, a potential exists for storm-generated waves and wind to erode nesting beaches, resulting in nest loss (NMFS and FWS, 1992).

Critical Habitat: St. Croix, Virgin Islands; Santa Rosa NP., Costa Rica; sites in Mexico. NMFS (Federal Register, 12 May 1995) established a leatherback conservation zone extending from Cape Canaveral to the Virginia-North Carolina border and including all inshore and offshore waters; this zone is subject to shrimping closures when high abundance of leatherbacks is documented. Mortality associated with the swordfish gillnet fisheries in Peru and Chile represents the single largest source of mortality for East Pacific leatherbacks (Eckert and Sarti, 1997).

2.5.2 Habitat

The leatherback sea turtle is mainly pelagic, inhabiting the open ocean, and seldom approaches land except for nesting (Eckert, 1992). It is most often found in coastal waters only when nesting or when following concentrations of jellyfish (TPWD, 2006), when it can be found in inshore waters, bays, and estuaries. It dives almost continuously, often to great depths.

Despite their large size, the diet of leatherbacks consists largely of jellyfish and sea squirts. They also consume sea urchins, squid, crustaceans, fish, blue-green algae, and floating seaweed (NFWL, 1980). The leatherback typically nests on beaches with a deepwater approach (Pritchard, 1971).

2.5.3 Range

The leatherback is probably the most wide-ranging of all sea turtle species. It occurs in the Atlantic, Pacific and Indian oceans; as far north as British Columbia, Newfoundland, Great Britain and Norway; as far south as Australia, Cape of Good Hope, and Argentina; and in other water bodies such as the Mediterranean Sea (NFWL, 1980). Leatherbacks nest primarily in tropical regions; major nesting beaches include Malaysia, Mexico, French Guiana, Surinam, Costa Rica, and Trinidad (Ross, 1982). Leatherbacks nest only sporadically in some of the Atlantic and Gulf states of the continental U.S., with one nesting reported as far north as North Carolina (Schwartz, 1976). In the Atlantic and Caribbean, the largest nesting assemblages occur in the U.S. Virgin Islands, Puerto Rico, and Florida (NMFS, 2006a).

The leatherback migrates further and ventures into colder water than any other marine reptile. Adults appear to engage in routine migrations between boreal, temperate, and tropical waters, presumably to optimize both foraging and nesting opportunities. The longest-known movement is that of an adult female that traveled 5,900 km to Ghana, West Africa, after nesting in Surinam (NMFS and FWS, 1992). During the summer, leatherbacks tend to occur along the east coast of the U.S. from the Gulf of Maine south to the middle of Florida.

2.5.4 Distribution in Texas

Apart from occasional feeding aggregations such as the large one of 100 animals reported by Leary (1957) off Port Aransas in December 1956, or possible concentrations in the Brownsville Eddy in winter (Hildebrand, 1983), leatherbacks are rare along the Texas coast, tending to keep to deeper offshore waters where their primary food source, jellyfish, occurs. In the Gulf, the leatherback is often associated with two species of jellyfish: the cabbagehead (*Stomolophus* sp.) and the moon jellyfish (*Aurelia* sp.) (NMFS and FWS, 1992). According to FWS (1981), leatherbacks never have been common in Texas waters. No nests of this species have been recorded in Texas for at least 70 years (NPS, 2006). The last two, one from the late 1920s and one from the mid-1930s, were both from Padre Island (Hildebrand, 1982, 1986).

2.5.5 Presence in the Project Area

A leatherback was caught by a relocation trawler in a shipping channel approximately 1.5 miles north of Aransas Pass in 2003 (i.e., south of the project area; NMFS, 2003). This species is unlikely to occur in the study area.

2.6 BROWN PELICAN

2.6.1 Reasons for Status

FWS listed the brown pelican (*Pelecanus occidentalis*) as endangered throughout its range outside the U.S. on 2 June 1970 (35 FR 8495) and throughout its U.S. range on 13 October 1970 (35 FR 16047). Population declines were largely the result of organochlorine pesticides, particularly endrin and DDT,

entering the marine food web. Endrin resulted in direct mortality, while DDT impaired reproduction by causing eggshell thinning; thus, eggs desiccated and became susceptible to breaking during incubation (Shields, 2002). Other factors included human disturbance and habitat loss resulting from commercial and residential development (FWS, 1995a). Pelicans are large, heavy birds and easily flushed from the nest. Flushing exposes the eggs and young to predation, temperature stress, and permanent abandonment by the parents.

A ban on the use of DDT in the U.S. in 1972, together with efforts to conserve and improve remaining populations, has led to increased numbers of brown pelicans. Populations in some areas have increased to historical breeding levels or above, with stable population numbers and productivity. FWS has delisted the brown pelican along the U.S. Atlantic Coast and the Gulf coasts of Florida and Alabama. It remains endangered throughout the remainder of its range, which includes Mississippi, Louisiana, Texas, California, Mexico, Central and South America, and the West Indies. In May 1998, the FWS announced its intention to delist or downlist to threatened status numerous species, including the brown pelican (63 FR 25502–25512; 8 May 1998).

2.6.2 Habitat

Brown pelicans inhabit warm coastal marine and estuarine environments (Shields, 2002). They are generally rare inland, but permanent year-round populations exist at the Salton Sea, California, and Lake Okeechobee, Florida, and they regularly occur as postbreeding visitors to inland waters in the southwest U.S. and central Florida (Shields, 2002). Brown pelicans breed colonially on undisturbed offshore islands, where they build nests on the ground or in trees and small bushes (AOU, 1998; Shields, 2002). Preferred sites are those free from human disturbance, flooding, and terrestrial predators such as raccoons. Brown pelicans typically forage in shallow waters within 12 miles of nesting sites during breeding, and rarely venture more than 45 miles offshore during nonbreeding (Shields, 2002). Sandbars, offshore rocks and islands, mangrove islets, jetties, pilings, piers, wharves, and oil/gas platforms provide important roosting and loafing sites (Shields, 2002).

2.6.3 Range

The brown pelican occurs along the Pacific Coast of the Americas from southern British Columbia south to Cape Horn, and throughout the Atlantic, Gulf and Caribbean coastal areas from New Jersey south to eastern Venezuela. In North America, it occasionally ventures inland, with records from Idaho, Wyoming, North Dakota, Iowa, Wisconsin, Michigan, Ontario, and Quebec (AOU, 1998; Shields, 2002). Its breeding range is more restricted: along the Pacific Coast from central California south to Chile, including the Galápagos Islands; and from North Carolina, south to eastern Venezuela, the West Indies, Greater Antilles, and Virgin Islands (AOU, 1998). While some migration occurs after nesting in both subspecies, many individuals overwinter close to their breeding grounds (FWS, 1980). Atlantic Coast populations move southward in the fall, with most birds wintering in the U.S., particularly in Florida. Some birds, however, disperse to the Cuban coast (Clapp et al., 1982). Gulf Coast birds tend to remain on the Gulf

Coast, although banded Texas and Louisiana birds have occurred in Mexico and Cuba (Palmer, 1962; Clapp et al., 1982).

Two subspecies occur in North America: the eastern brown pelican (*P. o. carolinensis*) ranging from North Carolina south through Florida and west to Texas, and the California brown pelican (*P. o. californicus*) in California (NFWL, 1980). The eastern subspecies' present-day range is the same as its historical range, but it occurs in reduced numbers. It became extirpated in Louisiana in 1966, but has since (beginning in 1968) been reintroduced from Florida. No known nesting records exist from Mississippi or Georgia (FWS, 1980; 50 FR 4938, 9 February 1985). Brown pelican colonies occur on the east coast of Mexico off the eastern tip of the Yucatan Peninsula (Mabie, 1986, 1988).

Historically, the brown pelican was a common bird of the Texas Gulf Coast with an estimated breeding population of 5,000 pairs residing in 17 colonies in 1918 (Mabie, 1990). By the 1960s, however, it was nearing extirpation. In 1963, only 14 recorded breeding pairs were present along the Texas coast; in 1964, no known nesting occurred (Mabie, 1986). The decline started during the 1920s and 1930s in relation to human disturbance (Oberholser, 1974), and continued until the 1970s because of pesticide contamination (King et al., 1977; Mabie, 1986). Since the 1960s, the brown pelican has made a gradual comeback in Texas with an estimated 2,400 breeding pairs in 1995 (Campbell, 1995). The majority of breeding birds occur on Pelican Island in Corpus Christi Bay, Nueces County, and Sundown Island near Port O'Connor in Matagorda County. Smaller colonies occasionally nest on Bird Island in Matagorda Bay, a series of older dredged material islands in West Matagorda Bay, Dressing Point Island in East Matagorda Bay, and islands in Aransas Bay (Campbell, 1995).

2.6.4 Presence in Project Area

The majority of breeding birds in Texas occur from Nueces County to Galveston County (Texas Ornithological Society [TOS], 1995). The species is an uncommon resident in the general area (FWS, n.d.), but likely occurs in the open water and barrier island habitats in the study area. Brown pelicans are unlikely to nest in the study area, but are likely to be present throughout most of the year.

2.7 WHOOPING CRANE

2.7.1 Reasons for Status

The whooping crane (*Grus americana*) was Federally listed as endangered on 11 March 1967 (32 FR 4001). Critical habitat has been designated in Aransas, Calhoun, and Refugio counties in Texas, and includes the Aransas National Wildlife Refuge (NWR). Two experimentally introduced flocks are listed as experimental nonessential populations; in Florida (FR, 22 January 1993) and New Mexico (62 FR 38932). The main factors for the decline of the whooping crane were loss of habitat to agriculture, human disturbance of nesting areas, uncontrolled hunting, and collisions with power lines (NatureServe, 2006). Biological factors, such as delayed sexual maturity and small clutch size prevent rapid population recovery. Drought during the breeding season presents serious hazards to this species (Campbell, 1995).

Whooping cranes are vulnerable to loss of habitat along their long migration route (NatureServe, 2006), along which they are still subject to cataclysmic weather events, accidental shooting, collision with power lines, and predators. They are susceptible to avian tuberculosis, avian cholera and lead poisoning (Campbell, 1995). Exposure to disease is a special problem when large numbers of birds are concentrated in limited areas, as often happens during times of drought.

While in Texas, the main population is at risk from chemical spills along the Gulf Intracoastal Waterway (GIWW), which passes through the center of their winter range (Campbell, 1995). The presence of contaminants in the food base is another potential problem on their wintering grounds (Oberholser, 1974), and a late season hurricane or other weather event could be disastrous to this concentrated population.

2.7.2 Habitat

Nesting habitat in Canada is freshwater marshes and wet prairies (NatureServe, 2006), interspersed with numerous potholes and narrow-wooded ridges. Whooping cranes use a variety of habitats during migration (Campbell, 1995). They feed on grain in croplands (Lewis, 1995), and large wetland areas are used for feeding and roosting. Riverine habitats, such as submerged sandbars, are often used for roosting. The principle winter habitat in Texas is brackish bays, marshes, and salt flats, although whooping cranes sometimes feed in upland sites characterized by oak mottes, grassland swales, and ponds on gently rolling sandy soils (Campbell, 1995).

Summer foods include large insect nymphs or larvae, frogs, rodents, small birds, minnows and berries. During the winter in Texas they eat a wide variety of plant and animal foods. Blue crabs, clams, and berries of Carolina wolfberry (*Lycium carolinianum*) comprise the diet. Foods taken at upland sites include acorns, snails, crayfish, and insects (Campbell, 1995).

2.7.3 Range

Whooping cranes were originally found throughout most of North America. In the nineteenth century, the main breeding area was from the Northwest Territories to the prairie provinces in Canada, and the northern prairie states to Illinois. A nonmigratory flock existed in Louisiana, but is now extirpated. Whooping cranes wintered from Florida to New Jersey along the Atlantic Coast, along the Texas Gulf Coast, and in the high plateaus of central Mexico. They now breed in isolated, marshy areas of Wood Buffalo National Park, Northwest Territories, and Canada. They winter primarily in the Aransas NWR and adjacent areas of the central Texas Gulf Coast (FWS, 1995a). During migration they use various stopover areas in western Canada and the American Midwest.

Two experimental flocks have been established by incubating eggs and rearing the young in captivity before releasing them into the wild. Cranes were introduced in Grays Lake NWR in Idaho in 1975; these birds winter at Bosque del Apache NWR in central New Mexico. This population is not successfully breeding and will become extirpated. Introduction of another flock to Kissimmee Prairie in Florida began in 1993. The Florida population will be non-migratory (NatureServe, 2006).

The natural wild population of whooping cranes spends its winters at the Aransas NWR, Matagorda Island, Isla San Jose, portions of the Lamar Peninsula, and Welder Point on the east side of San Antonio Bay (NatureServe, 2006). The main stopover points in Texas for migrating birds are in the central and eastern panhandle (FWS, 1995a).

2.7.4 Presence in the Project Area

According to FWS (1995a), Brazoria County is within the species' migration corridor; however, the species is unlikely to occur in the study area because of the absence of suitable wintering habitat. NDD (2006) indicates documented records of whooping cranes from marshes west of the Brazos River; however, these likely represent vagrant birds and no wintering populations are present in the project area.

2.8 BALD EAGLE

2.8.1 Reasons for Status

The bald eagle (*Haliaeetus leucocephalus*) first received legal protection under the Eagle Protection Act on 8 June 1940 (amended 23 October 1972). FWS listed the bald eagle (*Haliaeetus leucocephalus*) (below the 40th parallel) as endangered on 11 March 1967 (32 FR 4001). Later it received protection under the ESA of 1973. The legal status of the species was changed on 14 February 1978 (43 FR 6233) to endangered in the conterminous U.S. except for Washington, Oregon, Minnesota, Wisconsin, and Michigan, where it was designated as threatened (FWS, 1984). FWS then downlisted the species to threatened on 12 July 1995 (60 FR 35999 36010). FWS proposed to remove the bald eagle from the Federal list of threatened and endangered species on 6 July 1999 (64 FR 36453 36464); however, a final decision is yet to be made.

Several factors have contributed to the decline of the bald eagle, including loss of habitat, mortality from shooting and trapping, and environmental contaminants (FWS, 1984). Human factors include direct mortality resulting from hunting, trapping, and poisoning, as well as indirect mortality resulting from collisions with power lines, structures, and vehicles and electrocution (Buehler, 2000). Mortality through shooting, however, is on the decline. Between 1975 and 1981, 18% of the total reported mortalities were due to shooting, compared to 62% between 1961 and 1965 (FWS, 1984).

Historically, increase in human population has resulted in extensive alterations in land use. Because the eagles nest near water, increased recreation and other human use of water resources have had negative effects on the bald eagle. The greater use of boats, off-road vehicles, and snowmobiles, and increased development of waterfront property have severely altered eagle habitat (Snow, 1981). The construction of reservoir has created new wintering and nonnesting habitat and nesting bald eagles may use these areas in the future, potentially resulting in a major redistribution of nesting (FWS, 1984).

Environmental contaminants are responsible for the greatest decline in eagle populations. Organochloride pesticides inhibit calcium metabolism, resulting in thin eggshells and, thus, reproductive failure. Since

banning of the use of DDT and other organochloride pesticides in the U.S., the eagles have slowly recovered. Most populations of bald eagles appear to be producing young at a normal rate (FWS, 1984).

2.8.2 Habitat

The bald eagle inhabits coastal areas, rivers and large bodies of water. Water is the common feature of its nesting habitat. Because fish and waterfowl comprise the bulk of the bald eagle's diet, nests are seldom far from a river, lake, bay, or other waterbody. Bald eagles generally build nests in the largest trees available, which provide adequate flight access and visibility of the surrounding area (Buehler, 2000). Nest trees may be in woodlands, woodland edges, or open areas, and are frequently the dominant or co-dominant trees in the area (Green, 1985). Bald eagles also nest on cliffs and rock pinnacles, particularly in the southwestern U.S., and occasionally on the ground and on manmade structures (Buehler, 2000).

Water is also an important element of the winter habitat, with eagles usually frequenting lakes and major river systems. Wintering bald eagles also use habitats with little or no open water, if rabbits, carrion, or other food items are regularly available (Green, 1985; Buehler, 2000).

2.8.3 Range

The bald eagle ranges throughout North America. Two subspecies are currently recognized based on size and weight: the northern bald eagle (*H. l. alascanus*) and the southern bald eagle (*H. l. leucocephalus*), the former being larger and heavier than the latter. This delineation, however, is of questionable merit due to a continuous size gradient from north to south throughout the range; eagles in the central part of the U.S. are intermediate in size. The northern population nests from central Alaska and the Aleutian Islands, east through Canada, and in the northern states of the U.S. The southern population nests primarily in the estuarine areas of the Atlantic and Gulf coasts from New Jersey to Texas and the lower Mississippi Valley, northern California to Baja California (both coasts), Arizona and New Mexico (Snow, 1981). Wintering ranges of the two populations overlap. Many of the northern bald eagles migrate south for the winter and can occur as far south as Texas. The southern eagles tend to be more sedentary although there is some northward movement during the summer (Snow, 1981). The largest wintering group is in Alaska, where over 3,000 have congregated in the Chilkat Valley during the fall and winter months (Steenhof, 1978).

The southern subspecies nests in Texas along the Gulf Coast and on major inland lakes during the winter months, and migrates to more-northern latitudes during the summer. The northern bald eagle nests in the northern U.S. and Canada during spring and summer, and migrates to the southern U.S., including Texas, during the fall and winter. Concentrations of wintering northern eagles are often present around the shores of reservoirs in Texas, with most wintering concentrations occurring in the eastern part of the state. In Texas, wintering bald eagles have occurred as far south as Cameron County (Oberholser, 1974). In Louisiana, bald eagle nest primarily along the Gulf Coast (Buehler, 2000); in winter, occasionally observed on large lakes in northern and central parishes (Buehler, 2000).

Ortego (2002) identified 155 nesting territories statewide, of which at least four currently exist in Brazoria County. Ortego (2002) does not disclose the locations of bald eagle nests; therefore, the exact locations of the nests are unknown.

2.8.4 Presence in the Project Area

NDD (2006) indicates an active bald eagle territory north of Freeport, between Clute and Oyster Creek (TPWD nest #020-8A), approximately 6 miles north of the project area. The species is likely present in the general area at some time during the year; however, no suitable nesting habitat is present in the study area.

2.9 PIPING PLOVER

2.9.1 Reasons for Status

FWS listed the piping plover (*Charadrius melodus*) as threatened and endangered on 11 December 1985 (50 FR 50726 50734). The piping plover is a Federally listed endangered species in the Great Lakes watershed, while the birds breeding on the Atlantic Coast and northern Great Plains are Federally listed as threatened. Piping plovers wintering in Texas and Louisiana are part of the northern Great Plains and Great Lakes populations.

Shorebird hunting during the early 1900s caused the first known major decline of piping plovers (Bent, 1929). Since then, loss or modification of habitat resulting from commercial, residential, and recreational developments, dune stabilization, damming and channelization of rivers (eliminating sandbars, encroachment of vegetation, and altering water flows), and wetland drainage have further contributed to the decline of the species (FWS, 1995a). Additional threats include human disturbances through recreational use of habitat, and predation of eggs by feral pets (FWS, 1995a).

2.9.2 Habitat

Piping plovers typically inhabit shorelines of oceans, rivers and inland lakes. Nest sites include sandy beaches, especially where scattered tufts of grass are present; sandbars; causeways; bare areas on dredge-created and natural alluvial islands in rivers; gravel pits along rivers; silty flats; and salt-encrusted bare areas of sand, gravel, or pebbly mud on interior alkali lakes and ponds (Haig and Elliott-Smith, 2004). On the wintering grounds, these birds use beaches, mudflats, sandflats, dunes, and offshore spoil islands (FWS, 1995a; AOU, 1998).

2.9.3 Range

The piping plover breeds on the northern Great Plains (Iowa, northwestern Minnesota, Montana, Nebraska, North and South Dakota, Alberta, Manitoba, and Saskatchewan), in the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario), and along the Atlantic Coast from Newfoundland to Virginia and (formerly) North Carolina. It winters on the Atlantic

and Gulf coasts from North Carolina to Mexico, including coastal Texas, and less commonly, in the Bahamas and West Indies (AOU, 1998; 50 FR 50726, 11 December 1985). Migration occurs both through the interior of North America east of the Rocky Mountains (especially in the Mississippi Valley) and along the Atlantic Coast (AOU, 1998). Few data exist on the migration routes of this species.

Approximately 35% of the known global population of piping plovers winters along the Texas Gulf Coast, where they spend 60 to 70% of the year (Campbell, 1995; Haig and Elliott-Smith, 2004). The species is a common migrant and rare to uncommon winter resident on the upper Texas coast (Richardson et al., 1998; Lockwood and Freeman, 2004). Piping plover concentrations in Texas occur in the following counties: Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kleberg, Matagorda, Nueces, San Patricio, and Willacy (FWS, 1988). In Louisiana, the piping plover is a rare migrant statewide and uncommon winter resident along the Gulf Coast in Cameron and Jefferson parishes (FWS, 1994). Piping plovers may occur in the study area, but suitable habitat is of limited extent.

2.9.4 Presence in the Project Area

Because of a lawsuit, FWS has designated critical habitat for the species in its nesting and wintering range (65 FR 41781–41812, 6 July 2000). Designation of critical habitat became final on 10 July 2001 (66 FR 17; 36038–36143). Critical habitat includes the land from the seaward boundary of mean low low water (MLLW) to where densely vegetated habitat, not used by the species, begins and where the constituent elements no longer occur.

Critical Habitat Unit TX-36 encompasses approximately 388 acres between the mouth of the Brazos River and Farm-to-Market Road (FM) 1495 and includes Bryan Beach and adjacent beach habitat (66 FR 17; 36142, 10 July 2001), just southwest of the project area. NDD (2004) maps show no documented records within the project area. However, wintering piping plovers are of potential occurrence on beaches and sand and mudflats along the bay margins within the study area.

2.10 LOUISIANA BLACK BEAR/Black bear

2.10.1 Reason for Status

FWS listed the Louisiana black bear (*Ursus americanus luteolus*) as threatened on 7 January 1992 (57 FR 588–595). The Service also designates other free-living bears of the species *U. americanus*, within the Louisiana black bear's historic range, as threatened because of similarity in appearance. The primary threats to the Louisiana black bear are habitat destruction and modification. Human activities have reduced or fragmented much of the species' habitat throughout its historic range. Additional threats include human related mortality (i.e., hunting and trapping, automobile-related mortality) (FWS, 1995b).

2.10.2 Habitat

Black bear habitat must have a combination of adequate food, water, cover, and denning sites within sufficiently large and remote blocks of land. The Louisiana black bear requires large, relatively remote blocks of bottomland hardwood forest (FWS, 1995b). Forest types within the range of the species include bald cypress (*Taxodium distichum*), bald cypress-water tupelo (*T. distichum-Nyssa aquatica*), river birch-American sycamore (*Betula nigra-Platanus occidentalis*), cottonwood (*Populus deltoides*), sugarberry-American elm-green ash (*Celtis laevigata-Ulmus americana-Fraxinus pennsylvanica*), Nuttall oak-American elm-green ash (*Quercus nuttallii-Ulmus americana-F. pennsylvanica*), overcup oak-water hickory (*Q. lyrata-Carya aquatica*), sweetgum-water oak (*Liquidambar styraciflua-Q. nigra*), and swamp chestnut oak-cherrybark oak (*Q. michauxii-Q. falcata*) (FWS, 1995b). Other habitat types include freshwater and brackish marshes, agricultural fields, wooded levees along canals and bayous, and salt domes (FWS, 1995b).

A key component of Louisiana black bear habitat is remoteness, which is relative to forest tract size and the presence of roads (FWS, 1995b). Optimal habitat generally consists of tracts larger than 2,500 acres that are at least 0.5 mile from well maintained roads and development, or tracts with 0.3 mile or less of road per square kilometer (km^2) (0.3861 mi^2) of forest (FWS, 1995b). Larger, undisturbed tracts of forest decrease the likelihood of human disturbance.

2.10.3 Range

While *U. americanus* is a widely distributed species, its range has declined since European colonization of North America. The species formerly ranged from northern Alaska, and northern Canada, south to central northern Mexico (FWS, 1995b). The Louisiana subspecies once occurred in southern Mississippi, all of Louisiana, and eastern Texas (FWS, 1995b). In Texas, Louisiana black bears occurred in all counties east of and including Cass, Marion, Harrison, Upshur, Rusk, Cherokee, Anderson, Leon, Robertson, Burleson, Washington, Lavaca, Victoria, Refugio, and Aransas (FWS, 1995b). Today, the only remaining Louisiana black bear populations occur in the Tensas and Atchafalaya river basins in Louisiana (FWS, 1995b).

2.10.4 Presence in the Project Area

According to Garner (1995), Louisiana black bears historically ranged as far east as Aransas and Refugio counties, which suggests they may have occurred in Brazoria County; however, no recent documented sightings of black bears exist from the Texas Gulf Coast. It is unlikely that either subspecies of black bear would occur in the study area.

2.11 WHALES

NMFS identifies five whale species of potential occurrence in the Gulf. These are the sei whale (*Balaenoptera borealis*), blue whale (*Balaenoptera musculus*), fin (or finback) whale (*Balaenoptera*

physalus), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*). These species are generally restricted to offshore waters; therefore, it is unlikely that any of these five species would regularly occur in the study area.

2.12 SMALLTOOTH SAWFISH

2.12.1 Reason for Status

Declines in smalltooth sawfish as been caused primarily by various fishing activities in the form of bycatch, especially in gill nets. Because adults can grow very large and can damage fishing gear, many incidentally captured sawfish are killed wantonly. Additionally habitat loss has been named a factor in directly affecting juveniles, which use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Much of these habitats have been converted or lost due development in Florida and other southeastern states (National Oceanic and Atmospheric Administration [NOAA], 2006c).

2.12.2 Habitat

Sawfish inhabit shallow coastal waters of tropical and temperate seas and estuaries along the Atlantic coast (i.e., New York to Central Brazil) including the Gulf, primarily from Louisiana to southern Florida. Specific habitat types include shallow waters very close to shore over muddy and sandy bottoms, sheltered bays, shallow banks, and in estuaries or river mouths (NOAA, 2006c).

2.12.3 Range

The sawfish is found in the Atlantic Ocean and Gulf. Historically, the U.S. population was common from Texas to Florida coasts, and along the east coast from Florida to Cape Hatteras. The current range of this species has been reduced to the Florida Peninsula, where smalltooth sawfish are relatively common only in the Everglades region in south Florida (NOAA, 2006c).

2.12.4 Presence in Project Area

Although the project area is in the historic range of sawfish, current data suggests that Florida is the only stronghold for the declining population. This species is more commonly found in the northern Gulf and is somewhat more common in tropical areas. Therefore, it is unlikely to occur within the study area.

2.13 GULF STURGEON

2.13.1 Reason for Status

FWS and NMFS listed the Gulf sturgeon (*Acipenser oxyrhinchus desotoi*), a subspecies of the Atlantic sturgeon (*A. oxyrhinchus*), as endangered on 30 September 1991 (56 FR 49653 49658). As with other sturgeon species, the damming of rivers has been the most significant threat to the Gulf sturgeon (NMFS,

2006b). Dams are now present on all of the major rivers within the gulf sturgeon's range (Pearl, Mississippi, and Alabama rivers), which prevents upstream migration for spawning. Other threats to the species include over-exploitation, incidental catch, dredging activities, the removal of snags, and dredged material placement associated with channel improvements and maintenance (FWS and Gulf States Marine Fisheries Commission [GSMFC], 1995; NMFS, 2006b).

2.13.2 Habitat

The Gulf sturgeon is anadromous, which means the species breeds in freshwater environments (i.e., river systems), but spends the remainder of the year in marine and estuarine environments. Spawning occurs in the deeper portions of rivers on clean rock or rubble bottoms. Mud and sand bottoms and seagrass communities are likely important marine habitats (FWS and GSMFC, 1995).

2.13.3 Range

The Gulf sturgeon historically ranged along the northeastern Gulf, in major rivers from the Mississippi delta in Louisiana, east to Charlotte Harbor, Florida, and in marine waters of the central and eastern Gulf (FWS and GSMFC, 1995; NMFS, 2006b). Its current range extends from Lake Pontchartrain and the Pearl River in Louisiana and Mississippi east to the Suwannee River in Florida. Sporadic records exist from as far west as the Rio Grande River between Texas and Mexico, and as far east and south as Florida Bay. Viable populations exist in the Mississippi, Pearl, Escambia, Yellow, Choctawhatchee, Appachicola, and Suwannee rivers (NMFS, 2006b).

2.13.4 Presence in Project Area

The NMFS has designated critical habitat for the Gulf sturgeon in Gulf rivers and tributaries (68 FR 13370, 19 March 2003). Although 14 critical habitat units have been identified in Florida, Alabama, Mississippi, and Louisiana, no critical habitat has been designated in Texas, and in fact, none is farther west than Lake Pontchartrain near New Orleans. The study area is not within the known historic range of the Gulf sturgeon. Fish are mobile species and frequently occur outside of their normal ranges, but it is unlikely that the species is present in the study area.

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3.0 ANALYSIS OF EFFECTS

3.1 Project-related Effects

The following species are unlikely to occur in the project area and, therefore, no impacts are expected: bald eagle, Louisiana black bear/black bear, whooping crane, gulf sturgeon, smalltooth sawfish, and listed whale species.

3.1.1 Sea Turtles

While rare in Texas waters, sea turtles may be present in the project area during certain times of the year. Thus, construction and post-construction maintenance activities could result in impacts to the sea turtle, should they be present in the project area. These impacts, however, would be temporary and local in nature. Feeding opportunities within the proposed channel could attract sea turtles, where they might be exposed to additional risks from boat traffic, contaminants, fishing activities, tangled fishing lines, and accumulated plastic detritus.

A pipeline dredge will be used in the bay and a hopper dredge will be used in the entrance channel. Sea turtles easily avoid pipeline dredges because of the slow movement of the dredge. The potential for the incidental take of sea turtles by hopper dredges would be minimized by the use of draghead deflectors and scheduling offshore dredging during the winter months when sea turtles are most likely to be elsewhere in warmer waters. A MOU agreement between NMFS and USACE is in place and implemented regarding the take of sea turtles with hopper dredges and measures are employed to ensure that significant impacts do not occur. Between 1980 and March 2006, maintenance dredging in the Freeport Harbor Channel by hopper dredges resulted in the lethal take of 10 sea turtles. Five loggerhead sea turtles were taken in 1996, one in 1999, and two in 2000. Two green sea turtles were taken in January and February 2006. Details of the sea turtle avoidance plan are included in Section 4.1.

The effects of placing dredged material on sea turtles at the proposed ODMDSs include: (1) a collision potential from vessel traffic; (2) the deposition of dredged material on turtles and forage areas, and (3) the possibility of trash and debris from the dredge operation.

Regarding the deposition of dredged material, modeling indicates that most of the dredged material is confined to a relatively small area. Because this is a short-term effect, and considering the mobility of the turtle species and the lack of limestone ledges in the proposed ODMDSs, the turtles should easily be able to avoid a descending plume and available food sources should not be seriously reduced (FWS, 2003). Regarding the vessel and debris possibility, it is the combined effect of many marine activities (e.g., oil spills, oil and gas operations, commercial fishing, marine transportation, etc.) that constitute the hazard and not a single activity such as a dredge operation. These activities, combined with natural predation and development on land, result in a cumulative adverse effect on sea turtles (DOI/MMS, 1987). As noted in Section 4.15.2.1 of the Port Freeport Channel Widening EIS to which this document is appended, it has

been determined that the proposed ODMDS designation does not constitute an adverse impact on listed sea turtles. The proposed Project may have minor adverse impacts to sea turtles from potential mortality associated with dredging activities.

3.1.2 Brown Pelican

This species likely forages in portions of the project area; however, no active nesting colonies occur in the project area and therefore, the proposed Project is unlikely to adversely affect the brown pelican.

3.1.3 Piping Plover

Dredging activities, which would occur in open water, would not directly affect the piping plover. The greatest potential for impacts to the piping plover would be associated with the placement of dredged materials or beach nourishment activities in areas of suitable habitat.. Wintering piping plovers are of potential occurrence on beaches and sand and mudflats along the bay margins within the study area. FWS-designated critical habitat for the piping plover (Critical Habitat Unit TX-36) encompasses approximately 388 acres between the mouth of the Brazos River and FM 1495 and includes portions of Bryan Beach and other adjacent beach habitat (66 FR 17; 36142, 10 July 2001). No beach nourishment operations will be conducted within Critical Habitat. The project site is not likely to be an important feeding and resting area for piping plover due to year round human recreational use. Construction activities during the placement of material on the beach may temporarily preclude its use by piping plover for feeding and resting. The duration of the activity will be short and the size of the construction area would not be large enough to cause any significant loss of habitat for the piping plover. The resultant additional beach will provide additional habitat for piping plovers that might use the area. Therefore, the proposed activity may affect, but is not likely to adversely affect piping plovers; no impacts to piping plover critical habitat will occur.

4.0 VOLUNTARY AVOIDANCE, MINIMIZATION, AND CONSERVATION MEASURES

4.1 Sea Turtle Avoidance Plan

Avoidance measures would include implementation of an avoidance plan for hopper dredge impacts to sea turtles. This avoidance plan includes reasonable and prudent measures that have largely been incorporated in USACE regulatory and civil works projects throughout the Gulf for more than a decade. These measures include use of temporal dredging windows, intake and overflow screening, use of sea turtle deflector dragheads, observer reporting requirements, and sea turtle relocation/abundance trawling:

- Hopper Dredging: hopper dredging activities in Gulf waters from the Mexico-Texas border to Key West, Florida, up to 1 mile into rivers shall be completed, whenever possible, between 1 December and 31 March, when sea turtle abundance is lowest throughout Gulf coastal waters. USACE should coordinate with NOAA should dredging need to occur outside of this window.

- Nonhopper-type dredging: pipeline or hydraulic dredges, which are not known to take turtles, must be used whenever possible between 1 April and 30 November in Gulf waters up to 1 mile into rivers.

- Observers: The USACE shall arrange for NOAA Fisheries-approved observers to be aboard the hopper dredges to monitor the hopper soil, screening, and dragheads for sea turtles and their remains. Observer coverage sufficient for 100% monitoring (i.e., two observers) of hopper dredging operations is required aboard the hopper dredges year-round in Texas waters between 1 April and 30 November, and whenever surface water temperatures are 11 degrees Celsius (°C) or greater.

- Screening: 100% inflow screening of dredged material is required and 100% overflow screening is recommended. If conditions prevent 100% inflow screening, screening may be reduced gradually, but 100% overflow screening is then required.

- Sea Turtle Deflecting Draghead: A state-of-the-art rigid deflector draghead must be used on all hopper dredges in all Gulf channels and sand mining sites at all times of the year.

- Dredge Take Reporting: observer reports of incidental take by hopper dredges must be reported to NOAA Fisheries by onboard endangered species observers within 24 hours of any observed sea turtle take. A preliminary report summarizing the results of the hopper dredging and any documented sea turtle takes must be submitted to NOAA Fisheries within 30 working days of completion of any dredging project. In addition, an annual report (based on fiscal year) must be submitted to NOAA Fisheries summarizing hopper dredging projects and documented incidental takes.

- Relocation Trawling: Relocation trawling shall be undertaken by the USACE where any of the following conditions are met: (a) two or more turtles are taken in a 24-hour period in the project; (b) four or more turtles are taken in the project; or, (c) when 75% of a District's sea turtle species

quota for a particular species has previously been met. Handling of sea turtles captured during relocation trawling in association with hopper dredging project in Gulf navigation channels and sand mining areas shall be conducted by NOAA Fisheries-approved endangered species observers.

Other conditions may also apply. A detailed outline of the conditions of the USACE's sea turtle avoidance is included in FWS's Biological Opinion for dredging of Gulf navigation channels and sand mining areas using hopper dredges (Consultation Number F/SER/2000/01287, November 19, 2003).

4.2 Shoreline Nourishment

Minimization measures would include gulf shoreline nourishment at Quintana or Surfside Beach. The 300,000 cy of silty/sand material dredged during construction of the proposed widening project would be used beneficially and placed on Quintana Beach in front of the Seaway Upland Confined Placement Area (UCPA). The beach on either side of this location has been enhanced through GLO or other programs, leaving a "gap" in front of the Seaway UCPA. Placement of the material in this location would fill in the gap, providing a continuous beach and some protection from erosion for the Seaway UCPA. The new beach would also provide potential foraging habitat for shorebirds.

5.0 SUMMARY

Because proper sea turtle avoidance measures will be implemented, the proposed Project is unlikely to adversely affect any Federally listed endangered or threatened species. The following species are unlikely to occur in the project area and, therefore, no impacts are expected: bald eagle, whooping crane, Louisiana black bear/black bear, gulf sturgeon, smalltooth sawfish, and listed whale species. The Project is unlikely to result in significant adverse effects on the following species: loggerhead sea turtle, Kemp's Ridley sea turtle, hawksbill sea turtle, leatherback sea turtle, green sea turtle, brown pelican, and piping plover. Proper turtle avoidance measures will be implemented according to the NMFS/USACE MOU. The piping plover will experience a beneficial effect from the proposed Project resulting from habitat enhancement (i.e., beach nourishment) through beneficial use of dredged material. No active brown pelican nesting colonies occur in the project area, and thus the project is unlikely to adversely affect the species.

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Appendix H

Texas Coastal Zone Management Consistency Determination

APPENDIX H

COMPLIANCE WITH GOALS AND POLICIES – SECTION 501.25 (a)–(f) DREDGING AND DREDGED MATERIAL DISPOSAL AND PLACEMENT PORT OF FREEPORT CHANNEL WIDENING ENVIRONMENTAL IMPACT STATEMENT

All new work material will be placed in an ODMDS and beach nourishment areas described in Section 2.4.2 of the DEIS. Maintenance material will be placed in an ODMDS. Therefore, this appendix refers only to the dredging and placement of new work material.

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 section are supplemental to any further restrictions or requirements relating to the beach access and use rights of the public. In implementing this section, 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.

<u>Compliance:</u> Dredged material will be placed on coastal shore areas as beach nourishment and in an ODMDS and may have some effects on coastal waters such as temporarily burying benthic organisms and increasing turbidity in area. However, these sites will be created only with new work material that has been tested and found not to contain harmful pollutants.

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

<u>Compliance:</u> For all sites, adequate dilution and dispersion occurs so as not to violate applicable surface water quality standards (EIS Section 3.9.2).

(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.

<u>Compliance:</u> No critical areas are affected by the location of the placement areas.

(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;

<u>Compliance:</u> Placement of new work material in existing placement areas was not an available option for this project. However, the ODMDS proposed for use has been used and was designated by the EPA for placement of construction material from the 45-Foot Project. Beach nourishment placement is a practicable alternative that would have beneficial effects for the coastal shore area. See the Dredged Material Management Plan (DMMP, Appendix B) for a discussion of all placement alternatives (e.g. marsh restoration) that were evaluated.

(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

<u>Compliance:</u> All practicable steps have been taken to minimize adverse affects on these resources.

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

<u>Compliance:</u> No critical areas are affected by the use of the placement areas; therefore, no significant degradation would result.

(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.

<u>Compliance:</u> For all sites, application of subparagraph (3) does not prohibit the use of the sites. Dredging is necessary to prevent economic impacts on navigation by improving the commercially navigable Freeport Harbor Jetty Channel system. Widening the channel is necessary to increase navigational safety.

(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 subsection where appropriate and practicable.

<u>Compliance:</u> Adverse effects of dredging and disposal as described in this EIS have been minimized as described under "Compliance" for paragraph (1) of this subsection.

(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;*

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

(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;

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

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

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

<u>Compliance:</u> Changes in water circulation and salinity should have minimal positive or negative impacts to fisheries. Most discharged material will be placed in an ODMDS and used for beach nourishment. No impoundment of draining or critical areas will occur.

(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 physiochemical 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

(D) adding chemical flocculants to enhance the deposition of suspended particulates in confined disposal areas.

<u>Compliance:</u> Sediments to be dredged from the Freeport Harbor Jetty Channel have been tested for a variety of chemical parameters of concern. There appear to be no significant cause for concern relative to placing these sediments in the Gulf of Mexico or using them beneficially. A summary of these results are included in the EIS.

(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.

<u>Compliance:</u> Dredged material will be used beneficially to nourish Quintana or Surfside Beach. Material placed in an ODMDS may have some temporary impacts by increasing turbidity in area. However, only new work material will be generated from construction activities that has been tested and found not to contain harmful pollutants. Future maintenance is anticipated to equal to existing conditions.

(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.

<u>Compliance:</u> All of the sites minimize or avoid adverse effects to the greatest extent practicable. Material to be used as beach nourishment will be discharged directly onto the beach. Sequenced discharge points will be used to disperse the material across the ODMDS.

(5) Adverse effects from dredging and dredged material disposal or placement operations can be minimized by adapting 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.

<u>Compliance:</u> All sites in this project meet this requirement. Contracts will be written to ensure compliance with all standards.

(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;

(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;

(C) avoiding sites having unique habitat or other value, including habitat of endangered 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;

(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;

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

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

<u>Compliance:</u> The beach nourishment site and ODMDS meet these requirements. Hopper dredging is also limited to the cooler months, where possible, when sea turtle activity and abundance is lowest. These dredges employ trawls in front of the dredge to remove sea turtles before the dredge gets to them and employs turtle observers to document any turtles that become entrained by the dragheads.

(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;

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

(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

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

<u>Compliance:</u> Placement of dredged material on the beach nourishment site may temporarily restrict use of the area by the public for recreational use. Temporary and minor adverse effects to fisheries may result from altering or removing productive fishing grounds and interfering with fishing activity in the ODMDS.

(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 paragraph if such data and information is produced and evaluated in compliance with §501.15(b)(1) of this title.

<u>Compliance:</u> The Freeport Harbor Channel widening constitutes new work dredging adjacent to the existing ship channel.

(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 subsection (a) of this section unless modified in design, size, use, or function.

<u>Compliance:</u> No existing upland, confined placement areas are being modified with new work material.

(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.

<u>Compliance:</u> All new work material from this project, which has the proper characteristics, is being used for beach nourishment/shoreline protection.

(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.

(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.

(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 subsection (a) of this section, 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.*

<u>Compliance:</u> All new work material from this which has the proper characteristics, is being used for beach nourishment/shoreline protection. Material not capable of being used beneficially will be placed in an ODMDS.

(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.*

<u>Compliance:</u> The new beach nourishment/shoreline protection placement area will affect submerged lands but will be of overall net environmental benefit.