US Army Corps of Engineers
Galveston District

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VOLUME II
FINAL
ENVIRONMENTAL IMPACT STATEMENT

FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT BRAZORIA COUNTY, TEXAS

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

September 2012

Volume I Contents for Final Environmental Impact Statement

<u>Volume II Contents for Final Environmental Impact Statement Appendices:</u>

Appendices:

Appendix D-1

Hazardous, Toxic, and Radioactive Waste Report

Appendix D-1

Hazardous, Toxic, and Radioactive Waste

1.0 INTRODUCTION

The Freeport Harbor Channel is a deep-draft navigation channel that connects the harbor facilities located in Freeport, Brazoria County, Texas, with the Gulf of Mexico. The U.S. Army Corps of Engineers (USACE) has proposed channel improvements to the existing project that include deepening and widening the existing channel and turning basins and reauthorizing the Stauffer Channel. This proposed project is referred to as the Freeport Harbor Channel Improvement Project (FHCIP). The project area includes a 1-mile buffer around the Freeport Harbor Channel System from the Stauffer Channel Turning Basin through the jettied Freeport Harbor entrance extending approximately 3 miles offshore to the 60-foot depth contour of the Gulf of Mexico. The project area also encompasses upland and offshore placement areas for disposal of dredged material from proposed improvements with a 1-mile buffer (Figure 1).

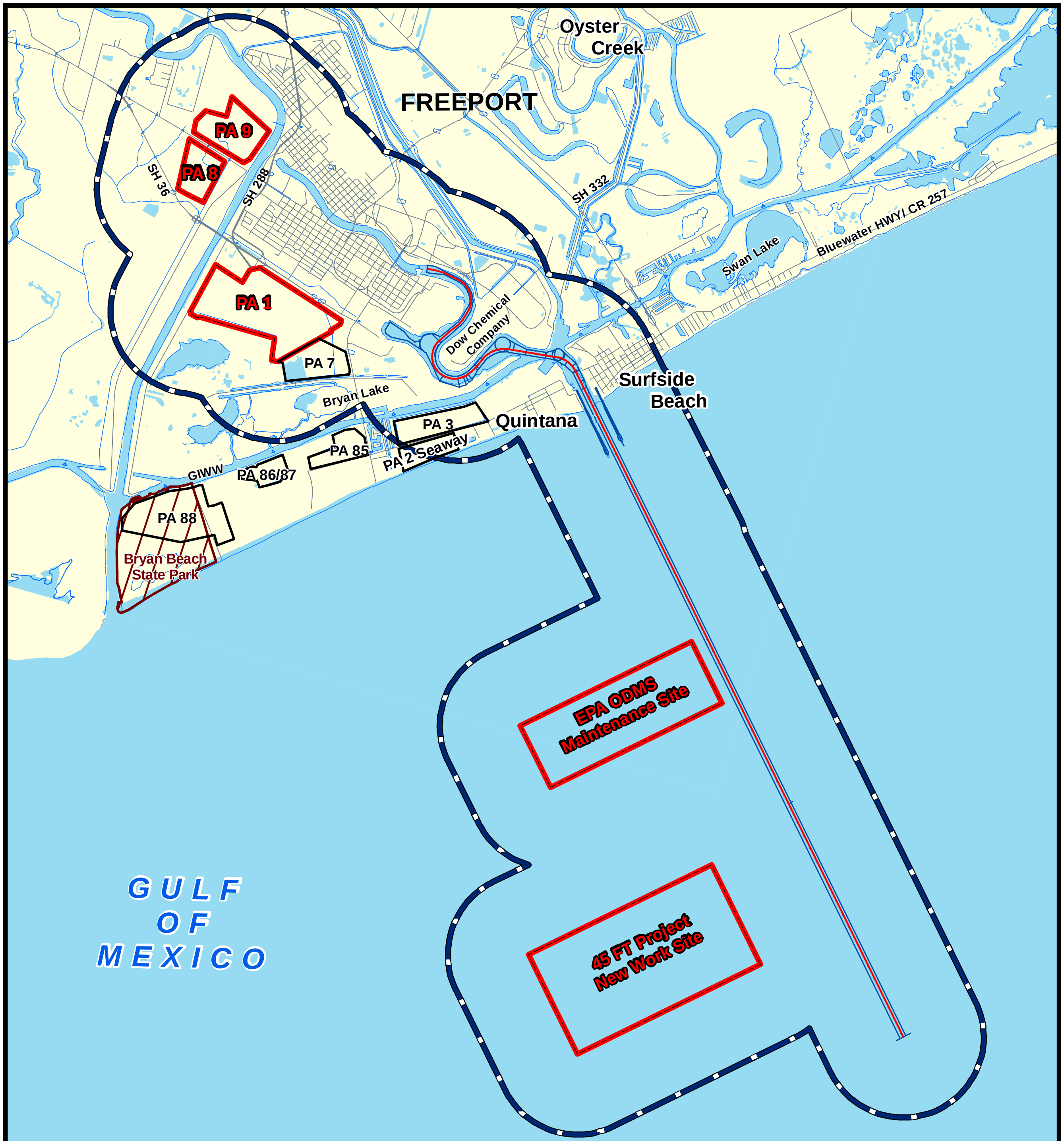
PBS&J was contracted by the USACE, Galveston District to compile and summarize Hazardous, Toxic, and Radioactive Waste (HTRW) data for the FHCIP project area. This HTRW assessment was conducted in general accordance with procedures described in the Department of the Army, USACE document ER 1165-2-132, Water Resource Policies and Authorities–Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Works Projects. The objective of this preliminary assessment is to identify the existence of, and potential for, HTRW contamination on lands in the project area, or external contamination that could impact, or be impacted by, the FHCIP.

The findings and recommendations presented in this HTRW assessment are based on the following scope of work:

A. Site History – An assessment of the history of the project area was performed by examination of available historic aerial photographs taken in 1944, 1965, 1975, 1987, 1995, and 2004.

B. Site Visit – PBS&J conducted visual inspections of the project area in March 2008 to determine the land use and existing condition of the project area and to identify the existence of conditions of environmental concern indicating the possible presence of hazardous materials or petroleum products.

C. Setting – PBS&J reviewed existing, available information to characterize the physical setting and geology of the project area, including a description of surface elevation, surface drainage, surface run-off and run-on, and other identifying physical features.



Legend

Channel Centerline

Dredged Material Placement Areas

Bryan Beach State Park

Project Area

Placement Areas

0 0.45 0.9 1.8

Miles

Figure 1

Freeport Harbor
Channel Improvement Project Area

Prepared for: USACE Galveston

Job No.: 044190100

Prepared by: A.Christiansen | Date: 03/24/2008

File: N:/Clients/U_Z/USACE/Projects/Freeport/044190100/projects/Figures/fig_1_appD.mxd

Additionally, PBS&J conducted interviews with Texas Commission on Environmental Quality (TCEQ) and local officials regarding potential sources of contamination to the project area.

D. Regulatory Agency Review – Available public information relating to the project area and surrounding properties was reviewed to identify regulated facilities, spill/release sites, and corrective or remedial actions. This information was obtained from a review of Federal, State, and local regulatory agency databases.

2.0 SITE HISTORY

Aerial photographs of the project area were obtained to examine the historic usage of the current Brazos River Channel, Brazos Harbor, and Port Freeport, and the former Brazos River Channel. The photographs depict the project area as it appeared in 1944, 1965, 1975, 1987, 1995, and 2004. The aerial photographs were obtained from the U.S. Geological Survey (USGS), the Agricultural Stabilization Conservation Service (ASCS), and the Texas Department of Transportation (TxDOT).

The earliest aerial photography available of the area was taken in 1944. These aerial photographs depict the project area from the western end of the former Brazos River Channel gulfward to include the Freeport Jetty Channel. The Brazos River had already been rerouted to the Brazos River Diversion Channel, which empties into the Gulf about 6 miles west of the Freeport Harbor Channel. The aerial photographs (ASCS, 1944) indicate that development in the project area is limited to the first process areas of the Dow Chemical facility and the construction of the workers housing in the Freeport area. The residential development appears to occur on both the north and south sides of the former Brazos River, but the development on the southern side is more extensive. The Dow plant, which occupied less than half of its current area, has constructed tank farms and process areas on the narrow bend of the waterway. Several impoundments are visible north of a railroad track. A small area containing several large, open-top, aboveground storage tanks is visible on the west bank of the waterway. The surrounding areas are mostly undeveloped, with some unimproved roads providing limited access. One bridge is noted in the town of Freeport (Farm to Market Road [FM] 1495), another crosses a canal northeast of Dow, and a third crosses the Gulf Intracoastal Waterway (GIWW) near Quintana. The barrier islands appear broader and more expansive than today and are predominantly undeveloped. Several small structures are also present at the U.S. Coast Guard Station. Large tracts of land adjacent to the GIWW appear to be used as dredge placement areas (PAs). The tracts of land proposed for the upland PAs 8 and 9 are undeveloped land used possibly for agriculture.

The 1965 photograph (ASCS, 1965) depicts the continued growth of the Dow facility with the construction of an additional process and storage area on the north side of the facility that is bound by a canal. Other industrial development includes the dredging of the Brazos Harbor and the installation of additional storage tanks at the Phillips tank farm along the west shore of the waterway. The town of Freeport has undergone continued growth with the addition of new homes on the north and south side of the Old Brazos River segment. The town of Surfside is visible with the presence of streets and structures. A new bridge is visible crossing the GIWW east of Surfside.

The 1975 photograph (ASCS, 1975) indicates continued growth; however, new development is not as readily apparent as in previous photographs. However, new warehouse structures are visible at the Brazos Harbor, and a new bridge crossing the Old Brazos River at FM 1495 is noted. Additional residential development appears to have occurred in Surfside. Several new roads are visible on the barrier island to the west of the Entrance Channel. Land use in this area remains mostly undeveloped, but two parcels are now used as surface impoundments.

The 1987 photograph (ASCS, 1987) indicates the addition of facilities and land-use changes in the project area. The most notable changes occur along the shoreline of the waterway, including the construction of a facility at Quintana consisting of a small tank farm and a berthing dock, the construction of a barge berthing facility on the peninsula between the GIWW and the Old Brazos River, the construction of additional process and storage facilities adjacent to Dow along the northern bank of the canal, additional storage capacity at the Phillips tank farm, and new docking facilities along the west bank of the Old Brazos River west of Dow.

The 1995 photograph (ASCS, 1995) indicates that the project area, adjacent properties, and surrounding properties remain basically unchanged from the 1987 photograph. The most notable changes seen in this infra-red image is the use of large parcels of land adjacent to the town of Freeport and the various industrial complexes for surface storage impoundments. These large tracts apparently contain water and sediment. Additional development is noted in the Quintana area. The process and storage facility located north of Dow beyond the canal appears to have been decommissioned and dismantled. What remains appears to be one structure and several small ponds. The drilling platform known as Zeus is visible at its mooring in the Entrance Channel. The tract of land identified as PA 1 appears to have been converted to an upland PA.

The most recent aerial photograph (ASCS, 2004) was taken in 2004, and the project area and surrounding properties are basically unchanged from the previous photograph. Portions of the original Dow facility appear to have been dismantled and are vacant. A canal is visible across the length of PA 1, while the tracts of proposed PAs 8 and 9 remain undeveloped agricultural land. No other visible changes are detectable in the photograph.

3.0 SITE RECONNAISSANCE

A visual inspection of the project area was conducted by PBS&J personnel on March 18–19, 2008, by boat and automobile. Port Freeport provided an escorted tour of the project area using Port Security personnel and a Port Security boat. The remaining component of the site reconnaissance was conducted by accessing the project area by public roadways. The site inspection was intended to identify indicators of areas of potential hazardous waste and confirm mapped locations of sites identified through the various regulatory agency reviews. Photography of the project area was restricted; however, photographs allowed taken during the site reconnaissance have been included in Appendix D-5.

The project area is characterized by a commercialized riverfront developed with industrial and maritime businesses. The former Brazos River (Old Brazos River) channel follows a sinuous path forming a long, narrow bend and intersecting the GIWW before flowing into the Gulf of Mexico. The site reconnaissance conducted by boat began at the Stauffer Turning Basin, which defines the northern extent of the project area (Site Photograph No. 1, Appendix D-5). A sign indicating the presence of underground gas or petroleum pipelines was observed within the turning basin (Site Photograph No. 2, Appendix D-5). The properties along the western shore of this northern segment of the Old Brazos River include small, private businesses that provide boat maintenance including wet and dry docks and refueling. One of these businesses operates several registered aboveground storage tanks used apparently for retail fuel sales. These tanks were reported in the regulatory agency database report. The tanks appeared to be located within secondary containment. The property along the entire eastern shore from the water lock to the GIWW is owned and operated by Dow. This facility has the greatest number of records reported in the regulatory agency database report for releases of regulated substances. Land use adjacent to the shore includes a railroad spur, a surface impoundment, a freshwater canal, and existing and former process areas. An earthen levee constructed along the shore separates the waterway from the adjacent railroad spur and process areas at the Dow facility.

The properties along the western shore of the central segment of the Old Brazos River include American Rice, Inc. and Port Freeport. These facilities, which occupy an area known as the Brazos Harbor, operate a shipping dock, warehouses, and grain silos. A ship was in the process of off-loading at Port Freeport docks during the site reconnaissance. The goods off-loaded from this ship were fruit including bananas and pineapples. Other items observed in and adjacent to the warehouse included numerous freight boxes, refrigerated cargo boxes, and components of wind turbines (i.e., tower sections and blades). Large spools of cable were observed adjacent to a warehouse at the Port facility. The space is reportedly leased by Port Freeport to a company that installs offshore marine cable for utility or communication.

Adjacent to Port Freeport, along the western shore, is a facility that stores anhydrous ammonia. The facility has a ship dock and a large pressurized storage vessel. ConocoPhillips operates the adjacent facility, which is a tank farm containing over 19 registered aboveground storage tanks. The tanks appear to be within secondary containment. The nearest facility occupies a narrow strip of land bound by the Old Brazos River to the north and the GIWW to the south. This small facility serves to off-load tankers of crude oil and transfer the unrefined product to either the Bryan Mound storage facility or to a processing facility or refinery (Site Photograph No. 3, Appendix D-5). The Freeport LNG (liquid natural gas) facility occupies a large tract of land along the southern bank of the GIWW. The facility was under construction at the time of the site reconnaissance. The remaining industrial facility. Another feature encountered during the site reconnaissance that is a potential source of contaminants to the project area is the abandoned drilling platform known as Zeus. This relict is docked along the western shore of the Freeport Channel almost midway between the GIWW and the jetties (Site Photograph No. 4, Appendix D-5). The properties that occupy the east and west shores of the Freeport channel between the GIWW and the jetties are characterized as residential and recreational. This segment is located adjacent to open waters of the Gulf of Mexico, but is protected by a 4,000-foot-long jetty (Site Photograph No. 5, Appendix D-5). A pipeline marker was observed near the U.S. Coast Guard Station indicating one or more underground pipelines crossing the Freeport ship channel (Site Photograph No. 6, Appendix D-5). Another pipeline marker was observed near the mouth of the entrance channel. The site reconnaissance conducted by boat concluded at the mouth of the jetty.

The areas designated as placement areas are characterized as undeveloped land. PA 1 has been used as a placement area and as a result remains undeveloped with several large unvegetated areas containing dredged material. Proposed PAs 8 and 9 are accessible by county roadway and appear to be grazed; they remain essentially undisturbed coastal prairie with some wooded areas.

The results of the site reconnaissance confirmed the mapped locations of sites identified through the various regulatory agency reviews. No new sites were identified. The site reconnaissance did, however, confirm numerous sources of hazardous material and hazardous waste immediately adjacent to the project footprint that have the potential to impact the project.

4.0 SETTING

4.1 DESCRIPTION OF PROJECT AREA

The project area for the FHCIP is located along the mid to upper Texas coast within Brazoria County. In general, the landward portion of the project area encompasses areas dominated by industrial, commercial, and residential development with some recreational, agricultural, and marsh areas. Prior to the diversion of the Brazos River, the Freeport Harbor Channel was the mouth of the Brazos River. Currently, the channel extends into the Gulf, with no associated bay, and terminates immediately southeast of State Highway (SH) 288, after passing through the City of Freeport. Inland from the channel, areas that are not developed are typically converted into upland dredged material PAs, marshes, lakes, or agricultural land used for livestock and/or crop production.

The portion of the Gulf within the project area is confined to the shelf area and is largely devoid of significant physiographic features. 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 project area is characterized as Quaternary (Recent and Holocene) Alluvium containing thick deposits of clay, silt, sand, and gravel (Barnes 1982, 1987), overlying the Pleistocene-aged 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 underlying Beaumont Formation is estimated to be less than 1,000 feet thick and consists mostly of clay, silt, sand, and gravel.

The surface topography of the project area is mainly flat to gently rolling and slopes to the southeast toward the Gulf. Surface elevations within the project area range from a high of approximately 5 feet above mean sea level (msl) at the northern portion (SH 288) to a low of approximately 0 foot msl at the Gulf. The Brazos River drains areas to the west of the project area and discharges into the Gulf, 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.

The bathymetry of the project area has been partially modified by human activity, mainly by channel dredging and subsequent formation of dredged material PAs. Water depths in the Freeport Harbor Entrance and Jetty channels are currently maintained by the USACE to a depth of –47 feet mean low tide (MLT). The existing channel is approximately 5.2 miles in length and is approximately 400 feet in width at the bottom and 1,150 feet wide at the water surface. Area tidal channels, passes, and dredged channels are greater than average depth. Water exchange between Port Freeport and the Gulf 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.

4.2 INTERVIEWS

PBS&J conducted interviews with staff of the TCEQ Region 12 office in May 2006 regarding potential sources of contamination to the project area. PBS&J contacted Aron Athavaley, site investigator, regarding his knowledge of HTRW contamination on lands in the project area, or external contamination that could impact the project. Mr. Athavaley informed PBS&J that, while there are facilities with ongoing corrective action activities adjacent to the waterway, there are no active enforcement actions under way. When PBS&J inquired of any direct sources of contamination to the project, he stated that there are off-site areas of impacted groundwater that could discharge into the waterway. These impacts have been documented by groundwater monitor wells along the Dow facility. Summaries of these interviews are included in Appendix D-3.

5.0 REGULATORY AGENCY DATABASE REVIEW

5.1 METHODOLOGY

PBS&J retained the services of TelAll Corporation (TelAll) of Austin, Texas, to conduct the regulatory agency database information search described in Section 1.0. The scope of the regulatory information search included the following databases: the National Priority List (NPL); the State Superfund List (TXSSF); Comprehensive Environmental Response, Compensation and Liability Information System Database (CERCLIS) including the No Further Remedial Action Planned (NFRAP) database; Resource Conservation and Recovery Act (RCRA) Generators and Violators List (RCRA-G); RCRA Corrective Actions List (CORRACT); RCRA Treatment, Storage, or Disposal List (RCRA TSD); Texas Underground and Aboveground Storage Tank Database (TXUST and TXAST); Leaking Underground Storage Tank Listings (TXLUST); Texas Voluntary Cleanup Program (TXVCP); Innocent Owner/Operator Program (IOP); City/County Solid Waste Landfill listings (TXLF); Unauthorized and Unpermitted Landfill Sites (LFUN); Emergency Response Notification System (ERNS) database; and Texas Spills Incident Information System (TXSPILL) database.

PBS&J performed a review and evaluation of the available public information relating to the site. The review consisted of summarizing the regulatory agency database information acquired by TelAll. A site reconnaissance was conducted in March 2008 to verify the location of sites referenced in the regulatory database search and to locate any additional unreported hazardous materials sites. The site locations were provided by TelAll and are approximate, since they are based on street address information included in the databases. A map illustrating the locations of these registered sites is included as Appendix D-4.

5.2 REGULATORY AGENCY DATABASE RESULTS

A total of 1,066 listings were identified within the study area during the various database searches. Several of these listings were associated with the same facilities or property (e.g., a facility/property that contains multiple petroleum storage tanks and is the site of several reported spills or emergency response actions). The 1,066 database listings were associated with a total of 201 facilities or properties within the study area. On the basis of the results of the regulatory database searches, the following sites are located within the subject area:

- Three CERCLIS sites;
- Six NFRAP sites;
- Five CORRACT sites;
- Nine RCRA generators sites;
- One RCRA treatment, storage, and disposal site;

- One hundred twenty-six petroleum storage tanks at 30 sites;
- Nineteen leaking underground storage tank sites;
- Five hundred forty-five reported emergency response actions; and
- Four hundred five reported spills.

No NPL, State Superfund, Voluntary Cleanup, or City/County solid waste landfill sites were located within the study area. The regulatory agency databases searched included sites that are onshore and are not typically available for the offshore portion of this project. The following provides a summary of the results of the regulatory agency database information search.

CERCLIS Sites: The CERCLIS database is the Environmental Protection Agency's (EPA) official repository for site- and nonsite-specific Superfund data in support of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The database contains information on hazardous waste site assessment and remediation from 1983 to the present and is used by the EPA in evaluating the status and progress of site cleanup actions, and to communicate planned activities and budgets. The NPL is a priority subset of the CERCLIS list and is a list of priority facilities that the EPA has determined to pose a threat to human health and/or the environment and where remedial action is required.

The regulatory database search listed the following three CERCLIS site within the study area.

- Gulfco Marine Maintenance (Site ID No. 3) at Brazoria County Road (CR) 756, Freeport, Texas 77541. The site is currently on the final NPL.
- Freeport Pharmacy (Site ID No. 36) at 200 Block of East 2nd Street, Freeport, Texas 77451. The site is not listed on the NPL.
- Nalco Chemical Company (Site ID No. 285) at CR 229, Freeport, Texas 77541. The site is not listed on the NPL.

NFRAP Sites: NFRAP sites indicate a CERCLIS site that is designated by the EPA as no further remedial action planned. Six NFRAP sites located within the study area were found during the database search. None of these sites are listed on the NPL, and all have undergone preliminary site assessment. The NFRAP sites include the follow facilities.

- Dow Chemical Company (Site ID No. 1) located at Old Brazos River at Dow Canal, Freeport, Texas 77541
- ConocoPhillips Petroleum Company (Site ID No. 2) located at Quintana Road, Freeport, Texas 77541
- Gulf Chemical and Metallurgical (Site ID No. 3) located at 302 Midway Road, Freeport, Texas 77541
- Mineral Research and Development Corporation (Site ID No. 3) located at 302 Midway Road, Freeport, Texas 77541

- Smith Welding (Site ID No. 58) located at 510 South Avenue A, Freeport, Texas 77541
- Stauffer Chemical Company, Phosphorous Product Division (Site ID No. 64), 608 East 2nd Street, Freeport, Texas 77541

CORRACT Sites: The CORRACT list is a subset of RCRIS and includes sites that are currently undergoing, or have undergone, corrective action. According to the database, five CORRACT sites are located within the study area. The following five sites were also listed in the RCRA TSD database:

- Dow Chemical Company (Site ID No. 1) located at Old Brazos River at Dow Canal, Freeport, Texas 77541
- ConocoPhillips Petroleum Company (Site ID No. 2) located at Quintana Road, Freeport, Texas 77541
- Gulf Chemical and Metallurgical (Site ID No. 3) located at 302 Midway Road, Freeport, Texas 77541
- Rhone Poulenc (Site ID No. 67) located at 6213 E. Highway 332, Freeport, Texas 77541
- Schenectady International Inc. (Site ID No. 71) located at 702 FM 523, Freeport, Texas 77541

RCRA Generators Sites: Under the RCRA, generators and transporters of hazardous waste are required to provide information concerning their activities to State agencies and the EPA. The RCRA-G list is also a subset of the Resource Conservation and Recovery Information System (RCRIS) database and tracks facilities that are registered generators or transporters of hazardous waste. According to the regulatory review, a total of nine regulated generator/transporter facilities are located within the study area. One of these facilities is listed as conditionally exempt small quantity generators (CESQG generate less than 100 kilograms [kg]/month of hazardous waste), two are listed as small quantity generators (SQG generate at least 100 kg/month but less than 1,000 kg/month of hazardous waste), and four are listed as large quantity generators (LQG generate at least 1,000 kg/month of hazardous waste). Two of the nine facilities are listed as transporters of hazardous waste. No permit violations were listed for any RCRA-G site.

- ConocoPhillips (Site ID No. 2) located at Highway 36 at Seaway Road, Jones Creek, Texas 77541
- ConocoPhillips (Site ID No. 2) located at CR 271, Freeport, Texas 77541
- Chemical Specialties (Site ID No. 3) located at 302 Midway Road, Freeport, Texas 77541
- Enduro Systems, Inc. (Site ID No. 18) located at 102 South Avenue A, Freeport, Texas 77541
- Texas Crewboats (Site ID No. 41) located at 222 West 2nd Street, Freeport, Texas 77541
- Masco Operators, Inc. (Site ID No. 42) located at 225 East Park Avenue, Freeport, Texas

- Gulf Chemical and Metallurgical (Site ID No. 3) located at 302 Midway Road, Freeport, Texas 77541
- Brazosport Independent School District (ISD) (Site ID No. 33) located at 1800 West 2nd Street, Freeport, Texas 77541
- Seaway Freeport Terminal (Site ID No. NA) located at Quintana Road, Freeport, Texas 77541

RCRA Treatment, Storage, and Disposal Sites: The RCRA treatment, storage, or disposal (TSD) database is also a subset of RCRIS. The database tracks facilities that treat, store, or dispose of hazardous materials and that are required to provide information to State agencies and the EPA. One RCRA-TSD facility was identified within the study area during the database search.

- Gulf Chemical and Metallurgical (Site ID No. 3) located at 302 Midway Road, Freeport, Texas 77541

Registered Storage Tanks Sites: The aboveground storage tank database (TXAST) and underground storage tank database (TXUST) are maintained by TCEQ to track permitted petroleum storage tank sites. According to the database, 20 facilities containing a total of 47 ASTs and 29 facilities containing a total of 79 USTs are located within the study area. Nineteen of the ASTs were listed as active, and the remaining 28 were listed as inactive. Sixteen of the registered USTs were listed as active, 58 were listed as removed from the ground, and 5 were listed as abandoned in-place.

Leaking Underground Storage Tank Sites: The leaking underground storage tank database (TXLUST) is a list maintained by TCEQ of facilities where a known underground storage tank release has occurred. According to the database, a total of 19 sites within the study area are listed as the location of a LUST. Final concurrence has been issued by TCEQ, and the cases have been closed for 16 of the LUST facilities. Two of the three sites pending closure reported impacts to groundwater, while the other reported no impact to soil or groundwater.

ERNS/State Spill Sites: The ERNS supports the release notification requirements of CERCLA and serves as a mechanism to document and verify incident location information as initially reported. More than one emergency response notification may have occurred at the same facility/property. Reported ERNS sites are frequently not identified at a facility address, and as a result, the spill or release locations are usually difficult to precisely locate. The database contained documentation for a total of 545 spill notifications at approximately 118 facilities/properties. The majority of the ERNS spill sites within the study area reportedly occurred at the following two locations.

- Dow Chemical Company (Site ID No. 1) located at the Old Brazos River at Dow Canal, Freeport, Texas 77541

- ConocoPhillips Petroleum Company (Site ID No. 2) located at Quintana Road, Freeport, Texas 77541

The TXSPILL includes cases where emergency response was needed for cleanup of toxic substances. As with the ERNS releases, several of these cases may occur at a single facility/property, and their spill or release locations are usually difficult to precisely locate. According to the database, a total of 405 spill-related cases occurred at 15 sites. Similar to the ERNS releases, the majority of the reported spills occurred at Dow Chemical Company.

6.0 REFERENCES

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———. 1987. Geologic Atlas of Texas, Beeville-Bay City Sheet. (1975; revised 1987) The University of Texas at Austin, Bureau of Economic Geology.

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Appendix D-2

TelALL Historic Aerial Photo Search

Historic Aerial Photo Search

for the site

Freeport EIS, Freeport, TX

performed for

PBS&J

5/18/2006

Photos Found

Date	County	Source	Scale	Researcher Comment
10-31-65	BRAZORIA	**ASCS**	1 inch = 2000 feet	EAST
4-15-44	BRAZORIA	**ASCS**	1 inch = 2000 feet	WEST
4-15-44	BRAZORIA	**ASCS**	1 inch = 2000 feet	CENTER
4-15-44	BRAZORIA	**ASCS**	1 inch = 2000 feet	EAST TOP
4-15-44	BRAZORIA	**ASCS**	1 inch = 2000 feet	EAST BOTTOM

AERIAL PHOTO SOURCE ACRONYMS

ASCS	AGRICULTURAL STABALIZATION .CONSERVATION SERVICE
FAIRCHILD	PRIVATE COMPANY
GLO	GENERAL LAND OFFICE
TOBIN	PRIVATE COMPANY
AMS	ARMY MAPPING SERVICE
COSA	CITY OF SAN ANTONIO
NCTCOG	NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS
CAPCO	CAPITOL AREA PLANNING COUNCIL
TXDOT	TEXAS DEPARTMENT OF TRANSPORTATION
USAF	UNITED STATES AIR FORCE
USDA	UNITED STATES DEPARTMENT OF AGRICULTURE
USGS	UNITED STATES GEOLOGICAL SURVEY
WALLACE	PRIVATE COMPANY
HGACOG	HOUSTON AREA COUNCIL GALVESTON
TELALL	PRIVATE COMPANY

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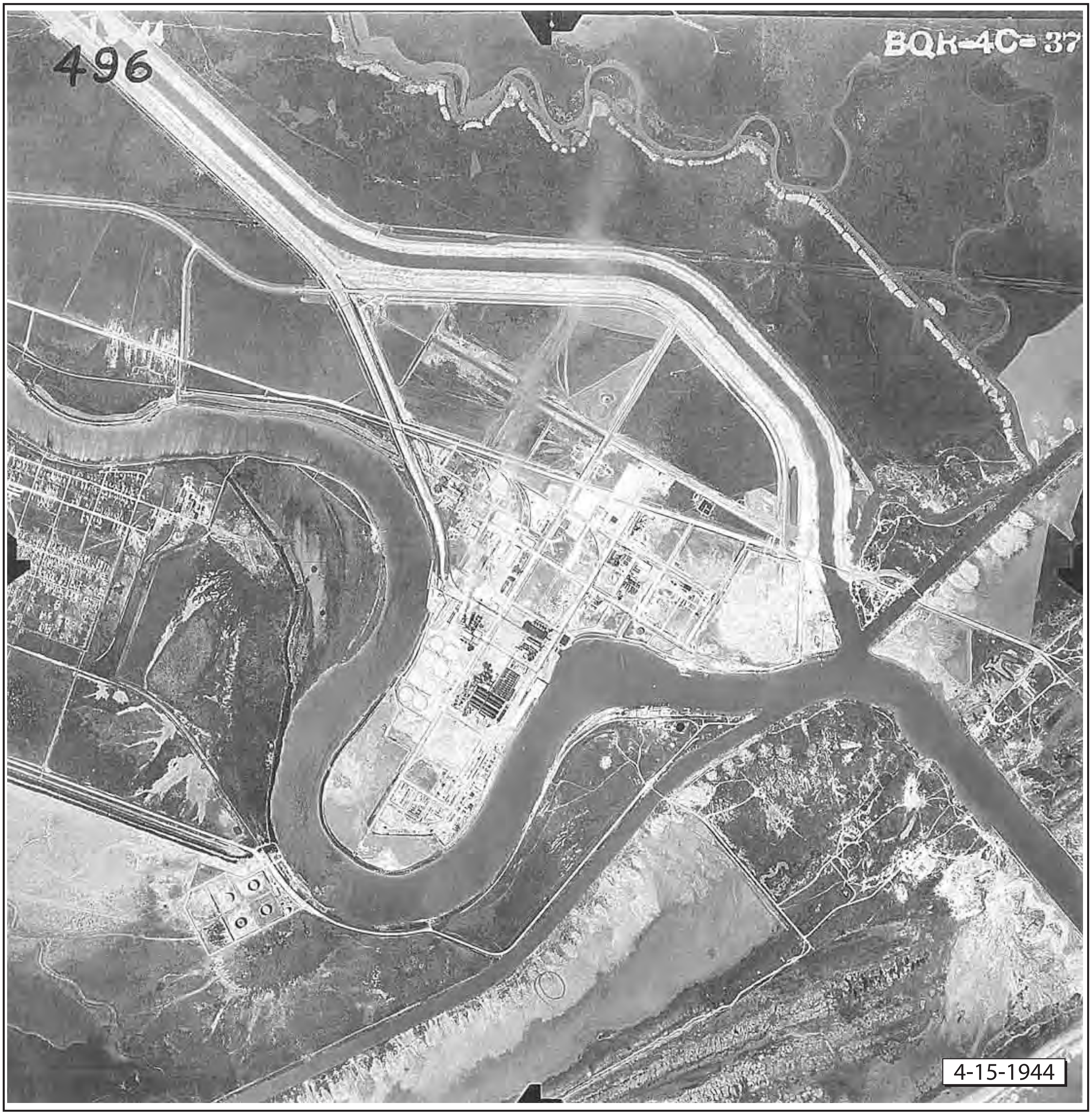

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File: I:\projects\hc1\usace\galv\441910\htrw\cad\aerial_1965a.ai

Historic Aerial Photo Search

for the site

Freeport EIS, Freeport, TX

performed for

PBS&J

5/18/2006

Photos Found

Date	County	Source	Scale	Researcher Comment
2004	BRAZORIA	**USDA**	1 inch = 2000 feet	EAST
2004	BRAZORIA	**USDA**	1 inch = 2000 feet	WEST
2-1995	BRAZORIA	**USGS**	1 inch = 2000 feet	EAST
2-1995	BRAZORIA	**USGS**	1 inch = 2000 feet	WEST
10-28-87	BRAZORIA	**TXDOT**	1 inch = 2000 feet	WEST
10-28-87	BRAZORIA	**TXDOT**	1 inch = 2000 feet	CENTER TOP
10-28-87	BRAZORIA	**TXDOT**	1 inch = 2000 feet	CENTER BOTTOM
10-28-87	BRAZORIA	**TXDOT**	1 inch = 2000 feet	EAST
1-25-75	BRAZORIA	**ASCS**	1 inch = 2000 feet	WEST
1-25-75	BRAZORIA	**ASCS**	1 inch = 2000 feet	EAST
10-31-65	BRAZORIA	**ASCS**	1 inch = 2000 feet	WEST
12-25-65	BRAZORIA	**ASCS**	1 inch = 2000 feet	CENTER

AERIAL PHOTO SOURCE ACRONYMS

ASCS	AGRICULTURAL STABALIZATION CONSERVATION SERVICE	**TXDOT**	TEXAS DEPARTMENT OF TRANSPORTATION
FAIRCHILD	PRIVATE COMPANY	**USAF**	UNITED STATES AIR FORCE
GLO	GENERAL LAND OFFICE	**USDA**	UNITED STATES DEPARTMENT OF AGRICULTURE
TOBIN	PRIVATE COMPANY	**USGS**	UNITED STATES GEOLOGICAL SURVEY
AMS	ARMY MAPPING SERVICE	**WALLACE**	PRIVATE COMPANY
COSA	CITY OF SAN ANTONIO	**HGACOG**	HOUSTON AREA COUNCIL GALVESTON
NCTCOG	NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS	**TELALL**	PRIVATE COMPANY
CAPCO	CAPITOL AREA PLANNING COUNCIL		

PBJA6805

(800) 583-0004 by fax (512) 472-4466

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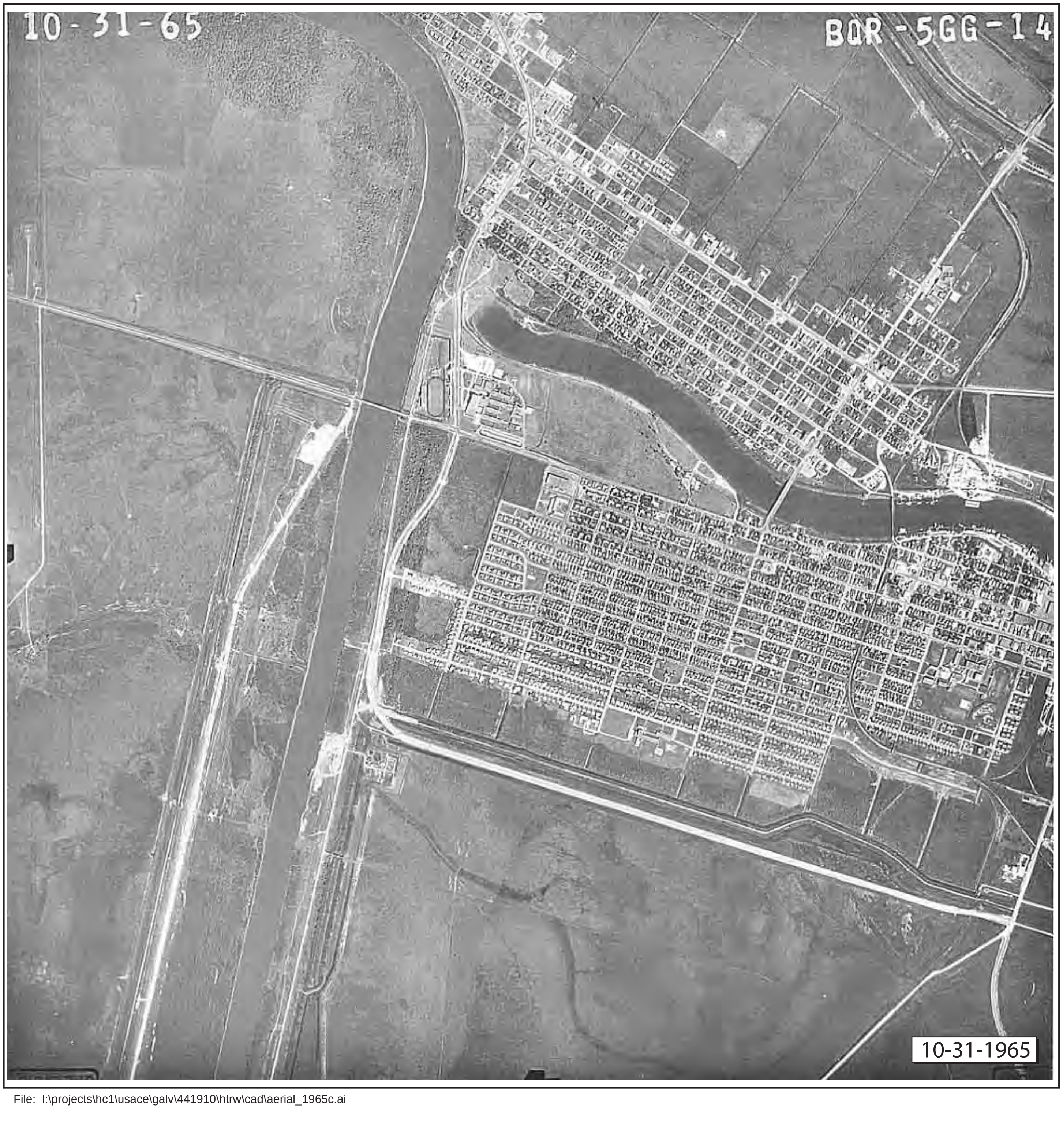

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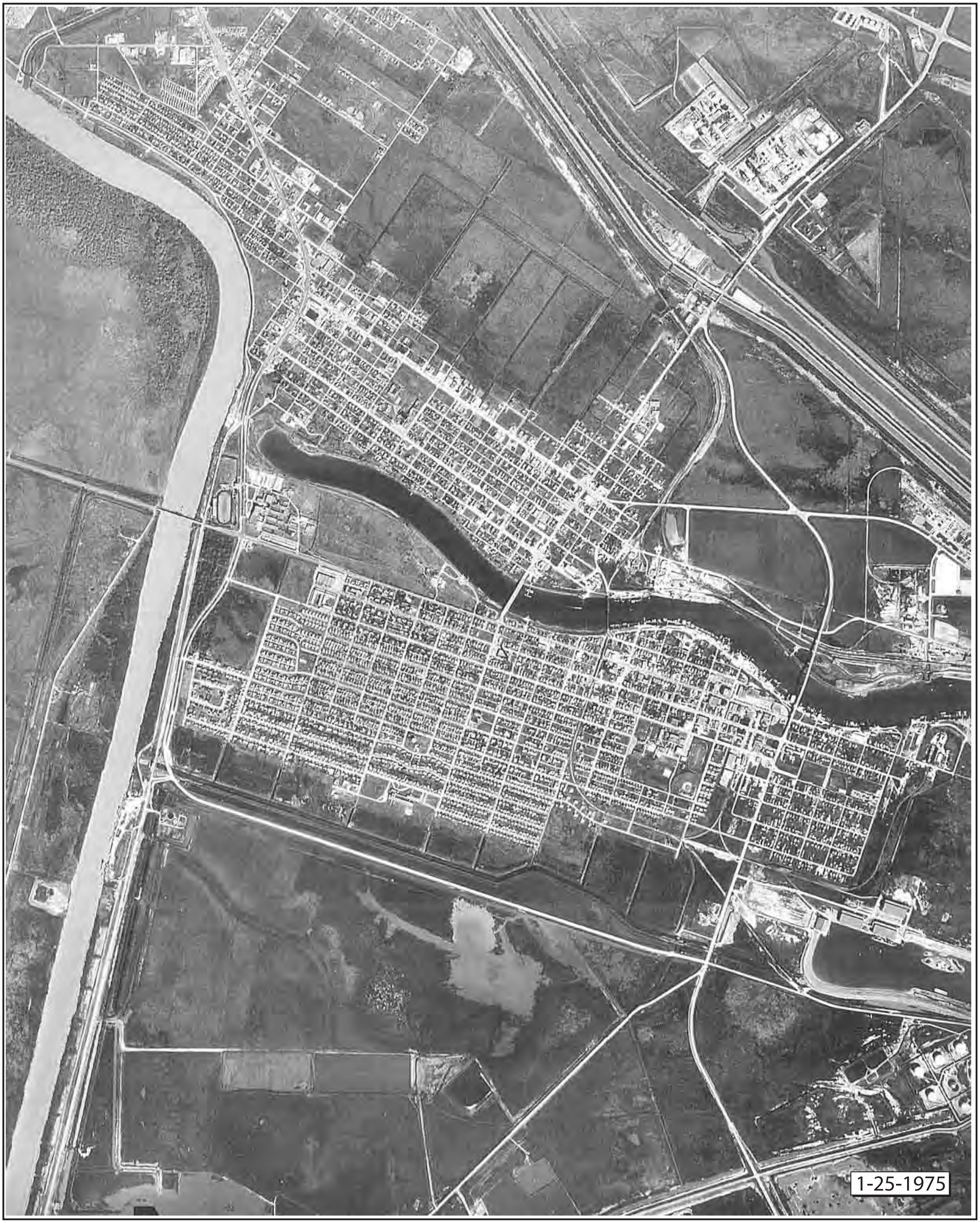

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File: I:\projects\hc1\usace\galv\441910\htrw\cad\aerial_1995b.ai

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File: I:\projects\hc1\usace\galv\441910\htrw\cad\aerial_2004b.ai

Appendix D-3

Hazardous, Toxic, and Radioactive Waste Interviews

PBS&J

Date 5/17/06
Time
Length

TELEPHONE CONVERSATION
SUMMARY

Incoming Call
Returned Call

JOB NO.

COMMUNICANT Linda Broasch POSITION Group LEADER

AFFILIATION TCEQ LOCATION Houston

PHONE NO. 713 767-3579 PBS&J CONTACT STEVE MCVEY

PURPOSE Interview for HTRW issues for Freeport

REMINDERS

COMMUNICATION I informed Ms. Broasch of my affiliation and stated my purpose. I told her that Aron Atharley recommended that I call to inquire of possible impacts to sediment of Freeport Harbor and ship channel.

She stated that there are contaminants in sediment in the river.

Upstream sediments are equally prone to contamination.

There is little flow to Brazos River/Harbor/Port

Water is both fresh and brine.

Then recommended that obtain data from Surface Water Quality Monitoring database. (call IT Staff)

She also stated that boats are sources of contaminants too.

REQUIRED ACTION Call 512 239-DATA

COPIES TO:

Prior Attempts Log

Date	Time	Recall by

PBS&J

Date 5/~~10~~17/06
Time
Length

TELEPHONE CONVERSATION
SUMMARY

Incoming Call
Returned Call

JOB NO.

COMMUNICANT Aron Athavley POSITION Site Investigator
AFFILIATION TCEQ Region 12 LOCATION Houston
PHONE NO. 713 767-3500 PBS&J CONTACT STEVE MCVEY
PURPOSE Interview for HTRW - Freeport, Texas

REMINDERS

COMMUNICATION

I informed Mr. Athavley of my affiliation and stated my purpose. He gave permission to interview and to use his name.

- Current enforcement of industry - none (that he is aware of).
- Violations of business adj to waterway - none
- Recent Inspections? Most recent inspection performed by TCEQ of Dow April ~~2006~~ 2005. Next scheduled inspection for Dow is June 2006.

He is not aware of any reported releases that would be beyond effluent parameters.

He did state that Dow does have some off-site migration of impacted groundwater. Ground water adjacent to waterway has reported to contain detectable levels of certain constituents.

Referred me to Stream Monitoring Program

REQUIRED ACTION Contact Ms. Linda Broasch (TCEQ)

COPIES TO:

Prior Attempts Log

Date	Time	Recall by

Appendix D-4

TelALL Data Summaries

Environmental Data Search

for the site

Freeport Harbor Channel Improvement Project (FHCIP)
Near SH 288 and SH 36, Freeport, TX

441901.00

performed for

PBS&J

11/9/2007

PBJA6864

Preface

TelALL Corporation
PBJA6864

This document of environmental concerns near Near SH 288 and SH 36, Freeport, TX reports findings of the TelALL data search, prepared on the request of PBS&J.

TelALL Corporation (TelALL) has designed this document to comply with the AAI and ASTM standard E 1527 - 05 (Accuracy and Completeness) and has used all available resources, but makes no claim to the entirety or accuracy of the cited government, state, or tribal records. Our databases are updated at least every 90 days or as soon as possible after publication by the referenced agencies. The following fields of governmental, state, and tribal databases may not represent all known, unknown, or potential sources of contamination to the referenced site. Many different variables effect the outcome of the following document. TelALL maintains extremely high standards, and stringent procedures that are used to search the referenced data. However, TelALL reserves the right at any time to amend any information related to this report.

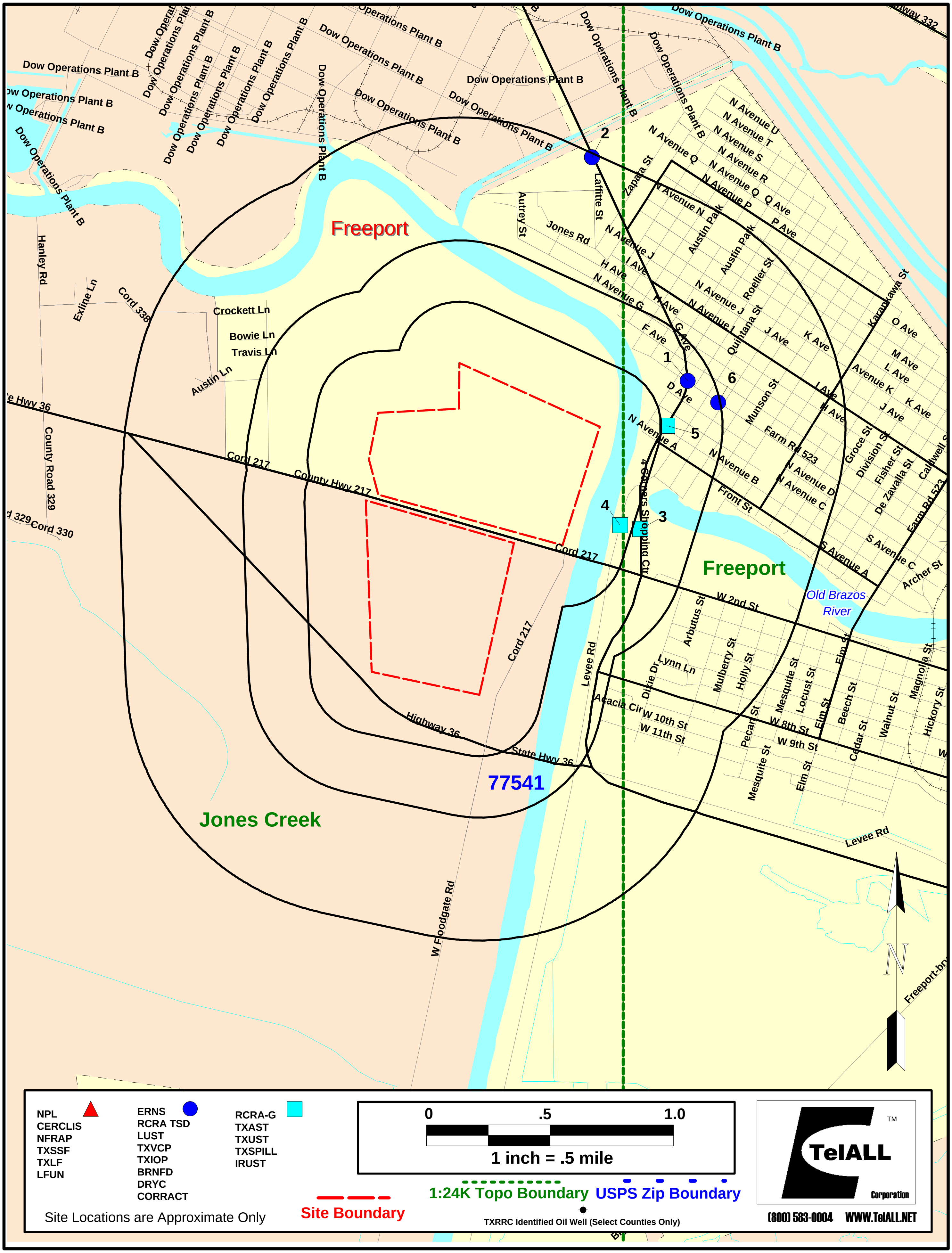
If there is a need for further information regarding this report, or for any customer support please call TelALL at 800 583-0004 for assistance.

This report is divided into the following components:

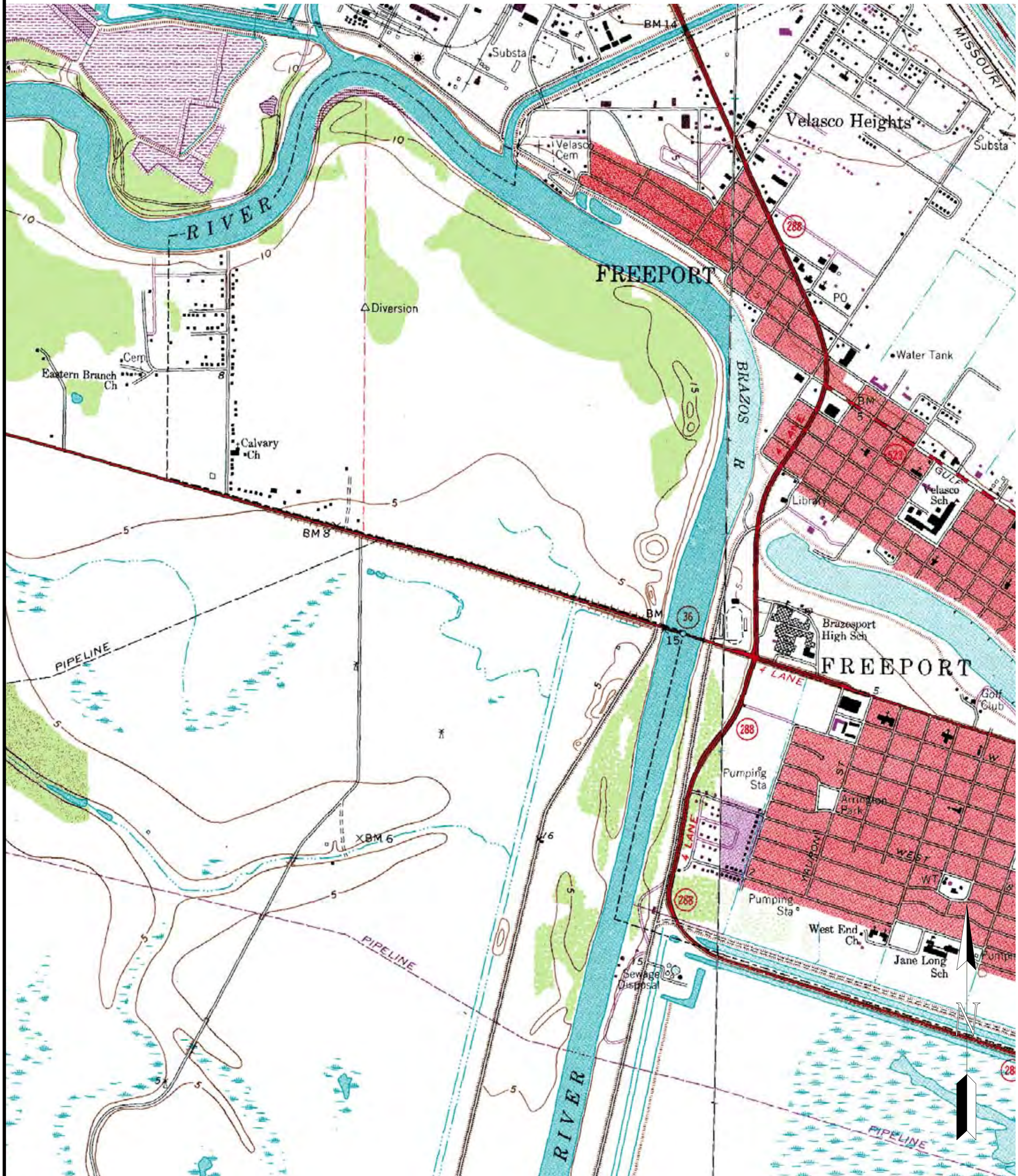
MAP	Identified geocodeable findings relative to this data search.
SUMMARY 1	Sorting of the identified sites by distance from the subject site.
FINAL	A description of each database and a detailed explanation of findings.

Sources

Database	Acronym	Last Updated	Minimum Search Distance	Findings
National Priority List	NPL	03/2008	1	0
Comprehensive Environmental Response, Compensation, and Liability Information System	CERCLIS	03/2008	0.5	0
No Further Remedial Action Planned	NFRAP	03/2008	0.5	1
Resource Conservation and Recovery Information System - Treatment Storage or Disposal	RCRA TSD	03/2008	1	1
Corrective Action	CORRACT	03/2008	1	1
Resource Conservation and Recovery Information System - Generators	RCRA-G	03/2008	0.25	0
Emergency Response Notification System	ERNS	01/2008	0.25	1
Texas Voluntary Cleanup Program	TXVCP	03/2008	0.5	0
Innocent Owner/Operator Program	TXIOP	03/2008	0.5	0
Texas State Superfund	TXSSF	01/2008	1	0
TCEQ Solid Waste Facilities	TXLF	02/2008	1	0
Unauthorized and Unpermitted Landfill Sites	LFUN	02/2008	0.5	0
Leaking Underground Storage Tanks	TXLUST	01/2008	0.5	4
Texas Underground Storage Tanks	TXUST	01/2008	0.25	7
Texas Above Ground Storage Tanks	TXAST	01/2008	0.25	2
Texas Spills List	TXSPILL	02/2008	0.25	0
Brownfield	BRNFD	03/2008	0.5	0
Dry Cleaner	DRYC	02/2008	0.5	0
Indian Reservation Underground Storage Tanks	IRUST	02/2008	0.25	0


Freeport
Freeport
Jones Creek
77541
Old Brazos River
Dow Operations Plant B
Laffite St
Zapata St
Autrey St
Jones Rd
Crockett Ln
Bowie Ln
Travis Ln
Austin Ln
Exline Ln
Cord 338
Hanley Rd
County Road 329
Cord 330
Cord 217
County Hwy 217
Cord 217
Highway 36
State Hwy 36
W Floodgate Rd
Levee Rd
Acacia Cir
W 10th St
W 11th St
Dixie Dr
Lynn Ln
W 2nd St
W 8th St
W 9th St
Arbutus St
Mulberry St
Holly St
Pecan St
Mesquite St
Locust St
Elm St
Beech St
Cedar St
Walnut St
Magnolia St
Hickory St
Front St
Farm Rd 523
N Avenue A
N Avenue B
N Avenue C
N Avenue D
N Avenue G
N Avenue J
N Avenue N
N Avenue P
N Avenue Q
N Avenue R
N Avenue S
N Avenue T
N Avenue U
Austin Park
Roeller St
Quintana St
Munson St
Karankawa St
Groce St
Division St
Fisher St
De Zavala St
Caldwell St
S Avenue A
S Avenue C
Archer St
Q Ave
P Ave
O Ave
M Ave
L Ave
K Ave
J Ave
I Ave
H Ave
G Ave
F Ave
D Ave
Avenue K
4 Corners Shopping Ctr
1
2
3
4
5
6
N
NPL
CERCLIS
NFRAP
TXSSF
TXLF
LFUN
ERNS
RCRA TSD
LUST
TXVCP
TXIOP
BRNFD
DRYC
CORRACT
RCRA-G
TXAST
TXUST
TXSPILL
IRUST
0
.5
1.0
1 inch = .5 mile
Site Locations are Approximate Only
Site Boundary
1:24K Topo Boundary
USPS Zip Boundary
TXRRC Identified Oil Well (Select Counties Only)
TelALL Corporation
(800) 583-0004
WWW.TelALL.NET

1995 NAPP Photograph



To identify the map date and or revision date please call TRNIS at 512-463-8337.

0 .5 1.0

Scale 1:24000

Current USGS 7.5 Minute Topographic Map

TelALL™ Corporation

(800) 583-0004 WWW.TelALL.NET

TelALL Corporation

Sites Sorted By Distance from Center

441901.00
Freeport Harbor Channel Improvement Project (FHCIP)
Near SH 288 and SH 36, Freeport, TX

Job PBJA6864
Date 11/9/2007

Distance/Direction		Database	Site Number	Address	City/State	Site Name
		TXLF				NO FINDINGS WITHIN ONE MILE.
		NPL				NO FINDINGS WITHIN ONE MILE.
		CERCLIS				NO FINDINGS WITHIN 1/2 MILE.
		RCRA-G				NO FINDINGS WITHIN 1/4 MILE.
		IRUST				NO FINDINGS WITHIN 1/4 MILE.
		TXSSF				NO FINDINGS WITHIN ONE MILE.
		TXSPILL				NO FINDINGS WITHIN 1/4 MILE.
		LFUN				NO FINDINGS WITHIN 1/2 MILE.
		TXIOP				NO FINDINGS WITHIN 1/2 MILE.
		BRNFD				NO FINDINGS WITHIN 1/2 MILE.
		DRYC				NO FINDINGS WITHIN 1/2 MILE.
		TXVCP				NO FINDINGS WITHIN 1/2 MILE.
.2						
	E	**TXAST**	4	516 LEVEE RD	FREEPORT	EAST LEVEE PUMP STATION
	E	**TXAST**	4	516 LEVEE RD	FREEPORT	EAST LEVEE PUMP STATION
.25						
	E	**TXUST**	3	500 BRAZOSPORT BLVD	FREEPORT	VISITORS CENTER
	E	**TXUST**	3	500 BRAZOSPORT BLVD	FREEPORT	VISITORS CENTER
	E	**TXUST**	3	500 BRAZOSPORT BLVD	FREEPORT	VISITORS CENTER
	E	**TXUST**	5	606 N BRAZOSPORT BLVD	FREEPORT	EVCO INDUSTRIAL HARDWARE
	E	**TXUST**	5	606 N BRAZOSPORT BLVD	FREEPORT	EVCO INDUSTRIAL HARDWARE
	E	**TXUST**	5	606 N BRAZOSPORT BLVD	FREEPORT	EVCO INDUSTRIAL HARDWARE
.41						
	N E	**TXLUST**	1	1002 BRAZOSPORT BLVD	FREEPORT	BUC EES 8
	N E	**TXLUST**	1	1002 BRAZOSPORT BLVD	FREEPORT	BUCEES 18
.5						
	N E	**TXLUST**	6	923 N GULF BLVD	FREEPORT	WILSON OIL CO SHELL STATION
1.						
	N	**RCRA TSD**	2	2301 N BRAZOSPORT BLVD STE B1226	FREEPORT	THE DOW CHEMICAL COMPANY
	N	**CORRACT**	2	2301 N BRAZOSPORT BLVD STE B1226	FREEPORT	THE DOW CHEMICAL COMPANY
Site Location Unknown						
		TXUST	unknown	BRAZOSPORT BLVD	FREEPORT	BRAZOSPORT J SCHOOL DIST
		TXLUST	unknown	823 BRAZOSPORT BLVD	FREEPORT	DIRTYS TATTOOS & SIGNS
		ERNS	unknown	COUNTY ROAD 217	FREEPORT	SPACE INC
		NFRAP	unknown	HWY.288	FREEPORT	DOW CHEMICAL CO.-PLANT B

Distances given are tenths of a statute mile.

TelALL™
Corporation

Environmental Data Search

for the site

Freeport EIS, Freeport, TX

441591.00

performed for

PBS&J

3/1/2006

PBJA6794

www.TelALL.net

(800) 583-0004   by fax (512) 472-4466

Preface

TelALL Corporation
PBJA6794

This document of environmental concerns near Freeport EIS, Freeport, TX
reports findings of the TelALL data search, prepared on the request of PBS&J.

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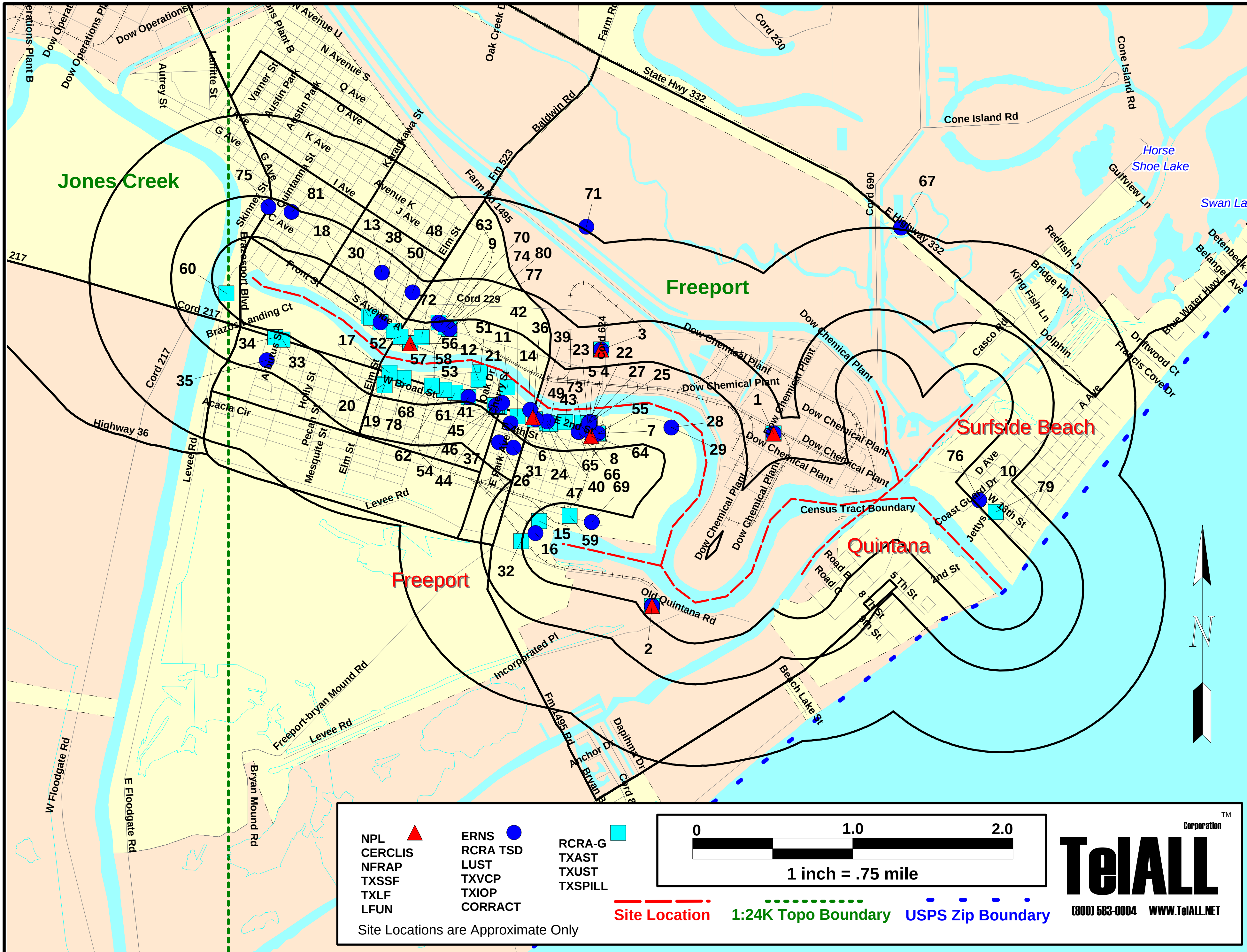
Sources

Database	Acronym	Last Updated	Minimum Search Distance	Findings
National Priority List	NPL	10/2005	1	0
Comprehensive Environmental Response, Compensation, and Liability Information System	CERCLIS	11/2005	0.5	3
No Further Remedial Action Planned	NFRAP	11/2005	0.5	6
Resource Conservation and Recovery Information System - Treatment Storage or Disposal	RCRA TSD	10/2005	1	1
Corrective Action	CORRACT	10/2005	1	5
Resource Conservation and Recovery Information System - Generators	RCRA-G	10/2005	0.25	9
Emergency Response Notification System	ERNS	10/2005	0.25	545
Texas Voluntary Cleanup Program	TXVCP	12/2005	0.5	0
Innocent Owner/Operator Program	TXIOP	12/2005	0.5	0
Texas State Superfund	TXSSF	10/2005	1	0
TCEQ Solid Waste Facilities	TXLF	01/2005	1	0
Unauthorized and Unpermitted Landfill Sites	LFUN	04/2002	0.5	1
Leaking Underground Storage Tanks	TXLUST	02/2006	0.5	18
Texas Underground Storage Tanks	TXUST	02/2006	0.25	73
Texas Above Ground Storage Tanks	TXAST	02/2006	0.25	45
Texas Spills List	TXSPILL	09/2003	0.25	403


Jones Creek
Freeport
Freeport
Surfside Beach
Quintana
Horse Shoe Lake
Swan Lake
Census Tract Boundary
Highway 36
State Hwy 332
E Highway 332
Dow Chemical Plant
Old Quintana Rd
Freeport-bryan Mound Rd
Levee Rd
Cone Island Rd
Brazosport Blvd
W Broad St
E 2nd St
Fm 1495 Rd
NPL
CERCLIS
NFRAP
TXSSF
TXLF
LFUN
ERNS
RCRA TSD
LUST
TXVCP
TXIOP
CORRACT
RCRA-G
TXAST
TXUST
TXSPILL
Site Locations are Approximate Only
0
1.0
2.0
1 inch = .75 mile
Site Location
1:24K Topo Boundary
USPS Zip Boundary
TelALL
Corporation
(800) 583-0004
WWW.TelALL.NET
N

0
1.0
2.0
1 inch = 4000 feet

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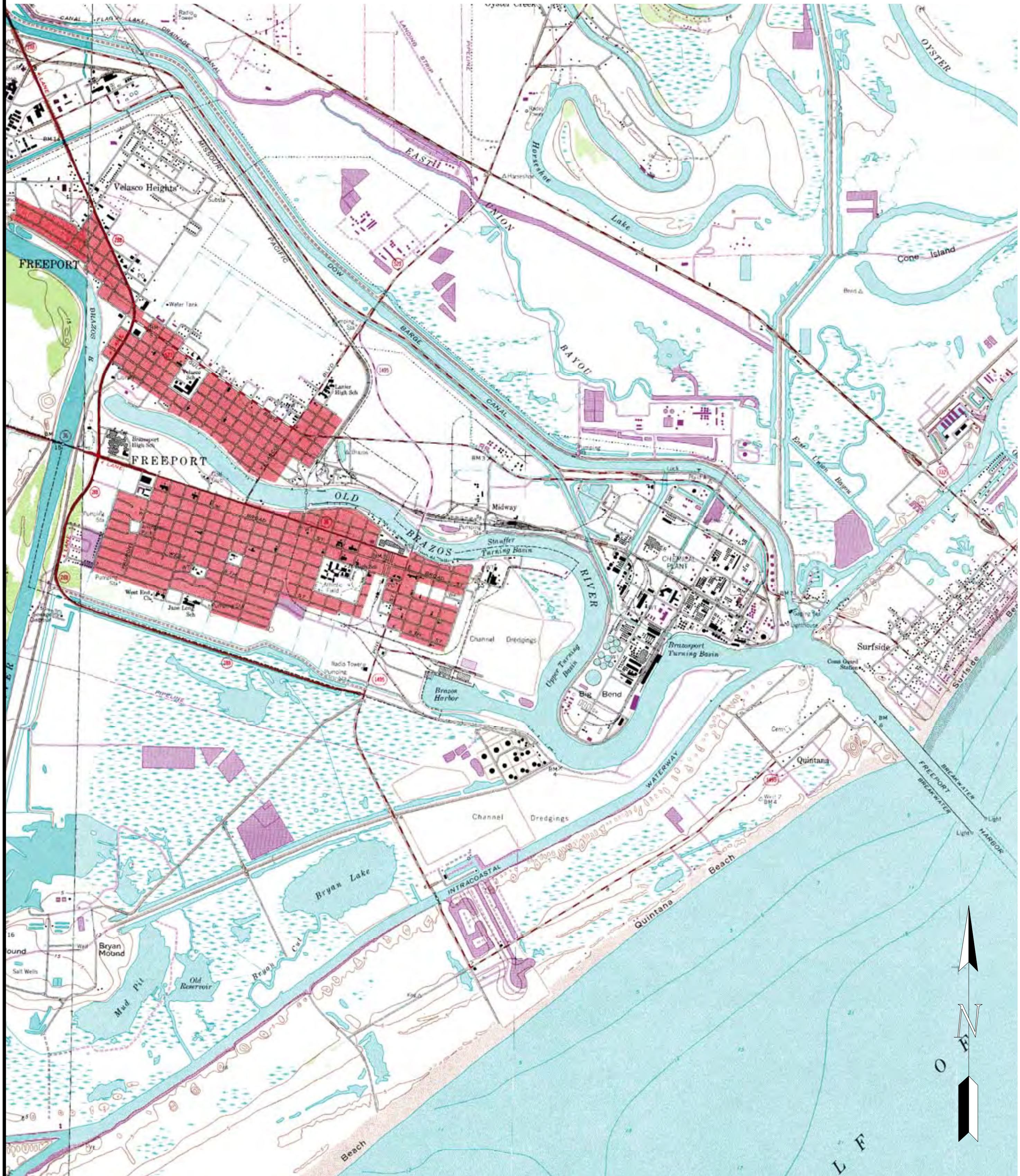

To identify the map date and or revision date
go to http://mac.usgs.gov/mac/maplists/selectstatelist.html
the quad name(s) are on the first map in this report.

0 1.0 2.0

1 inch = 4000 feet

Current USGS 7.5 Minute Topographic Map

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSSF				NO FINDINGS WITHIN ONE MILE.
	TXLF				NO FINDINGS WITHIN ONE MILE.
	TXVCP				NO FINDINGS WITHIN 1/2 MILE.
	NPL				NO FINDINGS WITHIN ONE MILE.
	TXIOP				NO FINDINGS WITHIN 1/2 MILE.
.05					
	TXAST	11	1 CHERRY ST	FREEPORT	SINGLETON SHRIMP
	TXAST	11	1 CHERRY ST	FREEPORT	SINGLETON SHRIMP
	TXAST	11	1 CHERRY ST	FREEPORT	SINGLETON SHRIMP
	TXAST	51	400 W BRAZOS	FREEPORT	WESTERN SEAFOOD
	TXAST	53	404 W BRAZOS	FREEPORT	WESTERN
.07					
	ERNS	14	100 WEST BRAZOS OLD BRAZOS RIVER	FREEPORT	
	ERNS	14	100 WEST BRAZOS OLD BRAZOS RIVER	FREEPORT	
	TXAST	43	227 BRAZOS ST	FREEPORT	BARONS MARINE WAYS INC
	TXAST	43	227 BRAZOS ST	FREEPORT	BARONS MARINE WAYS INC

Distance/Direction	Database	Site Number	Address	City/State	Site Name
.09					
	erns	4	1200 E. BRAZOS	FREEPORT	MI DRILLING FLUIDS
	erns	4	1200 E. BRAZOS	FREEPORT	MI DRILLING FLUIDS
	erns	4	1200 E. BRAZOS	FREEPORT	MI DRILLING FLUIDS
	erns	5	1201 EAST BRAZOS	FREEPORT	TDI BROOKS INC.
	erns	5	1201 EAST BRAZOS	FREEPORT	TDI BROOKS INC.
	erns	5	1201 EAST BRAZOS	FREEPORT	TDI BROOKS INC.
	TXAST	22	1100 E BRAZOS	FREEPORT	FREEPORT ICE & FUEL
	TXAST	22	1100 E BRAZOS	FREEPORT	FREEPORT ICE & FUEL
	TXAST	22	1100 E BRAZOS	FREEPORT	FREEPORT ICE & FUEL
	TXAST	22	1100 E BRAZOS	FREEPORT	FREEPORT ICE & FUEL
	TXAST	22	1100 E BRAZOS	FREEPORT	FREEPORT ICE & FUEL
	TXAST	22	1100 E BRAZOS	FREEPORT	FREEPORT ICE & FUEL
	TXAST	22	1100 E BRAZOS	FREEPORT	FREEPORT ICE & FUEL
	TXSPILL	23	1100 E BRAZOS ST	FREEPORT	G & G ENTERPRISES
	ERNS	24	115 EAST 2ND STREET	FREEPORT	E T CORP
	TXSPILL	25	1160 E BRAZOS ST	FREEPORT	BARON SEAFOOD
	ERNS	25	1160 EAST BRAZOS OLD BRAZOS	FREEPORT	BARON SEAFOOD
	ERNS	25	1160 EAST BRAZOS OLD BRAZOS	FREEPORT	BARON SEAFOOD
	TXAST	27	1200 E BRAZOS	FREEPORT	FREEPORT TERMINAL
	TXAST	27	1200 E BRAZOS	FREEPORT	FREEPORT TERMINAL
	TXAST	27	1200 E BRAZOS	FREEPORT	FREEPORT TERMINAL
	TXAST	27	1200 E BRAZOS	FREEPORT	FREEPORT TERMINAL
	ERNS	28	1200 E BRAZOS WWT DOCK	FREEPORT	TUG BOAT ARIES
	ERNS	29	1200 EAST BRAZOS	FREEPORT	M I DRILLING FLUIDS LLC
	CERCLIS	36	200 BLOCK EAST 2ND	FREEPORT	FREEPORT PHARMACY
	TXAST	39	220 E 2ND	FREEPORT	HARBOR ICE & FUEL
	TXAST	39	220 E 2ND	FREEPORT	HARBOR ICE & FUEL
	TXAST	39	220 E 2ND	FREEPORT	HARBOR ICE & FUEL
	TXAST	39	220 E 2ND	FREEPORT	HARBOR ICE & FUEL
	ERNS	40	222 EAST 2ND ST	FREEPORT	STANCO MARINE INC.
	TXUST	47	300 E 2ND ST	FREEPORT	W H PIERCE JR
	TXUST	47	300 E 2ND ST	FREEPORT	W H PIERCE JR
	TXUST	47	300 E 2ND ST	FREEPORT	W H PIERCE JR
	TXAST	49	326 E 2ND	FREEPORT	FREEPORT ICE COMPANY
	TXAST	49	326 E 2ND	FREEPORT	FREEPORT ICE COMPANY
	TXAST	49	326 E 2ND	FREEPORT	FREEPORT ICE COMPANY
	TXAST	49	326 E 2ND	FREEPORT	FREEPORT ICE COMPANY
	TXAST	73	803 E BRAZOS	FREEPORT	EAST FREEPORT PUMP STATION
	TXAST	73	803 E BRAZOS	FREEPORT	EAST FREEPORT PUMP STATION

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
.1					
S	**ERNS**	2	ST RD 731 AND FM 1495 2.1 MI NORTH F	FREEPORT	PHILLIPS 66
S	**TXSPILL**	2	#3 DOCK AT PHILLIPS, FREEPORT TERM	FREEPORT	PHILLIPS PETROLEUM
S	**TXSPILL**	2	PHILLIPS FREEPORT ON OLD RIVER RO	FREEPORT	PHILLIPS FREEPORT
S	**ERNS**	2	BRAZOS HARBOR ICW 395 PHILLIPS DO	FREEPORT	
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66 CO
S	**ERNS**	2	PHILLIPS TERMINAL #1 CTY RD 731 FRE	FREEPORT	PHILLIPS 66
S	**ERNS**	2	PHILLIPS FREEPORT TERM. OLD BRAZO	FREEPORT	PHILLIPS 66
S	**ERNS**	2	POB 896 QUINTANA RD.	FREEPORT	PHILLIPS 66 CO
S	**ERNS**	2	PHILLIPS FREEPORT TWO DOCK 3	FREEPORT	
S	**erns**	2	PHILLIPS TERMINAL DOCK 3 1000 COUN	FREEPORT	PHILLIPS OIL COMPANY
S	**erns**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	PHILLIP'S DOCK TERMINAL 1, DOCK 2	FREEPORT	JAHRE SHIPPING
S	**erns**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66 CO
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	PHILLIPS PETROLEUM DOCK FREEPORT	FREEPORT	SABINE TRANSPORTATION
S	**ERNS**	2	HWY 35 AND FM 524 PHILLIPS PETROLE	FREEPORT	
S	**ERNS**	2	PHILLIPS PETROLEUM TERM	FREEPORT	CONOCO
S	**erns**	2	FREEPORT TERMINAL	FREEPORT	PHILLIPS PETROLEUM
S	**erns**	2	1000 COUNTY ROAD 731/ COUNTY ROA	FREEPORT	PHILLIPS OIL COMPANY
S	**erns**	2	FREEPORT TERMINAL	FREEPORT	PHILLIPS PETROLEUM
S	**ERNS**	2	DOCK NO.1 TERMINAL NO.2	FREEPORT	PHILLIPS 66
S	**ERNS**	2	1 MI NE OF INTERSECTION OF FM 1495	FREEPORT	PHILLIPS 66
S	**ERNS**	2	1 MILE NE OF THE INTER- SECTION OF C	FREEPORT	PHILLIPS PETROLEUM
S	**ERNS**	2	PHILLIPS FREEPORT	FREEPORT	HOLLYWOOD MARINE
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	PHILLIPS FREEPORT	FREEPORT	HOLLYWOOD MARINE
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**CORRACT**	2	COUNTY ROAD 731 1 MI NE AND .3	FREEPORT	CONOCOPHILLIPS COMPANY
S	**RCRA-G**	2	COUNTY ROAD 731 1 MI NE AND .3	FREEPORT	CONOCOPHILLIPS COMPANY
S	**ERNS**	2	PHILLIPS 66 DOCK NO.3	FREEPORT	BRENT TRANSPORTATION
S	**ERNS**	2	PHILLIPS DOCKS TERMINAL 1 DOCK 2	FREEPORT	
S	**ERNS**	2	PHILLIPS TERMINAL NO.2 QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	PHILLIPS SWEENY/ SAN BERNARD RIVE	FREEPORT	HOLLYWOOD MARINE INC
S	**erns**	2	QUINTANA RD 1000 COUNTY RD 240	FREEPORT	PHILLIPS 66
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	FREEPORT HARBOR PHILLIPS TERMINA	FREEPORT	HOLLYWOOD BARGES
S	**ERNS**	2	PHILLIPS SWINNING ST BERNARD RIVE	FREEPORT	HOLLYWOOD MARINE
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	PHILLIPS MARINE TERMINAL #4 DOCK--B	FREEPORT	
S	**ERNS**	2	FREEPORT BERTH 2	FREEPORT	PHILLIPS 66
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	QUINTANA RD POB 897	FREEPORT	PHILLIPS 66 CO
S	**ERNS**	2	PORT OF FREEPORT IN CHANNEL NEAR	FREEPORT	
S	**erns**	2	PHILLIPS TERMINAL BERTH 2	FREEPORT	M/V BOW SAPHIR
S	**ERNS**	2	HIGH ISLAND BLOCK 561A	FREEPORT	PHILLIPS PETROLEUM CO
S	**erns**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	QUINTANA RD	FREEPORT	PHILLIPS 66
S	**ERNS**	2	PHILLIPS #2 TERMINAL	FREEPORT	
S	**erns**	2	PHILLIPS PETROLEUM, NUMBER THREE	FREEPORT	TEXACO

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
S	TXLUST	2	1852 1/2 W 2ND ST	FREEPORT	PHILLIPS 66
S	erns	2	1000 COUNTY ROAD 731/ COUNTY ROA	FREEPORT	PHILLIPS OIL COMPANY
S	erns	2	FREEPORT TERMINAL	FREEPORT	PHILLIPS PETROLEUM
S	erns	2	1000 COUNTY ROAD 731/ COUNTY ROA	FREEPORT	PHILLIPS OIL COMPANY
S	ERNS	2	QUINTANA RD	FREEPORT	PHILLIPS 66 CO
S	ERNS	2	NEAR THE BRAZOS RIVER ON RIGHT OF	FREEPORT	PHILLIPS 66 CO
S	ERNS	2	QUINTANA RD, TOW BOAT MAMA RU MO	FREEPORT	PHILLIPS 66 CO
S	ERNS	2	PHILLIPS DOCK/FREEPORT TERMINAL O	FREEPORT	ALAMO INLAND MARINE
S	erns	2	PHILLIPS PETROLEUM, NUMBER THREE	FREEPORT	TEXACO
S	TXSPILL	2	ENTIRE TERMINAL	FREEPORT	PHILLIPS TERMINAL
S	TXSPILL	2	MAIN PROCESS FLAREEPN-62-61-5, CR	BRAZORIA	PHILLIPS CLEMINS TERMINAL
S	RCRA-G	2	HIGHWAY 36 W @ SEAWAY RD	JONES CREEK	CONOCOPHILLIPS
S	ERNS	2	QUINTANA RD	FREEPORT	PHILLIPS 66 CO
S	ERNS	2	POB 896 QUINTANA RD.	FREEPORT	PHILLIPS 66 CO
S	ERNS	2	PHILLIPS DOCK	FREEPORT	HOLLYWOOD MARINE INC
S	ERNS	2	PHILLIPS FREEPORT BERTH 3	FREEPORT	HOLLYWOOD MARINE INC
S	ERNS	2	PHILLIPS PETROLEUM DOCK NO.2	FREEPORT	DIXIE MARINE INC
S	NFRAP	2	QUINTANA ROAD	FREEPORT	PHILLIPS PETROLEUM CO FREEPOR
S	ERNS	2	.5 MILES SOUTH OF FREEPORT	FREEPORT	PHILIPS PETROLEUM CO.
S	ERNS	2	PHILLIPS 66	FREEPORT	
S	ERNS	2	1 MILE NE INTERSECTION COUNTY RD 7	FREEPORT	PHILLIPS PETROLEUM CO
S	ERNS	2	#3 BERTH #2 TERMINAL QUINTANA RD	FREEPORT	PHILLIPS 66 CO
S	ERNS	2	PHILLIPS TERMINAL NO. 1, DOCK 2	FREEPORT	STAPP TOWING CO.
S	ERNS	2	PHILLIPS #2 TERMINAL MILE POST 395	FREEPORT	TUGBOAT "CREOLE RIVER"
S	ERNS	2	PHILLIPS DOCKS COUNTY RD 731	FREEPORT	
S	ERNS	2	QUINTANNA ROAD TERMINAL NO. 2	FREEPORT	PHILLIPS 66
S	ERNS	2	PO BOX 892 QUINTANA RD	FREEPORT	PHILLIPS 66
S	erns	2	PHILLIPS PETROLEUM, NUMBER THREE	FREEPORT	TEXACO
S	ERNS	2	NO. 2 TERMINAL NO. 2 BERTH AT PHILLI	FREEPORT	
S	TXSPILL	2	FREEPORT DOCK #3	FREEPORT	PHILLIPS 66
S	ERNS	2	POB 896 QUINTANA RD.	FREEPORT	PHILLIPS 66 CO
S	ERNS	2	QUINTANA RD DOCK NO.2	FREEPORT	PHILLIPS 66
S	ERNS	2	PHILLIPS PETROLEUM	FREEPORT	LEEVAC MARINE
S	ERNS	2	PHILLIPS PETROLEUM TERMINAL	FREEPORT	
S	ERNS	2	IN FRONT OF THE PHILLIPS 66 DOCK	FREEPORT	
	TXUST	12	10 ASH	FREEPORT	SHRIMP BOAT STORE
	TXAST	17	1010 E 2ND ST	FREEPORT	CAPT ELLIOTS PARTY BOATS INC
	TXAST	17	1010 E 2ND ST	FREEPORT	CAPT ELLIOTS PARTY BOATS INC
.11					
	TXUST	56	510 S AVE A	FREEPORT	FREEPORT SERVICE CENTER
	TXUST	56	510 S AVE A	FREEPORT	FREEPORT SERVICE CENTER
	TXSPILL	57	510 S AVENUE A # 77541	FREEPORT	CITY OF FREEPORT
	NFRAP	58	510 SOUTH AVE A	FREEPORT	SMITH WELDING WORKS INC
	TXUST	78	903 2ND ST	FREEPORT	STOP N GO 2492
	TXUST	78	903 2ND ST	FREEPORT	STOP N GO 2492
	TXUST	78	903 2ND ST	FREEPORT	STOP N GO 2492

Distance/Direction	Database	Site Number	Address	City/State	Site Name
.12					
	RCRA-G	18	102 S AVENUE A	FREEPORT	ENDURO SYSTEMS INC
	TXAST	30	122 S AVE A	FREEPORT	VELASCO SCALE CO
	TXUST	30	122 S AVE A	FREEPORT	VELASCO SCALE CO
	TXUST	30	122 S AVE A	FREEPORT	VELASCO SCALE CO

Distance/Direction	Database	Site Number	Address	City/State	Site Name
.13					
	TXSPILL	1	BLOCK A-7000, JUMBO EDC UNIT, DOW	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LEAKING CELL @ UNOITY,DOW CHEMIC	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW BARGE CANAL, FREEPORT TX.	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	UNIT H 3200, DOW CHEMICAL - FREEPO	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW, FREEPORT	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	LEAKING FLANGE,DOW CHEMICAL - FRE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200 CHLORPYRIDINE UNIT IN THROX	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL - FREEPORT,.	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200 BLOCK, DOW CHEMICAL, FREEP	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-3861 BLOCK, DOW, 2301 N. BRAZOSP	FREEPORT	DOW CHEM OPERATION
	TXSPILL	1	PROCESS UNIT IN SUMP AREA OF FREE	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW C	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FREEPORT FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FREEPORT FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	LIGHTNING STRUCK HCL TANK,DOW CH	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PIPELINE IN 1000 BLOCK, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A600 MAG1,DOW CHEMICAL ,2301 N. BR	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW C	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW CHEMICAL, OYSTER CREEK UNIT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	AREA 26 DOW FACILITY FREEPORT	FREEPORT	CENTURY WEST
	TXSPILL	1	A-3200 CHOROPURADINE UNIT,DOW CH	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW, FREEPORT, PLANT A, 3000 BLOCK	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW FREEPORT FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A 3204 BLOCK, DOW, 2301 N. BRAXOSP	FREEPORT	DOW USA
	TXSPILL	1	PLANT A AT THE INTERSECTION OF FAR	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-1700 BLK ETHYL BENZENE PLANT	FREEPORT	DOW
	TXSPILL	1	DOW CHEM A A8 DOCK, FREEPORT,TX	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL A A8 DOCK, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CANAL, FREEPORT,TX	FREEPORT	UNK
	TXSPILL	1	INCINTERATOR WAS SHUT DOWN	FREEPORT	RHONE POULENC
	TXSPILL	1	LIGHT HYDROCARBONS 7 PLANT,DOW	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW FACILITY IN FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOCK A-22 FREEPORT TX.	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PROPERTY AT JACINTO PORT BLV	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FREEPORT HARBOR	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	DOW PLANT A FACILITY COOLING SYST	FREEPORT	DOW CHEMICAL TEXAS OPERATION
	TXSPILL	1	PLANT A FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW, FREEPORT BLDG. OC-708	FREEPORT	
	TXSPILL	1	AREA 26 DOW FREEPORT	FREEPORT	CENTURY CORTRACTORS
	TXSPILL	1	A1700 BLK, PLANT A, 2301 BRAZOSPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A IN FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	UNK	FREEPORT	DOW CHEMICAL
	TXSPILL	1	UNK	FREEPORT	DOW CHEMICAL
	TXSPILL	1	D-440 TANK INB-33 TANK FARM,DOW CH	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	FREEPORT BARGE CANAL	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	OC-600 LIGHT HYDROCARBONS #8,DO	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200 CHLOROPYRADIENES UNIT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-3200 SYSTET PLANT, FROM A TANK T	FREEPORT	DOW
	TXSPILL	1	DOW CHEM, FREEPORT A3200 BLOCK	FREEPORT	DOW CHEMICAL

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	LIGHT HYDROCARBONS 7 PLANT,DOW	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	AIR AFFECTED, PROCESS UNIT, DOW F	FREEPORT	DOW, NO. AMERICAN
	TXSPILL	1	CAUSTIC PRODUCTION	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLANT A AT FM 1495 & 229, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL - FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	AT DOW CHEMICAL PLANT IN FREEPOR	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	UNION PACIFIC RAILYARD, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3800 BLOCK, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBON PRODUCTION #8,	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PRODUCTION UNIT, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ETHYL BENZENE UNIT, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PRODUCTION UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	STYRENE # 2 UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	AREA OC-708, DOW FACILITY, FREEPOR	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	STYRENE II UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GLYCERINE 2 FINISHING UNIT AND SOIL	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	TRICHLOROETHYLENE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	FM 1495 & COUNTY ROAD 229 @ FACILIT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FACILITY AT ABOVE LOCATION @ FM 14	FREEPORT	DOW CHEMICAL
	TXSPILL	1	PLANT A 850' INTO DITCH	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3800, ETHYLENE/AMINE UNIT,DOW CH	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW DOCK @ FREEPORT	FREEPORT	DOW CHEMICAL USA TX. DIV.
	TXSPILL	1	DOW CHEMICAL PLANT, FREEPORT	FREEPORT	DOW CHEMICAL USA, TX. DIV.
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL USA TEX. DIV.
	TXSPILL	1	DOW BARGE CANAL DOCKS PLANT A, F	FREEPORT	DOW CHEMICAL CO. USA TX. DIV
	TXSPILL	1	PLANT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	BRIAN MOUND	FREEPORT	DOW CHEMICAL
	TXSPILL	1	OLD BRAZOS RIVER @ DOW PLANT 'A', F	FREEPORT	DOW CHEMICAL CO USA, TX. DIV.
	TXSPILL	1	FM 1495 AND CR 229, PLANT A	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ROTARY KILN @ FACILITY AT ABOVE LO	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL COMPANY ICW	FREEPORT	KIRBY MARINE
	ERNS	1	DOW CHEMICAL DOCK	FREEPORT	DAN MARINE TOWING
	TXSPILL	1	FACILITY AT ABOVE LOCATION	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DITCH ON FACILITY AT ABOVE LOCATIO	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	PLANT A @ DOW CHEM, 3301 5TH AVE S	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FACILITY AT ABOVE LOCATION	FREEPORT	DOW CHEMICAL
	TXSPILL	1	TRUCK LOADING AREA @ FACILITY AT A	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FM 1495 & COUNTY ROAD 225	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A4000 BLOCK PLANT A	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT IN FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A1600 BLOCK OF DOW PLANT A, FREEP	FREEPORT	DOW CHEMICAL
	TXSPILL	1	REACTOR IN POLYETHYLENE # 2	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLANT A FACILITY AT 826 BLOCK	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL USA, TEX DIV.
	TXSPILL	1	3200 BLOCK INSIDE FACILITY AT ABOVE	FREEPORT	DOW CHEMICAL
	TXSPILL	1	BLOCK 400 OF 'PLANT A' COMPLEX, FRE	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FACILITY AT ABOVE LOCATION	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A3200 CHLOROPURADINE.DOW CHEMIC	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	MAGNESIUM PRODUCTION A-600	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PROCESS UNIT ETHYLDIAMENE BLOCK.	FREEPORT	DOW CHEMICAL - FREEPORT

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ETHYLENE PRODUCTION UNIT,DOW CH	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE #4 UNIT, DOW CHEMIC	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ENTHYLBENZENE A.,DOW CHEMICAL - F	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE UNIT#4, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3500 BLOCK SHIP FLARE.	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A7 DOCK IN PLANT A IN BAY CANAL	FREEPORT	DOW FREEPORT
	TXSPILL	1	DOW CHEMICAL PLANT AT FREEPORT	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	DOW PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT IN FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW FREEPORT FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL A320 BLOCK	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	PIPELINE CORRIDOR BETWEEN PLANTS	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL - FREEPORT PLANT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	DOW CHEMICAL, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	PLANT A, DOW CHEMICAL CO., FREEPO	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW CHEMICAL PLANT, FREEPORT	FREEPORT	DOW CHEMICAL COMPANY USA
	TXSPILL	1	A 1700 ETHYL BENZENE UNIT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW FREEPORT PLANT	FREEPORT	DOW CHEMICAL-TEXAS DIVISION
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW-TEXAS OPERATIONS
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL, OYSTER CREEK DI
	TXSPILL	1	DOW PLANT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL PLANT A CAUSTIC UNIT	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	DOW CHEMICAL COMPANY	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	PLANT SITE AT ABOVE ADDRESS	FREEPORT	DOW CHEMICAL U.S.A.
	TXSPILL	1	DOW PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	@ CO. A4 DOCK AT PLANT A ON THE OL	FREEPORT	DOW CHEMICAL U.S.A. (TX. DIV.)
	TXSPILL	1	PIPELINE FROM DOW FREEPORT PLANT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	PLANT A	FREEPORT	DOW CHEMICAL USA TEX. DIV.
	TXSPILL	1	BRAZOS RIVER HARBOR, FREEPORT AT	FREEPORT	DOW CHEMICAL CO. USA TX. DIV.
	TXSPILL	1	PLANT 'A' BETWEEN DOW BARGE CANA	FREEPORT	DOW CHEMICAL USA, TEX. DIV.
	TXSPILL	1	DOW CHEMICAL, FREEPORT	FREEPORT	DOW CHEMICAL CO. USA, TX. DIV.
	TXSPILL	1	2600 BLK. 'A' PLANT, OUTFALL 201, OUTF	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW A-4 DOCK, PLT A, FREEPORT SHIP	FREEPORT	DOW CHEM. TEX. DIV.
	TXSPILL	1	LOADING DOCK AREA	FREEPORT	DOW CHEMICAL
	TXSPILL	1	LOADING DOCK AREA	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FREEPORT PLANT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	BLOCK A-1800 IN DOW'S PLANT A	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	DOW PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	CO. A8 DOCK AT PLANT A ON THE OLD B	FREEPORT	DOW CHEMICAL U.S.A
	TXSPILL	1	PLANT SITE AT ABOVE ADDRESS	FREEPORT	DOW CHEMICAL

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	POLYETHYLENE #1 UNIT AT ABOVE FACI	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	OUTFALL NO. 1	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	HAZARDOUS WASTE LANDFILL @ FACILI	FREEPORT	DOW CHEMICAL
	TXSPILL	1	PLANT A @ FM 1495 & CO. RD. 229	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A 1800 BLOCK OF DOW PLANT A, FREEP	FREEPORT	DOW CHEMICAL
	TXSPILL	1	IN A2700 BLOCK OF ABOVE FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A IN FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A IN FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL PLANT	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	FACILITY AT ABOVE ADDRESS	FREEPORT	DOW CHEMICAL
	TXSPILL	1	ON PLANT SITE THROUGH OUTFALL 001	FREEPORT	DOW CHEMICAL USA, PLANT A
	TXSPILL	1	PLANT A	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	PDC PROCESSING SYSTEM	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	PUMP SEAL ON PROCESS PUMP	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ETHYLENE PRODUCTION	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	DOW PLANT, FREEPORT, TEXAS	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW PLANT, FREEPORT, TEXAS	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	A3500 MARINE OPERATIONS	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	ALLYL CHLORIDE UNIT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	A-3200 CHLOROPERIDIENE, FREEPORT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	BLOCK A-7000, JUMBO EDC UNIT, DOW	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE UNIT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	ETHYLENE PRODUCTION CRACKING UNI	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	SHEENING ONTO RIVER FROM OUTFALL	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	BETWEEN OYSTER CREEK AND PLANT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	FURNACE, FREEPORT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	FREEPORT FACILITY	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	CLORINE UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE #2	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	FIRE AT OC 600 BLK LIGHT HYDROCARB	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	FREEPORT PLANT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	LIGHT HYDROCARBONS #7 PLANT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	PIPELINE	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	PSA 150, F550 FLARE FOR PROCESS VE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	OUTDOOR BURNING	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	DOW A4 MOTOR VESSEL @ DOW, 2301	FREEPORT	DOW
	TXSPILL	1	DOW CHEMICAL PLANT A	FREEPORT	DOW CHEMICAL
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLANT A FACILITY AT FM 1495 & COUNT	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	PLANT A A 4100 FARM ROAD 1405, COU	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	BOLIVAR PENNISULA BARGE TERMINAL	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-8 DOCK AT BRAZOS HARBOR, FREEP	FREEPORT	DOW CHEMICAL FREEPORT
	TXSPILL	1	DOW, FREEPORT BARGE DOCK A4,	FREEPORT	DOW FREEPORT(M/V MARINE CHEMI
	TXSPILL	1	DOW PLANT A ON FM 1495, FREEPORT,	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A, F.R. 1495, FREEPORT, 77	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW, BRAZOS HARBOR, FREEPORT	FREEPORT	DOW CHEMICAL

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	A-3 DOCK DOW FREEPORT ON MAIN DO	FREEPORT	DOW CHEMICAL FREEPORT
	TXSPILL	1	PLANT A PUMP P-208B	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3 DOCK, DOW, 2301 BRAZOSPORT BL	FREEPORT	DOW CHEMICALS
	TXSPILL	1	SYM-TET UNIT TOX EQUIPMENT.	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW'S A-8 DOCK, BRAZOS RIVER, FREE	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A1600 AIR STRIPPER @ DOW, 2301 BRA	FREEPORT	DOW CHEMICAL
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PRODUCTION UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	COMPRESSOR TO FLARE.	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	STRATTAN RIDGE FACILITY PIPELINE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBON 7, DOW CHEMIC	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	UNIT 301, DOW CHEMICAL - FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBON UNIT 7	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYCARBONATE UNIT, BLK 8400, DOW	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A3200 BLOCK D206PSV, DOW CHEMICAL	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ETHYLBENZINE A UNIT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	DOW DOCK # 4 AT FREEPORT, 77541	FREEPORT	GRASSO OIL FIELD SERVICES
	TXSPILL	1	A 3200 CHLORPURADIENE UNIT,DOW C	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	N & S RAILCAR LOAD RACK	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	CHLOROALKLYDE,DOW CHEMICAL - FR	FREEPORT	DOW CHEMICAL - FREEPORT
	NFRAP	1	OLD BRAZOS RIVER & DOW CANAL	FREEPORT	DOW CHEMICAL CO TEXAS DIVISION
	TXSPILL	1	DOW CHEMICAL - FREEPORT PLANT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	6 INCH UNDERGROUND PIPELINE,DOW	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW, FREEPORT, TX SANITARY LANDFI	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PHENOL ASTOL UNIT, OYSTER CREEK,	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLUG ON PUMP IN UNIT A-3800 ETHYLE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-2400,DOW CHEMICAL - FREEPORT,230	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-1800,DOW CHEMICAL - FREEPORT,230	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLANT A, 3800 BLOCK,DOW CHEMICAL -	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	FLASH DRUM	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	DOW CHEMICAL - FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ETHYLBENZENE UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A 3200 CHLOROPURADENES,DOW CHE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A PLANT 1700 BLOCK,DOW CHEMICAL -	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3800 BLOCK.,DOW CHEMICAL - FREEP	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200 BLOCK, DOW CHEMICAL - FREEP	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBONS # 7, WASTE HE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	UNIT A-38, ETHYLENE AMINE, DOW CHE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW CHEMICAL - FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A8 DOCK,DOW CHEMICAL - FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLY 4 4100 UNIT, DOW CHEMICAL - FR	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	403 OUTFALL, DOW CHEMICAL - FREEP	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200 BLOCK AT PLANT, FREEPORT, TX	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200, CHLOROPYRIDINE UNIT, DOW C	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBON NO. 7	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ALIAL CHLORIDE UNIT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	FREEPORT	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	LIGHT HYDROCARBONS NO. 7	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE #2	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	FLANG ON VESSEL D-200	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBONS #8	FREEPORT	DOW CHEMICAL - FREEPORT

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	PLANT A	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	SYM-TET PLAN PLANT-A 3200	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	RAIL CAR LOADING ARM	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	CHLORAPRENE PLT.	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBONS 7 UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A3200	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	LIGHT HYDROCARBON	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	CRACKED GAS COMPRESSOR	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ETHYLENE DIAMINE PLANT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200 UNIT, DOW CHEMICAL , 2301 BRA	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A2600 BLOCK	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A3200 BLOCK, DOW CHEMICAL - FREEP	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A2400 BLOCK, DOW CHEMICAL - FREEP	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	FM 1495 EXIT, DOW CANAL ROAD TO C	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-22 DOCK FREEPORT MARINE VESSEL	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	VERSENE UNIT, A2600 BLOCK	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	F-550 FLARE, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLANT A, DOW CHEMICAL - FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW CHEMICAL FREEPORT PLANT A		DOW CHEMICAL
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	DOW CHEMICAL PLANT A FREEPORT	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW CHEMICAL PLANT A PIPELINE	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	PIPELINE CORRIDOR NORTHEAST OF D	FREEPORT	DOW CHEMICAL USA
	ERNS	1	(ITALIAN VESSEL) DOW CHEMICAL FACI	FREEPORT	TEXAS MARINE
	TXSPILL	1	DOW CHEMICAL PLANT	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	CHLORINE 4 PLANT @ FACILITY AT ABO	FREEPORT	DOW CHEMICAL
	TXSPILL	1	PLANT SITE SODIUM HYDROXIDE STOR	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	DOW CHEMICAL PLANT A BLOCK A	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW CHEMICAL PLANT A FREEPORT	FREEPORT	DOW CHEMICAL COMPANY U.S.A.
	TXSPILL	1	FROM PLANT TO OUTFALL 201	FREEPORT	DOW CHEMICAL (TEX. DIVISION)
	TXSPILL	1	DOW CHEMICAL USA FREEPORT		DOW CHEMICAL USA
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW CHEMICAL COMPANY PLANT A	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	DOW CHEMICAL COMPANY DOCKS	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	DOCK A-14, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	HEAT EXCHANGER IN PLANT A.	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	LINE FROM REACTOR TO STORAGE TAN	FREEPORT	DOW U.S.A (TEXAS DIVISION)
	TXSPILL	1	DESIGN REP. TRYING TO FIX A-3500 BLO	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW CHEMICAL CO. TEXAS WORKS	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	REACTOR IN PLANT (A-3200), DOW FREE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	OYSTER CREEK UNIT 1	FREEPORT	DOW CHEMICAL USA TX OPERATION
	TXSPILL	1	A1700 BLOCK OF DOW CHEMICAL PLAN	FREEPORT	DOW CHEMICAL COMPANY

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	PLANT A FACILITY A-1800 BLOCK	FREEPORT	DOW CHEMICAL
	TXSPILL	1	PLANT A FACILITY A-1800 BLOWN	FREEPORT	DOW CHEMICAL
	TXSPILL	1	PLANT SITE (A-1700)	PREEPORT	DOW CHEMICAL
	TXSPILL	1	INTERNAL DITCHES IN PLANT	FREEPORT	DOW CHEMICALS TEXAS OPERATIO
	TXSPILL	1	PLANT A PRODUCTION UNIT (CHLOROP	FREEPORT	DOW CHEMICAL USA,TX OPNS
	TXSPILL	1	AT PARKING LOT FOR A3A DOCK OF DO	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-13 DOCK, FREEPORT HAUBOR, INTER	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DISPERSIMENT TOWER, DOW FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DISPERSMENT TOWER, DOW FACILITY	FREEPORT	DOW CHEMICAL
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	DOW FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL COMPANY	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	PLANT A FACILITY FM 1495 INTERSECTI	FREEPORT	DOW CHEMICALS
	TXSPILL	1	A 1800 BLOCK, (BL-0082R), 2301 BRAZOS	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	A-3200 BLK IN FREEPORT PLANT, BRAZ	FREEPORT	DOW CHEMICAL
	TXSPILL	1	AMINES DIANIMES PLANT A 1700 BLOCK	FREEPORT	DOW CHEMICALS
	TXSPILL	1	DOW CHEMICAL PLANT FM 1495 & KATY	FREEPORT	DOW CHEMICAL COMPANY
	TXSPILL	1	A 3200 BLOCK, CHLOROPYRIDINE PROD	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	RAILYARD, VELASCO, UNION PACIFIC IN	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	A-3 DOCK, FREEPORT, FM 1495 & COUN	FREEPORT	DOW CHEMICAL
	TXSPILL	1	PLANT FACILITY, A-3000 BLOCK,FREEPO	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW CHEMICAL COMPANY PLANT A	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	DOW CHEMICAL PLANT A FREEPORT	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	A-14 DOCK, DOW CHEMICAL, FREEPORT	FREEPORT	DOW CHEMICAL U.S.A (TX. DIV.)
	TXSPILL	1	3 A DOCK	FREEPORT	DOW FREEPORT
	TXSPILL	1	DOCK 822 , FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ON SITE CANAL - MAIN OUTFALL CANAL	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	A-600 BLOCK, NEAR MIXING BOX. PLANT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	SOUTH OF PLANT 'A' IN WASTEWATER C	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-600 BLOCK, NEAR MIXING BOX, PLANT	FREEPOSR	DOW CHEMICAL CO.
	TXSPILL	1	BRAZOS HARBOR- A-8 DOCK, DOW CHE	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-1600, DOW, 2301 BRAZOSPORT BLVD.,	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	FREEPORT FACILITY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE #2	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE #2 PLANT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	FREEPORT PLANT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	POLYETHYLENE #2,DOW CHEMICAL - FR	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	DOW CHEMICAL PLANT	FREEPORT	DOW CHEMICAL USA DIVISION
	TXSPILL	1	OYSTER CREEK UNIT, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-8 DOCK AT DOW	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	RELEIF VALVE	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	ETHYLBENZENE A-1700, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-3200 UNIT, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	CATOX UNIT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A LEVEL CHLORIDE B-6800	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	GENERAL DELIVERY	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PHENOL/ ACETONE PRODUCTION OC30	FREEPORT	DOW CHEMICAL - FREEPORT

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	DOW PLANT, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	PLANT A ON FM 1495 OUTSIDE OF FREE	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW DISCHARGE CANAL	FREEPORT	DOW CHEMICAL DIVISION
	TXSPILL	1	DOW CHEMICAL PLANT 'A' CANAL	FREEPORT	DOW CHEMICAL OYSTER CREEK DIV
	TXSPILL	1	A-8 DOCK, PLANT A, FREEPORT	FREEPORT	DOW CHEMICAL CO. USA, TX. DIV.
	TXSPILL	1	LIGHT HYDROCARBONS	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	A-6 DOCK	FREEPORT	DOW
	TXSPILL	1	A3-A DOCK AT DOW, FREEPORT	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	A3-A DOCK AT DOW, FREEPORT	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	A-1900 SITE	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	A7 DOCK OF PLANT A, FREEPORT, CR 2	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A, 3600 BLOCK, FREEPORT	FREEPORT	DOW CHEMICAL - FREEPORT
	TXSPILL	1	SALT GLASS POWER HOUSE, A-5000 BL	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW PLANT A, FM 1495 & CO RD 229, FR	FREEPORT	DOW CHEMICAL
	TXSPILL	1	AT BAYPORT DOCK-INTERSECTION OF F	FREEPORT	DOW CHEMICAL USA TX OPERATION
	TXSPILL	1	A 7000 AT DOW	FREEPORT	DOW USA
	TXSPILL	1	INTERCOASTAL WATERWAY INT W/ FRE	FREEPORT	DOW CHEMICAL
	TXSPILL	1	A-1600 BLOCK PLANT A-CHLORINATED	FREEPORT	DOW USA TEXAS OPERATIONS
	TXSPILL	1	FREEPORT PLANT, INSIDE PLANT	FREEPORT	DOW - FREEPORT
	TXSPILL	1	FREEPORT FACILITY, CR 229 & FM 1495	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	CO. RD. 229 & FM 1495, FREEPORT	FREEPORT	DOW CHEMICAL
	TXSPILL	1	DOW-FREEPORT, PLANT D-6200	FREEPORT	DOW CHEMICAL CO.
	TXSPILL	1	DOW CHEMICAL ,FREEPORT (PLANT A)	FREEPORT	DOW CHEMICAL
	TXSPILL	1	SOIL INSIDE PLANT FACILITY	FREEPORT	DOW USA
	TXSPILL	1	FREEPERT, TX	FREEPORT	DOW CHEMICAL CO
	TXSPILL	1	PLANT	FREEPORT	DOW CHEMICAL TX OPERATIONS
	TXSPILL	1	DOW CHEMICAL AT HWY 288B AT A8 DO	FREEPORT	DOW CHEMICAL USA
	TXSPILL	1	PLANT A, INTERSECTION OF SH2292 FM	FREEPORT	DOW CHEMICAL CO. PLANT A
	TXSPILL	1	DOW CHEMICAL CO. BARGE CANAL	FREEPORT	DOW CHEMICAL
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FREE PORT SHIP CHANNEL DOW CHEMI	FREE PORT	DIXIE CARRIER INC
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FARM RD 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOCK A8 DOW CHEMICAL FREEPORT	FREEPORT	DIXIE MARINE INC
	ERNS	1	DOW CHEMICAL DOCK A8	FREEPORT	STROHM SHIPPING
	ERNS	1	COUNTY RD 229 AND FM 1495 DOCK A-7	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	P O BOX BB	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL IN THE INTRACOASTAL	FREEPORT	
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	INTERSECTION OF FM 1495 AND COUNT	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL PLANT DOCK NO.4	FREEPORT	MARINE TRANSPORT MGMT INC
	ERNS	1	PLANT A DOCK A3 FARM ROAD 1495 CO	FREEPORT	DOW CHEMICAL CO
	ERNS	1	A-3 DOCK COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL CO
	ERNS	1	A4 DOCK AT DOW CHEMICAL	FREEPORT	T/V CATALINA
	ERNS	1	PLANT A, FM 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL CO
	ERNS	1	DOW CHEMICAL FARM RD. 1495 AND CO	FREEPORT	DOW CHEMICAL CO

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	ERNS	1	BRAZOS R. AT FREEPORT	FREEPORT	DOW CHEM
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	28-57.0N 95-19.0W DOCK A3	FREEPORT	DOW CHEMICAL CO
	ERNS	1	COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM ROAD 1495 AND COUNTY ROAD 2	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 AND FARM RD 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	A9 DOCK COUNTY RD 229 & FM1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY 229 AND FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL PLANT	FREEPORT	TEXAS MARINE AGENCY
	ERNS	1	COUNTY RD 229 & FM 1495 DOW CHEMI	FREEPORT	
	ERNS	1	AA DOCK NEXT TO M/V STOLT SAPPHIR	BRAZORIA	
	ERNS	1	INTERSECTION OF FARM ROAD 1495 AN	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM RD 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM ROAD 1495 AT THE INTERSECTIO	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM RD 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	322	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	BRAZOS HARBOR AT ITS INTERSECTION	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FM 1495 & CR 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FM 1495 AND CR229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FM 1495 AND CTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	ACROSS FROM RATTLESNAKE PT, 5 MI	SURFSIDE	
	ERNS	1	FARM RD 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL A-4 DOCK	FREEPORT	
	ERNS	1	FARM RD 1495 COUNTY RD 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	PLANT A FACILITY FARM RD 1495 AND C	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	FARM ROAD 1495 AT INTERSECTION OF	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM RD. 1495 AND CO. RD. 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW FREEPORT DOCK A8	FREEPORT	JO TANKERS
	ERNS	1	COUNTY RD 229 & FM 1495	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL DOCK A-3	FREEPORT	
	ERNS	1	FREEPORT HARBOR DOW CHEMICAL D	FREEPORT	
	ERNS	1	COUNTY RD 229 AT THE INTERSECTION	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL PLANT "A" FARM ROAD	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FTM 1495 AND COUNTY ROAD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM ROAD 1495 AT THE INTERSECTIO	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL PLANT	FREEPORT	MISENER MARINE CONSTRUCTION
	ERNS	1	FARM RD 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	A-4 DOCK AT DOW CHEMICAL PLANT	FREEPORT	NATIONAL MARINE NAVIGATI.
	ERNS	1	DOW CHEMICAL COUNTY RD 229 & FM 1	FREEPORT	CONTINENTAL DREDGING
	erns	1		FREEPORT	DOW CHEMICAL
	erns	1	NEAR DOW CHEMICAL PLANT	FREEPORT	UNION PACIFIC RAILROAD
	erns	1	DOW BARGE CANAL A 4100 BLOCK	FREE PORT	PILING INC.
	erns	1	A3200 BLOCK 2031 N. BRAZOSPORT BLV	FREEPORT	DOW CHEMICAL CORP
	erns	1	DOW CHEMICAL CO. TERMINAL	FREEPORT	ANGLO-PACIFIC / LAURIN MARITIME
	erns	1	DOW CHEMICAL GULF ICW	FREEPORT	
	ERNS	1	DOW CHEMICAL PLANT A FARM RD 1495	FREEPORT	DOW CHEMICAL CO

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	erns	1	DOW CHEMICAL DOCK A22	FREEPORT	STOLT PARCEL TANKERS INC
	erns	1	DOW CHEMICALS	FREEPORT	ATHENIAN SEA CARRIERS
	erns	1	DOW CHEMICAL FUEL DOCK	FREEPORT	KIRBY INLAND MARINE
	erns	1	DOW CHEMICAL A-1 DOCK MM 390 GIC	FREEPORT	KIRBY INLAND MARINE
	erns	1	DOW CHEMICAL PLANT	FREEPORT	KIRBY INLAND MARINE
	ERNS	1	A-3200 BLOCK DOW CHEMICAL SYMTEC	FREEPORT	DOW CHEMICAL CORP
	ERNS	1	(ITALIAN VESSEL) DOW CHEMICAL FACI	FREEPORT	TEXAS MARINE
	ERNS	1	DOW CHEMICAL COMPANY ICW	FREEPORT	KIRBY MARINE
	erns	1	DOW CHEMICALS DOCK A22	FREEPORT	KIRBY INLAND MARINE
	erns	1	DOW CHEMICAL FREEPORT TEXAS DOC	FREEPORT	
	ERNS	1	ALONG FREEPORT CHANNEL	FREEPORT	DOW CHEMICAL
	CORRACT	1	BUILDING B-401	FREEPORT	DOW CHEMICAL CO
	ERNS	1	GULF OF MEXICODOW CHEMICAL TERM	FREEPORT	
	ERNS	1	ON THE INTRACOASTAL WATERWAY AT	FREEPORT	M/V DOMENICO IEVOLI
	ERNS	1	A-1700 UNIT2301 NORTH BRAZOSPORT	FREEPORT	DOW CHEMICAL
	ERNS	1	A1700 UNIT2301 NORTH BRAZOSPORT B	FREEPORT	DOW CHEMICAL
	erns	1	COMPANY PIER NORTH BRAZOSPORT B	FREEPORT	DOW CHEMICAL
	erns	1	DOW CHEMICAL FREEPORT TEXAS DOC	FREEPORT	
	erns	1	A22 DOCK	FREEPORT	DOW CHEMICAL
	erns	1	DOW CHEMICAL COMPANY OYSTER IND	FREEPORT	
	erns	1	DOW CHEMICAL COMPANY OYSTER IND	FREEPORT	
	erns	1	DOW CHEMICAL COMPANY OYSTER IND	FREEPORT	
	erns	1	DOW CHEMICALS	FREEPORT	ATHENIAN SEA CARRIERS
	erns	1	DOW CHEMICALS	FREEPORT	ATHENIAN SEA CARRIERS
	ERNS	1	DOW CHEM CO A4 DOCK	FREEPORT	
	erns	1	DOW CHEMICAL FREEPORT TEXAS DOC	FREEPORT	
	ERNS	1	DOW CHEMICALS	FREEPORT	BACON TOWING CO
	ERNS	1	DOW CHEMICAL DOCK	FREEPORT	DAN MARINE TOWING
	ERNS	1	FM RD 1495, COUNTY RD 229	FREEPORT	DOW CHEMICAL CO
	ERNS	1	DOW CHEMICAL DOCK A1	FREEPORT	HOLLYWOOD MARINE
	ERNS	1	BLDG OC 708 PLANT "A" FACILITY	FREEPORT	DOW CHEMICAL CO
	ERNS	1	BRAZOS HARBOR AT DOW'S A3 DOCK 1	FREEPORT	
	ERNS	1	DOW CHEMICAL CO DOCK A-4	FREEPORT	MARINE TRANSPORT MGMT INC
	ERNS	1	DOW FREEPORT SLIP A-8	FREEPORT	JO TANKERS
	ERNS	1	ON THE M/V MARINE CHEMIST AT DOW	FREEPORT	DOW CHEMICAL
	ERNS	1	A8 DOCK DOW CHEMICAL	FREEPORT	
	ERNS	1	PLANT A FARM ROAD 1495 COUNTRY R	FREEPORT	DOW CHEMICAL CO
	ERNS	1	DOW CHEMICAL COUNTY RD 229 & FAR	FREEPORT	
	ERNS	1	PLANT A 3200 BLOCK	FREEPORT	DOW CHEMICAL CO
	ERNS	1	DOW FREEPORT DOCK BETWEEN A-3 A	FREEPORT	PACE MARINE SERVICES
	ERNS	1	DOW CHEMICAL A-4 DOCK	FREEPORT	
	ERNS	1	BLDG OC 708 FM 1490	FREEPORT	DOW CHEMICAL CO
	ERNS	1	PLANT A FM 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL CO
	ERNS	1	DOW CHEMICAL CO. PLANT A FACILITY	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	PLANT "A" COUNTY RD 229 AND FM 1495	FREEPORT	DOW CHEMICAL CO
	ERNS	1	DOW CHEMICAL DOCK A 13	FREEPORT	
	ERNS	1	DOW D6 DOCK MILE 8 BRAZOS RIVER	FREEPORT	BARGE TRANSPORTATION CO
	ERNS	1	PLANT	FREEPORT	DOW CHEMICAL
	ERNS	1	DOW CHEMICAL PLANT A FARM RD 1495	FREEPORT	
	ERNS	1	DOW CHEMICAL PROPERTY ADJACENT	FREEPORT	
	ERNS	1	BLDG OC 708	FREEPORT	DOW CHEMICAL CO

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	TXSPILL	1	FACILITY AT ABOVE LOCATION	FREEPORT	DOW CHEMICAL
	ERNS	1	DOW CHEM A PLANT SCALES HWY 523	FREEPORT	
	ERNS	1	INTERSECTION OF FM 1495 AND CNTY R	FREEPORT	DOW CHEMICAL
	ERNS	1	BLDG OC 708	FREEPORT	DOW CHEMICAL CO
	ERNS	1	BLDG OC 708	FREEPORT	DOW CHEMICAL CO
	ERNS	1	DOW DOCK A-4	FREEPORT	STOLT-CORMORANT INC.
	ERNS	1	A2400 BLOCK	FREEPORT	DOW CHEMICAL CO
	ERNS	1	BLDG OC 708 DOW A4 DOCK	FREEPORT	DOW CHEMICAL CO
	ERNS	1	IN THE FREEPORT HARBOR ADJACENT	FREEPORT	
	ERNS	1	INTERSECTION OF FARM ROAD 1495 AN	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW CHEMICAL CO A8 DOCK 2301 BRAZ	FREEPORT	CIVIL MECHANICAL INC
	ERNS	1	FARM RD 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	1495 FARM RD AND 229 COUNTY RD	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW A22 DOCK INTERSECTION THE IC	FREEPORT	DOW CHEMICAL
	ERNS	1	INTERSECTION OF FARM RD 1495 AND	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	ACROSS FROM DOW CHEMICAL A1 DOC	FREEPORT	M/V MORNING STAR
	ERNS	1	INTERSECTION FM RD 1495 AND COUNT	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	INTERSECTION OF FM 1495 AND COUNT	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW CHEMICAL A-22	FREEPORT	SMQI SERVICES INC.
	ERNS	1	DOW CHEMICAL	FREEPORT	COASTAL TOWING INC
	ERNS	1	INT OF FR 1495 AND CNTY RD 229	FREEPORT	DOW CHEMICAL
	ERNS	1	INT FREEPORT HARBOR AND INTRACOA	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW CHEMICAL PORT OF FREEPORT	FREEPORT	DOW CHEMICAL
	ERNS	1	DOW A8 DOCK / MI 395 ICW FREEPORT I	FREEPORT	
	ERNS	1	FARM RD 149 & COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	INT FARM RD 1495 AND CTY RD 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	INTERSECTION OF FARM ROAD 1495 AN	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM RD 1495 & CTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL A-22	FREEPORT	TEXAS MARINE AGENCY
	ERNS	1	COUNTY RD 229 INTERSECTIN FARM RD	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	INTERSECTION OF FM RD 1495 AND CTY	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	FM 1495 & CR 229 DOW CHEMICAL FACI	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FREEPORT HARBOR AT THE DOW CHEM	FREEPORT	
	ERNS	1	INTERSECTION FARM RD 1495 AND COU	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	1495 FARM RD AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	COUNTY RD 229 & FM 1425	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM RD 1495 & COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	INTERSECTION OF FM 1495 & COUNTY R	FREEPORT	DOW CHEMICAL
	ERNS	1	FM RD 1495 AT CTY RD 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW PLANT A FACILITY FARM ROAD 149	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	INT OF FM 1495 & COUNTY RD 229	FREEPORT	DOW CHEMICAL
	ERNS	1	DOW CHEMICAL PLANT	FREEPORT	GROENDYKE TRANSPORT
	ERNS	1	DOW CHEMICAL COMPANY HWY 322	FREEPORT	CENTURY CONTRACTORS
	ERNS	1	INTERSECTION OF INTRA- COASTAL CA	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM FD 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW TERMINAL / PIER A-4	FREEPORT	M/T PANAM QUERIDA
	ERNS	1	INTERSECTION OF FARM RD 1495 AND	FREEPORT	DOW CHEMICAL
	ERNS	1	FARM ROAD 1459 AND COUNTY ROAD 2	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	FARM RD 1495 & 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW PIER	FREEPORT	DIXIE CARRIERS
	ERNS	1	INTERSECTION OF FARM ROAD 1495 AN	FREEPORT	DOW CHEMICAL COMPANY

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	ERNS	1	FARM RD 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL FACILITY A8 DOCK. INT	FREEPORT	
	ERNS	1	FM 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	FARM ROAD 1495 AT INTERSECTION OF	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	DOW CHEMICAL DOCK A22	FREEPORT	TRANSMARINE NAVIGATION
	ERNS	1	DOW 3A DOCK	FREEPORT	
	ERNS	1	DOCK A-4 DOW	FREEPORT	M/T TOLRUNNER
	ERNS	1	PLANT A FACILITY INTERSECTION OF TX	FREEPORT	DOW CHEMICAL COMPANY
	ERNS	1	INTERSECTION FARM RD 1495 AND COU	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	NEAR DOW CHEM FACILITY AT INTERSE	FREEPORT	
	ERNS	1	DOW CHEMICAL A-4 DOCK INTERSECTI	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW CHEMICAL PROPERTY ON THE INT	FREEPORT	WESTERN TOWING CO
	ERNS	1	INT OF FM 1495 & CNT RD 229	FREEPORT	DOW CHEMICAL
	ERNS	1	BRAZOS RIVER INSIDE DOW CHEMICAL	FREEPORT	
	ERNS	1	INTERSECTION OF FM1495 AND CTY RD	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	FARM RD 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	INTERSECTION OF COUNTY RD 229 AND	FREEPORT	DOW CHEMICAL
	ERNS	1	DOW DIVISION	FREEPORT	DOW CHEMICALS
	ERNS	1	INTERSECTION FM1495 & COUNTY RD 2	FREEPORT	DOW CHEMICAL
	ERNS	1	INT. OF FM RD 1495 & CTY RD 229	FREEPORT	DOW CHEMICAL
	ERNS	1	INT OF FM RD 1495 & CTY RD 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	FARM RD 1495 AND COUNTY RD 229	FREEPORT	DOW CHEMICAL COM.
	ERNS	1	DOW CHEMICAL TERMINAL	FREEPORT	SCANDANAVIAN MARINE
	ERNS	1	DOW CHEMICAL	OYSTER CREEK	DESTEC ENERGIES
	ERNS	1	INTERSECTION OF COUNTY RD 229 AND	FREEPORT	DOW CHEMICAL COM.
	TXUST	52	402 S AVE A	FREEPORT	SERGIOS GARAGE
	TXUST	52	402 S AVE A	FREEPORT	SERGIOS GARAGE
	TXUST	52	402 S AVE A	FREEPORT	SERGIOS GARAGE
	TXUST	52	402 S AVE A	FREEPORT	SERGIOS GARAGE
.14					
	TXLUST	38	201 S AVE A	FREEPORT	VACANT
	TXUST	38	201 S AVE A	FREEPORT	VACANT
	TXUST	38	201 S AVE A	FREEPORT	VACANT
	TXUST	38	201 S AVE A	FREEPORT	VACANT
	ERNS	65	618 EAST 2ND ST	FREEPORT	DIXIE CARRIER
	ERNS	66	618 EAST 2ND STREET	FREEPORT	GNH TOWING
	ERNS	66	618 EAST 2ND STREET	FREEPORT	GNH TOWING
.15					
	erns	7	503 PORT ROAD	FREEPORT	TETRA TECHNOLOGIES
	TXLUST	21	103 CHERRY ST 240 2ND ST	FREEPORT	INTERMEDICS
	TXUST	50	331 S AVENUE A	FREEPORT	HANDI STOP 72
	TXUST	50	331 S AVENUE A	FREEPORT	HANDI STOP 72
	TXUST	50	331 S AVENUE A	FREEPORT	HANDI STOP 72
	TXAST	55	505 PORT RD	FREEPORT	AMERICAN RICE
	TXAST	55	505 PORT RD	FREEPORT	AMERICAN RICE
	TXAST	55	505 PORT RD	FREEPORT	AMERICAN RICE
	TXAST	72	722 S AVE B	FREEPORT	AGIN SHRIMP PACKERS
	TXAST	72	722 S AVE B	FREEPORT	AGIN SHRIMP PACKERS

Sites Sorted By Distance from Center

Distance/Direction		Database	Site Number	Address	City/State	Site Name
.16						
		erns	8	618 E. SECOND	FREEPORT	
		erns	8	618 E. SECOND	FREEPORT	
		erns	8	618 E. SECOND	FREEPORT	
.17						
		TXUST	19	1021 W BROAD	FREEPORT	FREEPORT CO & TOLL
		TXUST	20	1024 W BROAD ST	FREEPORT	DIAMOND FOOD MART 3
		TXUST	20	1024 W BROAD ST	FREEPORT	DIAMOND FOOD MART 3
		TXUST	20	1024 W BROAD ST	FREEPORT	DIAMOND FOOD MART 3
		NFRAP	64	608 E 2ND STREET	FREEPORT	STAUFFER CHEMICAL CO PHOSPHO
.18						
		TXUST	59	515 PETE SCHAFF BLVD	FREEPORT	BRAZOS RIVER HARBOR NAV DISTRI
		ERNS	69	700 PETE SCHAFF BLVD MAINTENANCE	FREEPORT	DOLE FRESH FRUIT
		ERNS	69	700 PETE SCHAFF BLVD MAINTENANCE	FREEPORT	DOLE FRESH FRUIT
.19						
		TXUST	37	200 W 2ND	FREEPORT	VACANT LOT
		TXUST	37	200 W 2ND	FREEPORT	VACANT LOT
		TXUST	37	200 W 2ND	FREEPORT	VACANT LOT
		TXUST	37	200 W 2ND	FREEPORT	VACANT LOT
		RCRA-G	41	222 W SECOND ST	FREEPORT	TEXAS CREWBOATS
		RCRA-G	42	225 E PARK AVE	FREEPORT	MASCO OPERATORS INC
		TXLUST	44	230 W 2ND	FREEPORT	SHAMROCK MINI MART
		TXUST	45	231 W 2ND ST	FREEPORT	SHAMROCK MINI EXPRESS
		TXUST	45	231 W 2ND ST	FREEPORT	SHAMROCK MINI EXPRESS
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
		TXUST	46	240 W 2ND ST	FREEPORT	INTERMEDICS INC
	W	**TXAST**	60	516 LEVEE RD	FREEPORT	EAST LEVEE PUMP STATION
	W	**TXAST**	60	516 LEVEE RD	FREEPORT	EAST LEVEE PUMP STATION
		TXUST	68	626 W 2ND	FREEPORT	GIROUARDS INC
		TXUST	68	626 W 2ND	FREEPORT	GIROUARDS INC
.21						
		TXUST	62	602 W 2ND ST	FREEPORT	ABANDONED STATION
		TXUST	62	602 W 2ND ST	FREEPORT	ABANDONED STATION
		TXUST	62	602 W 2ND ST	FREEPORT	ABANDONED STATION
		TXUST	62	602 W 2ND ST	FREEPORT	ABANDONED STATION
		TXUST	62	602 W 2ND ST	FREEPORT	ABANDONED STATION
		TXUST	62	602 W 2ND ST	FREEPORT	ABANDONED STATION
.22						
		erns	6	226 WEST PARK AVE ARCO SEAWAY D	FREEPORT	DSD SHIPPING
		TXAST	15	1001 PINE ST	FREEPORT	BRAZOS RIVER HARBOR NAVIGATIO
		TXUST	15	1001 PINE ST	FREEPORT	BRAZOS RIVER HARBOR NAVIGATIO
		TXUST	15	1001 PINE ST	FREEPORT	BRAZOS RIVER HARBOR NAVIGATIO
		ERNS	16	1001 PINE ST	FREEPORT	MCDERMOTT MARINE CONSTRUC

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
.23					
	TXUST	61	530 W 2ND	FREEPORT	CARLOS GARAGE
.24					
	TXLUST	54	430 W 2ND ST	FREEPORT	MECHANIC SHOP
	TXUST	54	430 W 2ND	FREEPORT	MECHANIC SHOP
	TXUST	54	430 W 2ND	FREEPORT	MECHANIC SHOP

Distance/Direction	Database	Site Number	Address	City/State	Site Name
.25					
	TXSPILL	3	SCRUBBER	FREEPORT	GULF CHEMICAL & METALLURGICAL
	RCRA-G	3	302 MIDWAY RD	FREEPORT	GULF CHEMICAL & METALLURGICAL
	TXSPILL	3	#1 ESP OFF RASTER #4,GULF CHEMICAL	FREEPORT	GULF CHEMICAL & METALLURGICAL
	TXLUST	3	302 MIDWAY	FREEPORT	GULF COAST METALLURGICAL
	TXAST	3	302 MIDWAY RD	FREEPORT	GULF CHEMICAL & METALLURGICAL
	RCRA TSD	3	302 MIDWAY RD	FREEPORT	GULF CHEMICAL & METALLURGICAL
	TXUST	3	302 MIDWAY RD	FREEPORT	GULF CHEMICAL & METALLURGICAL
	RCRA-G	3	302 MIDWAY RD	FREEPORT	CHEMICAL SPECIALTIES INC
	TXSPILL	3	ESP 1&2, GULF CHEMICAL & METALLUR	FREEPORT	GULF CHEMICAL & METALLURGICAL
	CERCLIS	3	BRAZORIA COUNTY RD 756	FREEPORT	GULFCO MARINE MAINTENANCE
	TXSPILL	3	ESP 1&2	FREEPORT	GULF CHEMICAL & METALLURGICAL
	TXSPILL	3	ELECTRIC ARC FURNACE BUILDING	FREEPORT	GULF CHEMICAL & METALLURGICAL
	TXSPILL	3	ESP 1 & 2	FREEPORT	GULF CHEMICAL & METALLURGICAL
	NFRAP	3	302 MIDWAY	FREEPORT	GULF CHEM & METALLURGICAL
	NFRAP	3	302 MIDWAY RD/PO DRAWER FF	FREEPORT	MINERAL RESEARCH & DEVELOPME
	TXSPILL	3	ESP NO. 1	FREEPORT	GULF CHEMICAL & METALLURGICAL
	CORRACT	3	302 MIDWAY RD	FREEPORT	GULF CHEMICAL & METALLURGICAL
	TXSPILL	3	UNIT NO. 1, 302 MIDWAY ROAD, FREEPO	FREEPORT	GULF CHEMICAL & METALURGICAL
	TXUST	3	302 MIDWAY RD	FREEPORT	GULF CHEMICAL & METALLURGICAL
	erns	9	701 S AVE D	FREEPORT	UNION PACIFIC
	erns	9	701 SOUTH AVENUE D	FREEPORT	
	erns	10	823 COAST GUARD DR.	FREEPORT	USCG-CUTTER KNIGHT ISLAND
	TXAST	32	1324 PINE ST	FREEPORT	PINE STREET PUMP STATION
	RCRA-G	33	1800 W SECOND	FREEPORT	BRAZOSPORT ISD
	TXUST	33	1800 W 2ND ST	FREEPORT	BRAZOSPORT ISD
	TXUST	34	1852 1/2 W 2ND ST	FREEPORT	THREE 71
	TXUST	34	1852 1/2 W 2ND ST	FREEPORT	THREE 71
	TXUST	34	1852 1/2 W 2ND ST	FREEPORT	THREE 71
	TXUST	34	1852 1/2 W 2ND ST	FREEPORT	THREE 71
	TXUST	34	1852 1/2 W 2ND ST	FREEPORT	THREE 71
	TXUST	34	1852 1/2 W 2ND ST	FREEPORT	THREE 71
	TXUST	63	603 S AVE D	FREEPORT	LIQUID CARBONIC IND MED CORP
	ERNS	63	603 SOUTH AVENUE D	FREEPORT	LIQUID CARBONIC
	ERNS	70	701 S AVENUE D	FREEPORT	BASF
	TXUST	74	817 S AVE D	FREEPORT	AREA SUPPLY
	TXUST	74	817 S AVE D	FREEPORT	STANLEY CONSTRUCTION CO
	ERNS	76	823 COAST GUARD DRIVE	FREEPORT	USCG-STATION FREEPORT
	TXLUST	76	823 COAST GUARD DR	SURFSIDE	USCG STATION FREEPORT
	TXAST	77	901 S AVE D	FREEPORT	PLANT NO 2
	TXAST	77	901 S AVE D	FREEPORT	PLANT NO 2
	TXUST	77	901 S AVE D	FREEPORT	PLANT NO 2
	ERNS	77	901 S AVE D	FREEPORT	SOUTHERN MATERIALS
	TXUST	77	901 S AVE D	FREEPORT	PLANT NO 2
	TXUST	79	91 FORT VELASCO DR	SURFSIDE BEACH	STOP N GO 2506
	TXUST	79	91 FORT VELASCO DR	SURFSIDE BEACH	STOP N GO 2506
	TXUST	79	91 FORT VELASCO DR	SURFSIDE BEACH	STOP N GO 2506
	TXLUST	80	917 S AVE D	FREEPORT	STANLEY CONSTRUCTION
	TXAST	80	917 S AVENUE D	FREEPORT	FFREEPORT

441591.00

Sites Sorted By Distance from Center

Freeport EIS, Freeport, TX

Distance/Direction		Database	Site Number	Address	City/State	Site Name
.35						
		TXLUST	26	118 WEST 5TH STREET	FREEPORT	GULF STATES INC
		TXLUST	31	131 E 5TH ST	FREEPORT	FREEPORT DRIVE IN GROCERY
.36						
	N	**TXLUST**	13	10 S GULF BLVD	FREEPORT	TRACOR HYDRO SERVICES INC
.4						
		TXLUST	48	320 S GULF BLVD	FREEPORT	DIAMOND FOOD MART 2
		TXLUST	48	320 SOUTH GULF BLVD	FREEPORT	DIAMOND FOOD MART 2
.45						
		TXLUST	35	1922 4TH ST	FREEPORT	STOP N GO 2597
.47						
	N	**TXLUST**	75	823 BRAZOSPORT BLVD	FREEPORT	DIRTYS TATTOOS & SIGNS
	N	**TXLUST**	81	923 N GULF BLVD	FREEPORT	WILSON OIL CO SHELL STATION
1.						
	N	**CORRACT**	67	6213 E HIGHWAY 332 STE I	FREEPORT	RHONE POULENC
	N	**CORRACT**	71	702 FM 523	FREEPORT	SCHENECTADY INTERNATIONAL INC

Distances given are tenths of a statute mile.

Sites Sorted By Distance from Center

Site Location Unknown

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	ERNS	unknown	MOBIL DOCKS 2311 FM 1495	BRAZORIA	
	ERNS	unknown	FARM RD 1495 AND COUNTY RD 229	FREEPORT	
	ERNS	unknown	PLANT A, IN THE ETHYLENE AMINES PL	BRAZORIA	
	ERNS	unknown	FARM RD 1495 AND COUNTY RD 229	BRAZORIA	
	ERNS	unknown	COUNTRY RD 229 AND FARM RD 1495 JU	FREEPORT	
	ERNS	unknown	INTRACOASTAL CANAL MILE 401 WEST	FREEPORT	
	ERNS	unknown	FARM RD 1495 AND COUNTY RD 229	FREEPORT	
	ERNS	unknown	OLD QUINTANA RD	BRAZORIA	
	ERNS	unknown	BRAZOS #453 "A" PLATFORM 29-30N 95-	BRAZOS	
	ERNS	unknown	PLANT A AT FM 1495 AND 229 RD	FREEPORT	
	ERNS	unknown	TERMINAL #1, DOCK #2 QUINTANA RD	BRAZORIA	
	ERNS	unknown	PLANT A FARM ROAD 295 COUNTY RD 2	FREEPORT	
	ERNS	unknown	BRAZOS RIVER MM 394	BRAZORIA	
	ERNS	unknown	PLANT A, FM 1495 AND CO RD 229 1/2 MI	BRAZORIA	
	ERNS	unknown	AT PLANT A ON FARM RD 1495 AND CO	BRAZORIA	
	ERNS	unknown	SOUTHWEST CORNER OF SLIP / MOBIL	FREEPORT	
	ERNS	unknown	BRAZOS HARBOR	FREEPORT	
	ERNS	unknown	A6 DOCK PLANT A AT FARM RD 1495 AN	FREEPORT	
	ERNS	unknown	BRAZOS RIVER	FREEPORT	
	ERNS	unknown	PLANT A FARM RD 1495 AND COUNTY R	FREEPORT	
	ERNS	unknown	A8 DOCK PLANT A FARM RD. 1495 AND	BRAZORIA	
	ERNS	unknown	OLD BRAZOS RIVER	BRAZORIA	
	ERNS	unknown	OLD BRAZOS RIVER CLOSE TO THE ME	FREEPORT	
	ERNS	unknown	QUINTANA RD IN THE OLD BRAZOS RIVE	FREEPORT	
	ERNS	unknown	FARM RD 1495 AND CTY 229	BRAZORIA	
	ERNS	unknown	PLANT A 1800 BLOCK / FARM MARKET IN	BRAZORIA	
	ERNS	unknown	FM 1495 AND CTY 229	FREEPORT	
	ERNS	unknown	FARM MARKET 1495 AND CNTY RD 229	FREEPORT	
	ERNS	unknown	AT THE PLANT FM 1495 CR229	FREEPORT	
	ERNS	unknown	MOBIL MARINE BASE, 2311 FM 1495	FREEPORT	
	ERNS	unknown	FM 1495 AND CR 229	FREEPORT	
	ERNS	unknown	MOBIL MARINE DOCK 2311 FM 1495	FREEPORT	
	ERNS	unknown	PLANT A ON FM 1495 & COUNTY ROAD 2	FREEPORT	
	ERNS	unknown	FM 1495 AND CR 229 PLANT A A3200 BL	FREEPORT	
	ERNS	unknown	FARM MARKET 1495 AND COUNTY RD 22	FREEPORT	
	ERNS	unknown	FARM DE MARKET 1495 AND COUNTY R	FREEPORT	
	ERNS	unknown	MILE 396 ON OLD BRAZOS RIVER	BRAZORIE	
	ERNS	unknown	PLANT A FARM RD 1495 CNTY RD 229	FREEPORT	
	ERNS	unknown	A8 DOCK, PLANT A (BRAZOS HARBOR)	FREEPORT	
	ERNS	unknown	MOBIL DOCK 2311 SM 1495	FREEPORT	
	ERNS	unknown	FARM RD. 1495 AND COUNTY RD. 229	FREEPORT	
	ERNS	unknown	FARM RD 1495 AND COUNTY RD 229	FREEPORT	
	ERNS	unknown	FARM RD 1495 AND COUNTY RD 229	FREEPORT	
	ERNS	unknown	PLANT A FACILITY FARM RD 1495 AND C	FREEPORT	
	ERNS	unknown	PLANT A FARM RD 1495 AND COUNTY R	BRAZORIA	
	ERNS	unknown	A-FACILITY FARM ROAD 1495 AND COUN	BRAZORIA	
	ERNS	unknown	INTERSECT OF COUNTY RD 229 AND FA	FREEPORT	
	ERNS	unknown	BRAZOS CHANNEL AT A6 DOCK	FREEPORT	
	ERNS	unknown	PLANT A FARM RD 1495 AND CO RD 229	FREEPORT	
	ERNS	unknown	FARM DE MARKET 1495 AND COUNTY R	FREEPORT	

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	ERNS	unknown	BRAZOS BLOCK 23, A	BRAZOS	
	ERNS	unknown	FM 1495 AND COUNTY RD 229	FREEPORT	
	ERNS	unknown	BRAZOS RIVER	FREEPORT	
	ERNS	unknown	A-22 DOCK 2301 BRAZOSPORT BLVD	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER NEAR WESTERN SE	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER MM:NONE	FREEPORT	
	ERNS	unknown	BRAZOS RIVER NEAR CG STA	FREEPORT	
	ERNS	unknown	BRAZOS 376	BRAZOS	
	ERNS	unknown	AT BRAZOS RIVER AND ICW	FREEPORT	
	ERNS	unknown	QUINTANA RD	FREEPORT	
	ERNS	unknown	QUINTANA RD	FREEPORT	
	ERNS	unknown	QUINTANA RD	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER AT WESTERN SEAF	FREEPORT	
	ERNS	unknown	QUINTANA RD SOUTH OF NO.4 DOCK	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER STANCO DOCK	FREEPORT	
	ERNS	unknown	OCSG #3938 BRAZOS A23	BRAZOS	
	ERNS	unknown	OLD BRAZOS RIVER G AND G ICEHOUSE	FREEPORT	
	ERNS	unknown	1.75MI E OF INTERSECTION OF FMR 149	FREEPORT	
	erns	unknown	WEST BRAZOS STREET / OLD BRAZOS R	FREEPORT	
	erns	unknown	WEST BRAZOS STREET / OLD BRAZOS R	FREEPORT	
	erns	unknown	WEST BRAZOS STREET / OLD BRAZOS R	FREEPORT	
	ERNS	unknown	FREEPORT INTERCOASTAL WATERWAY	FREEPORT	
	ERNS	unknown	FREEPORT TWO TERMINAL	FREEPORT	
	ERNS	unknown	FREEPORT INTERCOASTAL WATERWAY	FREEPORT	
	ERNS	unknown	BRAZOS RIVER MM:NONE	FREEPORT	
	ERNS	unknown	QUINTANA RD	FREEPORT	
	ERNS	unknown	COUNTY RD 229 & FARM RD 1495 IN BRA	FREEPORT	
	ERNS	unknown	BRAZOS RIVER BUTCH'S BAIT CAMP	FREEPORT	
	ERNS	unknown	BRAZOS RIVER HWY 288	FREEPORT	
	ERNS	unknown	INTRA-COASTAL WATERWAY AND BRAZ	FREEPORT	
	ERNS	unknown	FM 1495 CR 229	FREEPORT	
	ERNS	unknown	BRAZOS HARBOUR A2 DOCK	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER NEAR FLOOD GATE	FREEPORT	
	ERNS	unknown	FM RD 1495 AND CTY RD 229	FREEPORT	
	ERNS	unknown	BRAZOS NO.105A	BRAZOS AREA	
	ERNS	unknown	PORT OF FREEPORT OLD BRAZOS RIVE	FREEPORT	
	ERNS	unknown	BRAZOS A 105	BRAZOS	
	ERNS	unknown	FARM RD 1495 AND COUNTY RD 229	FREEPORT	
	ERNS	unknown	QUINTANA RD POB 897	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER	FREEPORT	
	ERNS	unknown	BRAZOS HARBOR DOCK 1	FREEPORT	
	ERNS	unknown	BRAZOS A-53	BRAZOS AREA	
	ERNS	unknown	BRAZOS HARBOR	FREEPORT	
	ERNS	unknown	BRAZOS 451A A PLATFORM OCSG # 393	BRAZOS	
	ERNS	unknown	PINE ST. BRIDGE AND WESTON SEAFOO	FREEPORT	
	ERNS	unknown	QUINTANA RD POB 897	FREEPORT	
	ERNS	unknown	QUINTANA RD OLD BRAZOS HARBOR	FREEPORT	
	ERNS	unknown	QUINTANA RD NEAR BERTH NO.2	FREEPORT	
	ERNS	unknown	BRAZOS 105	BRAZOS	
	erns	unknown	OLD BRAZOS RIVER	FREEPORT	

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	erns	unknown	OLD BRAZOS RIVER	FREEPORT	
	erns	unknown	UNKNOWN SHEEN INCIDENT BRAZOS B	BRAZOS AREA	
	erns	unknown	BRAZOS HARBOR	FREEPORT	
	erns	unknown	BRAZOS HARBOR	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER	FREEPORT	
	erns	unknown	UNKNOWN SHEEN INCIDENT OLD BRAZ	FREEPORT	
	erns	unknown	UNKNOWN SHEEN INCIDENT OLD BRAZ	FREEPORT	
	erns	unknown	UNKNOWN SHEEN INCIDENT BRAZOS B	BRAZOS AREA	
	erns	unknown	OLD BRAZOS RIVER	FREEPORT	
	ERNS	unknown	MARINE TERMINAL, BRAZOS HARBOR, D	FREEPORT	
	erns	unknown	INTERSECTION OF INTERCOASTAL WAT	FREEPORT	
	erns	unknown	OLD BRAZOS RIVER / NEAR WESTERN S	FREEPORT	
	erns	unknown	TOP COAT SKAUGEN PETROTRANS RO	FREEPORT	
	erns	unknown	OLD BRAZOS BEACH	FREEPORT	
	erns	unknown	ON BRAZOS RIVER	FREEPORT	
	erns	unknown	VELASCO YARD	FREEPORT	
	erns	unknown	BRAZOS HARBOR PIER NO.3	FREEPORT	
	erns	unknown	OLD BRAZOS RIVER	FREEPORT	
	ERNS	unknown	PLANT A FARM TO MARKET ROAD 1495	FREEPORT	
	ERNS	unknown	QUINTANA ROAD	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER WEST 2ND ST	FREEPORT	
	erns	unknown	ON THE OLD BRAZOS RIVER AT 400 W.	FREEPORT	
	erns	unknown	ON THE OLD BRAZOS RIVER AT 400 W.	FREEPORT	
	erns	unknown	ON THE OLD BRAZOS RIVER AT 400 W.	FREEPORT	
	erns	unknown	BRAZOS BLOCK 453	BRAZOS	
	erns	unknown	BRAZOS BLOCK 453	BRAZOS	
	erns	unknown	UNKNOWN SHEEN INCIDENT BRAZOS B	BRAZOS AREA	
	ERNS	unknown	FM. 1495 AND COUNTRY RD. 229	FREEPORT	
	erns	unknown	UNKNOWN SHEEN INCIDENT OLD BRAZ	FREEPORT	
	erns	unknown	OLD RIVER, EAST OF THE PINE ST BRID	FREEPORT	
	erns	unknown	OLD RIVER, EAST OF THE PINE ST BRID	FREEPORT	
	erns	unknown	OLD RIVER, EAST OF THE PINE ST BRID	FREEPORT	
	erns	unknown	OLD BRAZOS RIVER	FREEPORT	
	erns	unknown	OLD BRAZOS RIVER	FREEPORT	
	erns	unknown	OLD BRAZOS RIVER	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER / TERMINAL 2 QUIN	FREEPORT	
	erns	unknown	BRAZOS BLOCK 453	BRAZOS	
	ERNS	unknown	PLANT A, FARM TO MARKET 1495 AND C	FREEPORT	
	ERNS	unknown	#2 TERMINAL, #1 BERTH OLD BRAZOS	FREEPORT	
	ERNS	unknown	PLANT A, HWY FM 1495 AND CR 229	FREEPORT	
	ERNS	unknown	BRIAN BEACH SWING BARGE, 1495 AND	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER SOUTHSIDE NEAR	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER G AND G ICEHOUSE	FREEPORT	
	erns	unknown	BRAZOS HARBOR	FREEPORT	
	ERNS	unknown	PLANT A FM 1495, COUNTY ROAD 229	BRAZORIA	
	ERNS	unknown	OCSG #3938 BRAZOS A23	BRAZOS	
	ERNS	unknown	PLANT A, COUNTY RD. 229 AND FM 1495	BRAZORIA	
	ERNS	unknown	COUNTY RD 229 AND FM 1495 ON COMP	FREEPORT, NEARES	
	ERNS	unknown	OLD BRAZOS RIVER STANCO DOCK	FREEPORT	
	ERNS	unknown	PLANT A AT FARM DEMARKET RD, 1495	FREEPORT	
	ERNS	unknown	PLANT A SITE NEAR HIGHWAY 1495	BRAZORIA	

Sites Sorted By Distance from Center

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	ERNS	unknown	FM 1495 & CNTY 229	FREEPORT	
	ERNS	unknown	BRAZOS RIVER MM:NONE	FREEPORT	
	ERNS	unknown	PLANT A FARM RD AND 1495 CR229	BRAZORIA	
	ERNS	unknown	PHILIPS NO 2 TERMINAL;NO 1 DOCK;QUI	FREEPORT	
	ERNS	unknown	DOCK 14 WESTERN SEAFOOD OLD BRA	FREEPORT	
	ERNS	unknown	BRAZOS BLOCK 23, A	BRAZOS	
	ERNS	unknown	OLL BRAZOS RIVER BETWEEN HIGHWA	FREEPORT	
	ERNS	unknown	PLANT A, 2700 BLOCK, HIGHWAY 1495	FREEPORT	
	ERNS	unknown	OLD BRAZOS RIVER AT WESTERN SEAF	FREEPORT	
	ERNS	unknown	PLANT A FAC, CNTY RD 229 AND 1495	BRAZORIA	
	ERNS	unknown	FM 1495 AND CR 229	FREEPORT	
	ERNS	unknown	COUNTY RD 229 & FM 1495, PLANT SITE	BRAZORIA	
	ERNS	unknown	PLANT A, AT BLOCK 18, HIGHWAY 523	FREEPORT	
	erns	unknown	AT THE DOCK 2215 FM 1495	FREEPORT	ABDON CALLAIS OFFSHORE
	erns	unknown	AT THE DOCK 2215 FM 1495	FREEPORT	ABDON CALLAIS OFFSHORE
	erns	unknown	AT THE DOCK 2215 FM 1495	FREEPORT	ABDON CALLAIS OFFSHORE
	ERNS	unknown	AT SOUTH EAST FACING SLIP2215 FM 14	FREEPORT	ABDON CALLAIS OFFSHORE
	ERNS	unknown	BRAZOS PORT BIRTH A-22	FREEPORT	ALLIED TOWING CORP.
	ERNS	unknown	BRAZOS PORT BIRTH A-22	FREEPORT	ALLIED TOWING CORP.
	ERNS	unknown	BRAZOS CITY DOCK NO. 5	FREEPORT	AMERICAN DREDGE
	ERNS	unknown	OCSG 6071-WELL A-2 BRAZOS BLOCK 49	BRAZOS	AQUILA ENERGY RESOURCES
	ERNS	unknown	BRAZOS 132-A	BRAZOS AREA	ARCO OIL AND GAS CO.
	ERNS	unknown	FREEPORT 2 MARINE TERMINL BRAZOS	FREEPORT	ARCO PIPELINE COMPANY
	ERNS	unknown	FREEPORT 2 MARINE TERMINL BRAZOS	FREEPORT	ARCO PIPELINE COMPANY
	ERNS	unknown	QUINTANNA RD DOCK #1 BERTH	BRAZORIA	B/V TREM
	ERNS	unknown	PHILIPS PETROLEUM DOCK FREEPORT,	FREEPORT	BRENT TRANSPORTATION
	ERNS	unknown	QUINTANA RD DOCK NO 3	FREEPORT	BROWN AND ROOT
	ERNS	unknown	FREEPORT LIGHTERING AREA	FREEPORT	C/T NYHERON
	ERNS	unknown	OLD BRAZOS RIVER	FREEPORT	CAPTAIN VICTOR
	ERNS	unknown	MONSANTO CHOCOLATE BAYOU BRAZO	FREEPORT	CHERYL K INC.
	ERNS	unknown	BRAZOS A 17	FREEPORT	CHEVRON USA INC
	ERNS	unknown	OLD BRAZOS RIVER WEST OF FLOOD G	FREEPORT	CITY OF FREEPORT
	ERNS	unknown	BRAZOS 368	BRAZOS AREA	COASTAL STATES GAS TRANS
	ERNS	unknown	BRAZOS HARBOR DOCK NO. 2	FREEPORT	CONTAINER SHIP "CONCORD"
	ERNS	unknown	FREEPORT DOCKS	FREEPORT	CREOLE TOWING
	ERNS	unknown	1/4 MILE WEST OF THE BRAZOS RIVER	BRAZORIA	CTC M/V KITTY CENAC
	TXLUST	unknown	BRAZOSPORT BLVD	FREEPORT	DIAMOND MINI MART 5
	ERNS	unknown	QUINTANA RD. DOCK NO. 3	FREEPORT	DIXIE MARINE INC.
	ERNS	unknown	BRAZOS BLOCK 437	BRAZOS	ENSERCH EXPLORATION INC
	TXAST	unknown	RT 2	FREEPORT	ERA HELICOPTERS
	TXSPILL	unknown	BRAZOS HARBOR	FREEPORT	EVANS STEAMSHIP CO.
	ERNS	unknown	BRAZOS 453 A PLATFORM OCSG 4713	BRAZOS	EXXON
	ERNS	unknown	WESTERN SEAFOOD / BRAZOS RIVER	FREEPORT	F/V FISHERMAN IX
	ERNS	unknown	OLD BRAZOS RIVER	FREEPORT	F/V JACK AARON
	ERNS	unknown	WEST BRAZOS WESTERN SEAFOOD DO	FREEPORT	F/V STEPHANY LYNN
	ERNS	unknown	FREEPORT -A- DOCK	FREEPORT	G & H TOWING
	ERNS	unknown	BRAZOS A DOCK FREEPORT HARBOR	FREEPORT	G AND H TOWING COMPANY
	ERNS	unknown	BRAZOS A DOCK FREEPORT HARBOR	FREEPORT	G AND H TOWING COMPANY
	ERNS	unknown	BRAZOS A-133	BRAZOS	GOM SHELF LLC
	ERNS	unknown	POB 896 QUINTANA RD.	FREEPORT	HOLYWOOD MARINE
	ERNS	unknown	QUINTANA ROAD	FREEPORT	INGRAM BARGE LINES

Distance/Direction	Database	Site Number	Address	City/State	Site Name
	LFUN	unknown	JONES CREEK AREA ON BRAZOS RIVER	BRAZORIA	JONES CREEK
	erns	unknown	BRAZOS FLOOD GATES	FREEPORT	KIRBY INLAND MARINE
	erns	unknown	BRAZOS FLOOD GATES	FREEPORT	KIRBY INLAND MARINE
	erns	unknown	BRAZOS FLOOD GATES	FREEPORT	KIRBY INLAND MARINE
	ERNS	unknown	BRAZOS FLOOD GATES	BRAZORIA	KIRBY INLAND MARINE
	ERNS	unknown	FREEPORT TERMINAL #1, DOCK #2, BRA	BRAZORIA	LEBOUF BROTHERS TOWING COMP
	ERNS	unknown	OLD BRAZOS RIVER	FREEPORT	M/V "THUAN HAI"
	ERNS	unknown	OLD BRAZOS RIVER	FREEPORT	M/V "THUAN HAI"
	ERNS	unknown	WEST BRAZOS MOORING	FREEPORT	M/V PHIGIT
	ERNS	unknown	BRAZOS BLOCK A7	BRAZOS	MESA OPERATING LIMITED PA
	erns	unknown	MILE 400 GULF ICW EASTSIDE OF BRAZ	FREEPORT	MO GULF TRANSPORT INC
	TXSPILL	unknown	MOBIL DOCKS AT FM 1495 & INTERCOAS	FREEPORT	MOBIL OIL
	CERCLIS	unknown	COUNTY ROAD 229	FREEPORT	NALCO CHEMICAL COMPANY PLANT
	ERNS	unknown	BRAZOS HARBOR DOCK A	FREEPORT	OBC SHIPPING, INC
	ERNS	unknown	PLATFORM SOUTH BRAZOS	SOUTH BRAZOS	OXYUSA INC.
	erns	unknown	BRAZOS	BRAZOS	PIONEER NATURAL RESOURCES
	erns	unknown	BRAZOS	BRAZOS	PIONEER NATURAL RESOURCES
	erns	unknown	BRAZOS	BRAZOS	PIONEER NATURAL RESOURCES
	ERNS	unknown	BRAZOS HARBOR DOLE FACILITY PIER	FREEPORT	PRINCE ARROW S.A.
	ERNS	unknown	BRAZOS RIVER FLOOD GATES MILE 401	FREEPORT	SABINE TRANSPORTATION
	ERNS	unknown	PHILIPS TERMINAL DOCK NO.2	FREEPORT	SCAN AMERICAN SHIPPING
	ERNS	unknown	BRAZOS BLOCK 552	BRAZOS	SEAGULL ENERGY
	ERNS	unknown	QUINTANA RD	FREEPORT	SEAWAY CRUDE PIPELINE CO
	RCRA-G	unknown	QUINTANA ROAD	FREEPORT	SEAWAY FREEPORT TERMINAL
	ERNS	unknown	BRAZOS 19-C OCS NO.G3936	BRAZOS AREA	SHELL OFFSHORE
	TXSPILL	unknown	BARGE SLIP E OF OLD BRAZOS RIVER N	FREEPORT	SHELL OIL COMPANY
	ERNS	unknown	OLD BRAZOS RIVER RM 397	FREEPORT	STAPP TOWING CO
	ERNS	unknown	DOCK #2 QUINTANA RD	BRAZORIA	STAPP TOWING
	ERNS	unknown	QUINTANA DR	FREEPORT	TEPPCO
	ERNS	unknown	DOCK #2FREEPORT TERMINAL #2QUINT	FREEPORT	TEPPCO
	ERNS	unknown	QUINTANA RD	FREEPORT	TEPPCO CRUDE OIL, LP
	ERNS	unknown	EAST END OF 2ND STREET	FREEPORT	TESORO PETROLEUM INC
	TXSPILL	unknown	US COAST GUARD, 823 COAST GUARD	FREEPORT	U.S. COAST GUARD
	ERNS	unknown	BRAZOS 105 PLATFORM A	BRAZOS AREA	UNICAL
	ERNS	unknown	VELASCO RAIL YARD/ AT INTERSECTIO	FREEPORT	UNION PACIFIC RAILROAD
	TXSPILL	unknown	BRAZOS RIVER, INTO DISCHARGE CANA	FREEPORT	UNKNOWN
	ERNS	unknown	OLD RIVER UNDER VELASCO RD BRIDG	FREEPORT	UNKNOWN
	ERNS	unknown	BRAZOS/ BLOCK 375	BRAZOS	UNOCAL
	TXUST	unknown	BRAZOS RIVER FLOODGATE	FREEPORT	US ARMY CORP ENGR GALVESTON
	TXUST	unknown	BRAZOS RIVER FLOODGATE	FREEPORT	US ARMY CORP ENGR GALVESTON
	TXUST	unknown	BRAZOS RIVER FLOODGATE	FREEPORT	US ARMY CORP ENGR GALVESTON
	TXSPILL	unknown	US COAST GUARD, 823 COAST GUARD	FREEPORT	US COAST GUARD
	TXSPILL	unknown	FREEPORT USCG FACILITY,823 COAST	FREEPORT	USCG
	ERNS	unknown	DOCK #3, BRAZOS HARBOR, OFF QUINT	FREEPORT	VESSEL, JOANN B
	TXLUST	unknown	E 2ND ST	FREEPORT	W H PIERCE JR
	ERNS	unknown	MAINE INDUSTRIAL SPECIALTIES WEST	FREEPORT	WESTERN SEAFOOD
	ERNS	unknown	WILLIAMS BRAZOS PLATFORM, BLOCK I	BRAZOS	WILLIAMS
	erns	unknown	BRAZOS 538	BRAZOS	WILLIAMS FIELD SERVICES
	erns	unknown	BRAZOS 538	BRAZOS	WILLIAMS FIELD SERVICES
	erns	unknown	BRAZOS 538	BRAZOS	WILLIAMS FIELD SERVICES

Appendix D-5

Site Reconnaissance Photos

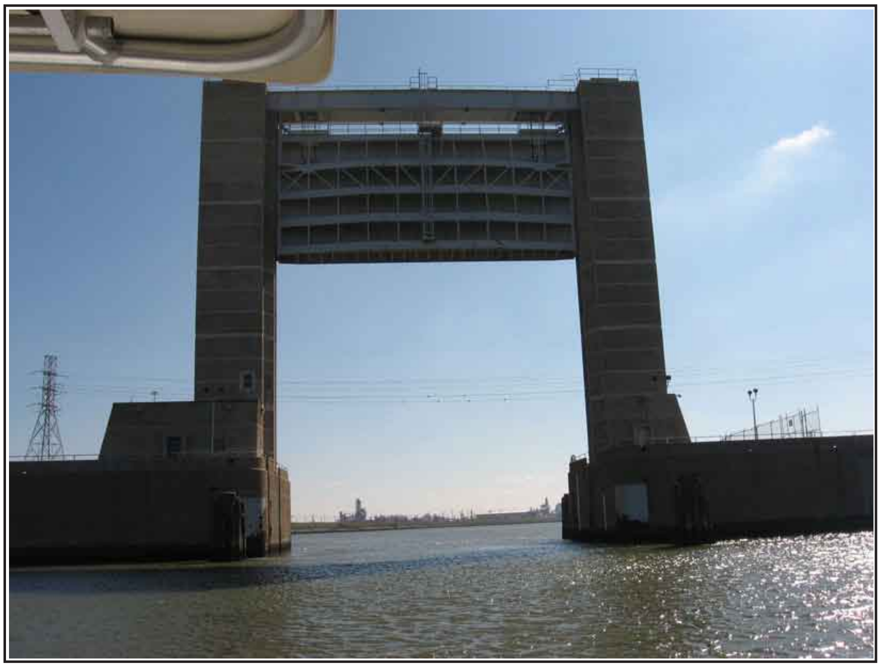

Photo 1 - View of flood control gate located at the northern extent of the project area at the Stauffer Turning Basin, facing northwest.

Photo 2 - View of sign within the Stauffer Turning Basin indicating a gas and petroleum pipeline crossing.

Appendix D-5

SITE PHOTOGRAPHS
HTRW SITE RECONNAISSANCE
FHCIP

Photo 3 - View of two tankers being offloaded at a facility located adjacent to the Brazosport Turning Basin, facing southwest.

Photo 4 - View of an offshore drilling platform (Zeus) docked along the Quintana shoreline, facing south.

Appendix D-5

SITE PHOTOGRAPHS
HTRW SITE RECONNAISSANCE
FHCIP

Photo 5 - View of entrance to Port of Freeport through the Freeport Jetty, facing southeast.

Photo 6 - View of sign within the entrance channel indicating a gas and petroleum pipeline crossing, facing north-east.

Appendix D-5

SITE PHOTOGRAPHS
HTRW SITE RECONNAISSANCE
FHCIP

Appendix E

Programmatic Agreement

PROGRAMMATIC AGREEMENT
REGARDING COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT FOR THE CONSTRUCTION AND MAINTENANCE OF THE FEDERAL FREEPORT HARBOR NAVIGATION CHANNEL IMPROVEMENT PROJECT, BRAZORIA COUNTY, TEXAS
AMONG
THE U.S. ARMY CORPS OF ENGINEERS GALVESTON DISTRICT
THE TEXAS STATE HISTORIC PRESERVATION OFFICER
AND
PORT FREEPORT

WHEREAS, the U.S. Army Corps of Engineers, Galveston District (USACE) has determined that the proposed construction and maintenance of the Federal Freeport Harbor Navigation Channel Improvement Project (hereinafter, "undertaking") may have an effect on properties eligible for inclusion in the National Register of Historic Places (NRHP) (hereinafter, "historic properties") pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C § 470) (hereinafter "NHPA") and its implementing regulation, "Protection of Historic Properties," (36 CFR 800); and

WHEREAS, the existing Federal Freeport Harbor Navigation Channel (FHNC) is administered by the USACE under the authority of Section 101 of the River and Harbor Act of 1970 (P.L. 91-611), and the USACE is studying FHNC operation under the authority of Section 216 of the Flood Control Act of 1970 (P.L. 91-611) which provides for review of completed projects when found advisable due to significantly changed physical or economic conditions; and

WHEREAS, Port Freeport (Port) is the non-federal partner with the USACE for this undertaking and is providing all lands, easements, rights-of-way, relocations, removals, and upland placement areas necessary for the project construction and operation; and

WHEREAS, the size of the project area and the number of alternatives being studied for proposed channel improvements make it necessary to defer final identification and evaluation of historic properties until authorization of proposed improvements is obtained; and

WHEREAS, the USACE, the Texas State Historic Preservation Officer (SHPO), and the Port agree that it is advisable to accomplish compliance with Section 106 through the development and execution of this Programmatic Agreement (PA) in accordance with § 800.6 and § 800.14(b)(3); and

WHEREAS, the USACE has invited the Advisory Council on Historic Preservation (Council) to determine whether the Council wishes to enter into the Section 106 process; and

NOW, THEREFORE, the USACE, the SHPO and the Port, agree that the proposed undertaking shall be implemented in accordance with the following stipulations in order to take into account the effects of the undertaking on historic properties and to satisfy the USACE's Section 106 responsibilities for all individual aspects of the undertaking.

Stipulation I

Identification, Evaluation, Effect Determination and Resolution

A. *Scope of Undertaking.* This PA shall be applicable to all new Federal construction activities related to the proposed undertaking and activities related to maintenance dredging of the Federal project. The Area of Potential Effects of the Federal undertaking (APE) shall be established by the USACE in consultation with the SHPO and shall include all areas to be directly affected by new dredging and channel construction, construction staging and access areas, new or extensions of existing placement areas, ecological mitigation features, areas affected by the beneficial uses of dredged material, and ongoing maintenance dredging activities related to the FHNC project.

B. *Qualifications and Standards.* The USACE shall ensure that all work conducted in conjunction with this PA is performed in a manner consistent with the Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation (48 Federal Register 44716-44740; September 23, 1983), as amended, or the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR 68), as appropriate.

C. *Definitions.* The definitions set forth in § 800.16 are incorporated herein by reference and apply throughout this PA.

D. *Identification of Historic Properties.* Prior to the initiation of construction or maintenance activities of the undertaking, the USACE shall make a reasonable and good faith effort to identify historic properties located in the APE. These steps may include, but are not limited to, background research, consultation, oral history interviews, sample field investigation and field survey. The level of effort for these activities shall be determined in consultation with the SHPO, the Port, Native American Indian tribes that attach religious and cultural significance to identified historic properties and any other consulting party. If no historic properties are identified in the APE, the USACE shall document this finding pursuant to § 800.11(d) and retain this documentation in USACE files for at least seven (7) years.

E. *Evaluation of National Register Eligibility.* If historic properties are identified within the APE, the USACE shall determine their eligibility for the National Register of Historic Places in accordance with the process described in § 800.4(c) and criteria established in 36 CFR 60. The determination of cultural significance shall be conducted in consultation with the SHPO, the Port, Native American Indian tribes that attach religious and cultural significance to identified historic properties and any other consulting party. Should the USACE and the SHPO agree that a property is or is not eligible, such consensus shall be deemed conclusive for the purpose of the PA. Should the USACE and SHPO not agree regarding the eligibility of a property, the USACE shall obtain a determination of eligibility from the Keeper of the National Register pursuant to 36 CFR 63.

F. *Assessment of Adverse Effects.*

1. *No Historic Properties Affected.* The USACE shall make a reasonable and good faith effort to evaluate the effect of each undertaking on historic properties in the APE. The USACE may conclude that no historic properties are affected by an undertaking if no historic properties are present in the APE, or the undertaking will have no effect as defined in §800.16(i). This finding shall be documented in compliance with § 800.11(d) and the documentation shall be retained by the USACE for at least seven (7) years. The USACE shall provide information on the finding to the public upon request, consistent with the confidentiality requirements of § 800.11(c).

2. *Finding of No Adverse Effect.* The USACE, in consultation with the SHPO, the Port, Native American Indian tribes that attach religious and cultural significance to identified historic properties and any other consulting party, shall apply the criteria of adverse effect to historic properties within the APE in accordance with § 800.5. The USACE may propose a finding of no adverse effect if the undertaking's effects do not meet the criteria of § 800.5(a)(1) or the undertaking is modified to avoid adverse effects in accordance with 36 CFR 68. The USACE shall provide to the SHPO documentation of this finding meeting the requirements of § 800.11(e). The SHPO shall have 30 calendar days in which to review the findings and provide a written response to the USACE. The USACE may proceed upon receipt of written concurrence from the SHPO. Failure of the SHPO to respond within 30 days of receipt of the finding shall be considered agreement with the finding. The USACE shall maintain a record of the finding and provide information on the finding to the public upon request, consistent with the confidentiality requirements of § 800.11(c).

3. *Resolution of Adverse Effect.* If the USACE determines that the undertaking will have an adverse effect on historic properties as measured by criteria in § 800.5.(a)(1), the agency shall consult with the SHPO, the Port, Native American Indian tribes that attach religious and cultural significance to identified historic properties and any other consulting party to resolve adverse effects in accordance with § 800.6.

a. For historic properties that the USACE and the SHPO agree will be adversely affected, the USACE shall:

1) Consult with the SHPO to identify other individuals or organizations to be invited to become consulting parties. If additional consulting parties are identified, the USACE shall provide them copies of documentation specified in § 800.11(e) subject to confidentiality provisions of § 800.11(c).

2) Afford the public an opportunity to express their views on resolving adverse effects in a manner appropriate to the magnitude of the project and its likely effects on historic properties.

3) Consult with the SHPO, the Port, Native American tribes which have indicated an interest in the undertaking, and any other consulting parties to seek ways to avoid, minimize or mitigate adverse effects.

4) Prepare an historic property treatment plan which describes mitigation measures the USACE proposes to resolve the undertaking's adverse effects and provide this plan for review and comment to the SHPO, the Port, Native American tribes which have indicated an interest in the undertaking, and any other consulting parties. All parties shall have 30 calendar days in which to provide a written response to the USACE.

b. If the USACE and SHPO fail to agree on how adverse effects will be resolved, the USACE shall request that the Council join the consultation and provide the Council with documentation pursuant to § 800.11(g).

1) If the Council agrees to join the consultation, the USACE shall proceed in accordance with § 800.9.

2) If, after consulting to resolve adverse effects pursuant to Stipulations I, II or IV of this PA, the Council, USACE or SHPO determines that further consultation will not be productive, then any party may terminate consultation in accordance with the notification requirement and process prescribed by § 800.7.

Stipulation II

Post Review Changes and Discoveries

A. *Changes in the Undertaking.* If construction on the undertaking has not commenced and the USACE determines that it will not conduct the undertaking as originally coordinated, the USACE shall reopen consultation pursuant to Stipulation I E – F.

B. *Unanticipated Discoveries or Effects.* Pursuant to § 800.13(a)(2), if historic properties are discovered or unanticipated effects on historic properties are found after construction on an undertaking has commenced, the USACE shall develop a treatment plan to resolve adverse effects and notify the SHPO, the Port, Native American Indian tribes that attach religious and cultural significance to identified historic properties and any other consulting party within two working days of the discovery. The notification shall include the USACE assessment of National Register eligibility of affected properties and proposed actions to resolve the adverse effects. Comments received from the SHPO, the Native American tribes or other consulting party within two working days of the notification shall be taken into account by the USACE in carrying out the proposed treatment plan. The USACE may assume SHPO concurrence in its eligibility assessment unless otherwise notified by the SHPO. The USACE shall provide the SHPO, the Port, Native American Indian tribes that attach religious and cultural significance to identified historic properties and any other consulting party which have expressed an interest in the undertaking a report of the USACE actions when they are completed.

Stipulation III

Curation and Disposition of Recovered Materials and Records

The USACE shall ensure that all archeological materials and associated records owned by the State of Texas or Port, which result from identification, evaluation, and treatment efforts conducted under this PA, are accessioned into a curational facility that has been certified or granted provisional status by the Texas SHPO in accordance with the Texas Administrative Code, Title 13, Part 2, Chapter 29.6 and meets the standards of 36 CFR 79, except as specified in Stipulation IV for human remains. Management and care of artifacts and collections shall follow the Texas Administrative Code, Title 13, Part 2, Chapter 29. Archeological items and materials from privately-owned lands in Texas shall be returned to their owners upon completion of analyses required for Section 106 compliance under this PA.

Stipulation IV

Treatment of Human Remains

A. *Prior Consultation of Native American Burials*: If the USACE investigations conducted pursuant to Stipulation I of this PA indicate a high likelihood that Native American Indian human remains may be encountered, the USACE shall develop a treatment plan for these remains in consultation with the SHPO, the Port, Native American Indian tribes that attach religious and cultural significance to identified historic properties and any other consulting party. The USACE shall ensure that tribes indicating an interest in the undertaking are afforded a reasonable opportunity to identify concerns, advise on identification and evaluation, and participate in the resolution of adverse effects in compliance with the terms of this PA.

B. *Inadvertent Discovery*. Immediately upon the inadvertent discovery of human remains during historic properties investigations or construction activities conducted pursuant to this PA, the USACE shall ensure that all ground disturbing activities cease in the vicinity of the human remains and any associated grave goods. Within two working days of the discovery, the USACE shall initiate consultation with the SHPO, Native American Indian tribes and any other consulting party that might attach religious and cultural significance to identified historic properties. The USACE shall consult with the SHPO, Native American Indian tribes and other consulting party which have expressed an interest in the undertaking in an effort to develop a plan for resolving the adverse effects.

C. *Advisory Council on Historic Preservation Policy Statement regarding Treatment of Burial Sites, Human Remains and Funerary Objects effective 23 February 2007:* This policy applies to all Federal Agencies with Undertakings that are subject to review under Section 106 of the NHPA. To be considered under Section 106, the burial site must be or be a part of an historic property, meaning that it is listed or eligible for listing in the National Register of Historic Places. This policy shall be applied if the burial site meets this criterion.

D. *Dispute Resolution*. If, during consultations conducted under paragraphs A and B of this stipulation, all consulting parties cannot agree upon an consensus plan for resolving adverse effects, the matter shall be referred to the Council for resolution in accordance with the procedures outlined in § 800.9.

Stipulation V

PA Amendments, Disputes and Termination

A. *Amendments*. Any party to this PA may propose to the other parties that it be amended, whereupon the parties shall consult in accordance with § 800.6(c)(7) to consider such an amendment.

B. *Disputes*. Disputes regarding the completion of the terms of this agreement shall be resolved by the signatories. If the signatories cannot agree regarding a dispute, any one of the signatories may request the participation of the ACHP in resolving the dispute in accordance with the procedures outlined in § 800.9.

C. *Termination of PA*. Any party to this PA may terminate it by providing sixty (60) days notice to the other parties, provided that the parties shall consult during the period prior to the termination to seek agreement on amendments or other actions that will avoid termination. In the event of termination of this PA by the SHPO, the USACE shall comply with the provisions of § 800 Subpart B.

Stipulation VI

Termination of Consultation

If, after consulting to resolve adverse effects pursuant to Stipulation I, II or IV of this PA, the USACE or SHPO determines that further consultation will not be productive, then either party may terminate consultation in accordance with the notification requirements and process prescribed by § 800.7.

Stipulation VII
Term of this Agreement

This PA remains in force for a period of ten (10) years from the date of its execution by all signatories. Sixty (60) days prior to the conclusion of the ten (10) year period, the USACE shall notify all parties in writing of the end of the ten year period to determine if they have any objections. If there are no objections received prior to expiration, the PA shall continue to remain in force for a new ten (10) year period.

DISTRICT ENGINEER, U.S. ARMY CORPS OF ENGINEERS, GALVESTON

MARCH 14, 2008

Colonel David C. Weston, District Engineer **Date**

TEXAS STATE HISTORIC PRESERVATION OFFICER

3/31/08

F. Lawerence Oaks, Texas State Historic Preservation Officer **Date**

PORT FREEPORT

James F. Brown, Jr.

MARCH 27, 2008

James F. Brown Jr., Chairman of the Board of Commissioners **Date**

Appendix F

Socioeconomic Baseline Conditions

Appendix F

Socioeconomic Baseline Conditions

1.0 SOCIOECONOMIC RESOURCES

This section presents a summary of economic and demographic characteristics of the study area within Brazoria County. Data were collected for Brazoria County and for the towns and cities that are within the study area (Figure 1). Population, employment, the area economy, a historical perspective of economic development, and Environmental Justice (EJ) are key areas of discussion.

1.1 Population

The proposed action involves widening and deepening of the existing navigation channels and turning basins as well as extending the Freeport Entrance Channel farther into the Gulf of Mexico (Gulf) (see Tables 2.4-1 and 2.4-2 of Final Environmental Impact Statement [FEIS]). The study area includes Brazoria County as well as the following towns/cities: Alvin, Angleton, Bailey's Prairie, Bonney, Brazoria, Brookside Village, Clute, Danbury, Freeport, Hillcrest, Holiday Lakes, Iowa Colony, Jones Creek, Lake Jackson, Liverpool, Manvel, Oyster Creek City, Pearland, Quintana, Richwood, Surfside Beach, Sweeny, and West Columbia.

The proposed action is located in Brazoria County with a 2009 population of 304,844 persons. Brazoria County maintained steady growth, increasing by 13 percent between 1980 and 1990, by 26 percent between 1990 and 2000, and 26 percent between 2000 and 2009 (Tables 1 and 2). Populations given for the study area towns/cities represent 2009 population estimates (Texas State Data Center, 2010). The City of Freeport, population 13,677, is located south of Oyster Creek (population 1,429), which is located northwest of the proposed action, while Quintana (population 37) and Surfside Beach (population 922) compose the southern portion of the study area. Located northwest of Freeport is Angleton (population 20,133), Bailey's Prairie (population 789), Lake Jackson (population 29,205), and Richwood (population 3,663). Bonney (population 425) is north of Angleton, and Liverpool (population 469) is east of Bonney. West Columbia (population 4,519) is west of Bailey's Prairie and northwest of Brazoria (population 3,120) and Jones Creek (population 2,294). Sweeny (population 3,985) is west of Brazoria (see Figure 1).

Population projections provided by the Texas Water Development Board (TWDB) 2006 Regional Water Plan indicate that population in Brazoria County is expected to grow at a similar rate as state growth rates through 2040. Brazoria County is projected to grow 37 percent from 2009 to 2040, while the State of Texas is projected to grow 50 percent during the same time (see Table 2). In addition, towns/cities within the study area are also expected to grow between 2009 and 2040. Cities that are expected to have the greatest growth include Freeport (82 percent increase), Oyster Creek (48 percent increase), and Brookside Village (47 percent increase). A few communities are not expecting any growth. These include Manvel (53 percent decrease), West Columbia (14 percent decrease), Jones Creek (7 percent decrease), and Brazoria with a 3 percent decrease (see Table 2).

Approximately 71 homes were destroyed by Hurricane Ike in 2008. Of those, 53 were owner-occupied, and 18 were renter-occupied. Home values vary by area. For instance, values in the Alvin area show an increase, while Pearland and Angleton have decreased since 2008. Overall, home values in the Brazosport area had risen in 2008 but were brought down, approximately $38 million decrease in total value, from the damage to the coast during the hurricane (U.S. Department of Homeland Security, 2008). Due to the expected overall growth within the study area, a likely concern could include the amount of current available housing. A multiple listing service was reviewed to determine the amount of housing within the study area.

Within the study area, approximately 570 homes are listed for sale. The number of homes for sale in specific price ranges are as follows: $1.8–1.0 million (3 homes), $930,000–524,000 (7 homes), $429,000–300,000 (52 homes), $299,900–204,000 (111 homes), $199,900–150,000 (95 homes), $149,900–101,900 (162 homes), $100,000–80,000 (70 homes), $79,900–50,000 (54 homes), and 17 homes in the range $49,900–35,000 (Multiple Listing Service, 2010). As shown, adequate housing is available within the study area to meet the demands of a growing population.

General population characteristics can be ascertained using parameters such as the number of households, age characteristics, median household income, poverty levels, and educational attainment.

The U.S. Census Bureau's 2000 census data were used to identify general population characteristics (Tables 3 through 7). Whenever possible, the most-up-to-date information has been provided to characterize the study area general population. The 2000 data are the most consistent for all parameters at the city/town level.

The study area general population can be characterized as comprising family households with an average family size of 3.23 persons that own their own homes. The largest age cohort was persons between 35 to 49 years of age (25.6 percent), followed by persons 50 to 64 years of age (13.9 percent), and persons 5 to 14 years of age (16.0 percent).

The study area median household income was $48,632, and the total percentage of persons living below the poverty level was 10.2 percent. The majority of the population attained a high school diploma and attended college. However, on average, only 6.9 percent received an Associates Degree, 13.8 percent received a Bachelors Degree, and 5.9 percent received a Graduate or Professional degree.

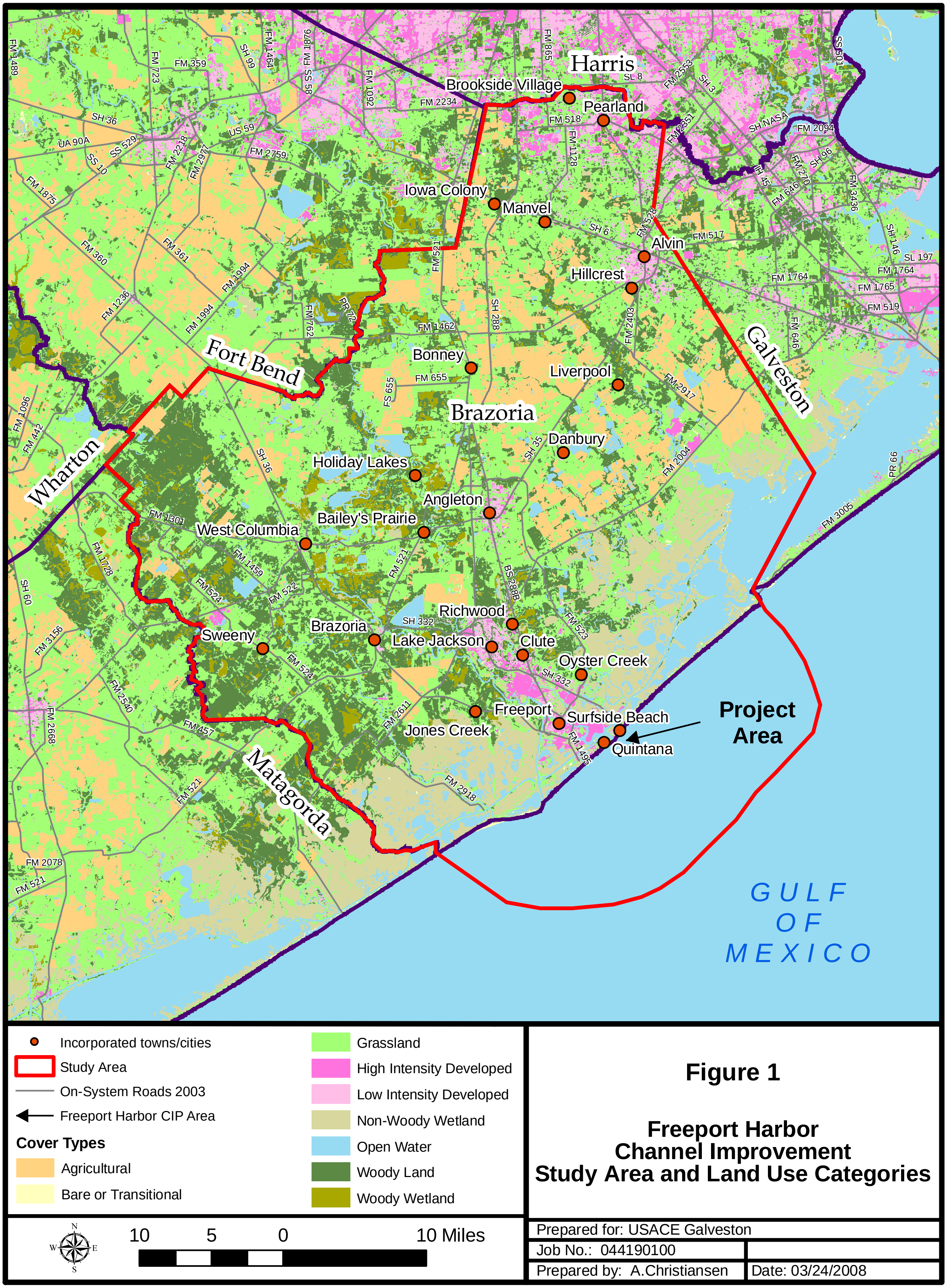

Figure 1

Freeport Harbor Channel Improvement Study Area and Land Use Categories

Prepared for: USACE Galveston

Job No.: 044190100

Prepared by: A.Christiansen | Date: 03/24/2008

File: N:/Clients/U_Z/USACE/Projects/Freeport/044190100/projects/AppF_Fig1.mxd

1.2 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 is offered at different locations for 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 such as healthcare 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 Public Safety. Individual communities are served by police or marshals. All departments have regular 24-hour patrols.

Fire protection within the vicinity of the study area is provided by the various fire departments of the study area cities. The cities of Alvin, Angleton, Clute, Danbury, Manvel, Pearland, Richwood, Sweeny, and West Columbia all have volunteer fire departments. The project area is served by the Freeport Fire Department, which serves the City of Freeport and is a "Combination Department," in that it has 10 full-time employees and 19 reserve members (Stanford, 2007). 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 four 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-foot enclosed fifth-wheel trailer containing a high-pressure breathing air system and hazardous material equipment, three ambulance units, one 55-foot snorkel elevated water fire truck, and two fire boats. The Freeport Fire & Emergency Medical Service Department currently provides service to the City of Freeport and the Village of Quintana. Surfside Beach provides emergency services through the Surfside Beach Police Department, with one full-time employee, one part-time employee, and volunteers (*The Alliance*, 2006a). Law enforcement within the vicinity of 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 Alvin, Angleton, Brazoria, Brookside Village, Clute, Danbury, Hillcrest, Freeport, Jones Creek, Lake Jackson, Manvel, Oyster Creek, Pearland, Quintana, Richwood, Surfside Beach, Sweeny, and West Columbia all provide police protection.

Brazoria County is served by eight different school districts: Alvin Independent School District (ISD), Angleton ISD, Brazosport ISD, Columbia-Brazoria ISD, Damon ISD, Danbury ISD, Pearland ISD, and Sweeny ISD. The Alvin ISD is located in the northeast portion of Brazoria County, and includes 13 elementary schools, 5 middle and junior high schools, 2 high schools, 1 academic alternative school, and 1 behavior alternative school (Alvin ISD, 2010). For the academic year 2008–2009, the enrollment for Alvin ISD was 16,000. Higher education is offered at Alvin Community College. Angleton ISD serves Angleton, Bonney, and Bailey's Prairie and has 5 elementary schools, 1 middle school, 1 intermediate school, 1 high school, and 1 early childhood campus. Enrollment for the academic year 2008–2009 was 6,290 (Texas Education Agency [TEA], 2010). The Brazosport ISD has schools within the communities of Freeport, Oyster Creek, Quintana, and Surfside Beach. The District includes 11 elementary schools, 2 middle schools, 3 intermediate schools, 2 high schools, and an alternative placement center (TEA, 2010). The district had an enrollment of 12,960 for the academic year 2008–2009. Higher education is available through the Brazosport College campus located in Lake Jackson. It is easily accessed from 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 16 majors, which transfer to 4-year schools (Brazosport College, 2006). Columbia-Brazoria ISD serves the cities of West Columbia and Brazoria and includes 3 elementary schools, a junior high, and a high school. The district had an enrollment 3,135 for the academic year 2008–2009 (TEA, 2010). Damon ISD has only one school, Damon Elementary, and serves the city of Damon and the surrounding area. For the academic year 2008–2009, enrollment for Damon ISD was 160 (TEA, 2010). Danbury ISD serves the city of Danbury and the surrounding areas, and encompasses one elementary school, one middle school, and one high school. Enrollment for the academic year 2008–2009 was 757 (TEA, 2010). Pearland ISD serves the cities of Pearland and Brookside Village, and includes 11 elementary schools, 9 middle and junior high schools, 2 high schools, Sheryl Searcy Ninth Grade Center, and the PACE Institute, a 7th and 8th grade campus for special-needs students. For the academic year 2008–2009, enrollment for Pearland ISD was 17,640 (TEA, 2010). Sweeny ISD serves the city of Sweeny and includes an elementary school, junior high school, and high school. Enrollment for the academic year 2008–2009 was 1,968 (TEA, 2010).

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 8.

1.3 Employment

According to the Texas Workforce Commission (TWC), the largest percentages of jobs in Brazoria County are within education and health services, trade, transportation and utilities, and government service sectors. Third-quarter employment in 2007 had a total of 84,819 persons employed in Brazoria County, of which 19 percent were employed in trade, transportation, and utilities, 19 percent in education and health care services, and 18 percent in the government sector. The workforce decreased 3.2 percent from 2007 to 2009, with a total of 82,063 persons employed in Brazoria County for the third quarter of 2009. The top three employment sectors for the third quarter of 2009 were trade, transportation, and utilities (21 percent), the government sector (20 percent), and education and health services (20 percent). Between 2007 and 2009, unemployment rates increased from 4.8 to 7.5 percent (TWC, 2010).

According to the U.S. Census Bureau 2000 data, the class of workers within the study area is similar to the State of Texas when looking at the percentage of government workers and unpaid family workers and has a slightly lower percentage of self-employed workers and a slightly higher percentage of private wage and salary workers (Table 9).

Approximately 55,192 Texas jobs are related to the activity within Port Freeport. The port is responsible for 11,696 direct local jobs, which creates $1.11 billion in personal income, with Brazoria County residents holding 75 percent of those jobs (Port Freeport, 2009). Top employers within the Brazosport area are primarily oil industry/port-related enterprises, healthcare, government, and retail industries (Table 10).

The number of workers who work outside their place of residence but still within the state and county in which they reside is much higher when compared to the State of Texas. The study area has a similar percentage of persons working inside their state of residence (99.1 percent) when compared to the state, with 99.0 percent; the percentage of workers that work inside their county of residence (59.7 percent) is much lower than the state (78.6 percent); and outside their place of residence (75.6 percent) is higher than the State of Texas (44.6 percent) (Table 11).

1.4 Economics

1.4.1 Historical Perspective

The Freeport area has been an important trade and shipping area since the nineteenth century. The navigation of Port 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 (Brazos River Harbor Navigation District [BRHND], 2004).

The first dock and terminal facilities were constructed in the early 1950s, and by 1961, the channel was dredged to a depth of 36 feet. 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. Port Freeport was authorized in 1988 to accept, operate, and maintain a Foreign Trade Zone within its boundaries (BRHND, 2004).

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

To diversify Port Freeport's cargo base, in 2004 the port began major projects that include a cool storage facility to handle temperature-sensitive commodities; construction of Berth 7, to accommodate vessels up to 48-foot draft; and the signing of a land lease agreement with Freeport LNG to facilitate the construction of a liquefied natural gas (LNG) receiving facility. These projects are in addition to multiple existing warehouses, transit sheds, dock facilities, and terminals (BRHND, 2004).

1.4.2 Current Regional Economics

The economy of Brazoria County and the Port Freeport area is broadly based in manufacturing and agriculture. 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 deepwater channel and port facilities, sports fishing services, and tourism are major components of the county's economic base (BRHND, 2004).

Port Freeport handles large volumes of commodities, including petroleum products, agricultural products, and general cargo such as animal feed, synthetic rubber, and automobiles (BRHND, 2004). The port is ranked 16th in U.S. foreign tonnage and 27th in the U.S. in total tonnage. Top import countries include Brazil, Colombia, Costa Rica, Guatemala, Honduras, and Mexico. Top export countries include Brazil, Colombia, Costa Rica, Cuba, Nigeria, Honduras, Saudi Arabia, and the Dominican Republic (Port Freeport, 2009). As stated in the Comprehensive Annual Financial Report for Port Freeport (BRHND, 2004), if Port Freeport harbor is deepened to 60 feet, it will boast the deepest-draft port facility on the Gulf.

Port Freeport totaled over $28.6 million in revenue in 2009. As a result of local and regional purchases by the 11,696 employees, an additional 43,496 induced jobs are estimated to be supported in the regional economy resulting in $4.6 billion in personal income, $10.2 billion in total economic activity in Texas, and $1.3 billion of investment in the local economy over the past 5 years (Port Freeport, 2009).

Freeport has become BASF Corporation's manufacturing base for nylon intermediates and polymers in North America with the construction of a $59 million polycaprolactam plant. The plant was built on existing operations and added 10 permanent positions. Construction is expected to employ 190 workers at its peak (*The Alliance*, 2005a).

Phase I of the Freeport LNG terminal, a 211-acre tract located on Quintana Island, opened in April 2008. The first phase brought 1,500 contractor jobs at its peak with an average of 600 workers a day. The Federal Energy Regulatory Commission has approved a $1 billion expansion of the site to begin in 2011. Currently, the facility has 50 permanent employees (*The Alliance*, 2009a).

Dow Texas Operations opened a new phenolic glycol ethers production facility in Freeport in 2008, which brought three permanent jobs to the area, in addition to numerous temporary construction jobs. In addition to bringing numerous construction jobs to the area, the plant will also reduce the company's transport of hazardous materials across the nation (Evans, 2007).

In 2007, Port Freeport began construction on a new Velasco terminal. To date, approximately 800 feet of berthing is complete. The Velasco Terminal is anticipating 1,591 direct local jobs brought to Brazoria County and $70 million in income to those workers. Approximately $43 million has been spent to date with $159 million budgeted over the next 5 years. Ultimately, the project will add 2,400 feet of berthing to the port (Port Freeport, 2009; Tompkins, 2006).

Air Liquide, which has a plant in Oyster Creek, has constructed an air separation unit on 2 acres adjacent to the current plant for the transmission of oxygen and nitrogen gas and liquid to its customers. This new construction could provide 100 jobs in addition to the 15 full-time plant jobs (Hagerty, 2007).

Although Hurricane Ike damaged range lights and caused shoaling at the channel entrance, resulting in restrictions to vessel depth, and downed power lines forced a shift in vehicular traffic to the port, overall the port did not suffer major destruction. Port Freeport employees whose homes were severely damaged were provided temporary housing (Port Freeport, 2009).

1.4.3 Tourism and Recreation

Tourism is a major contributor to the study area economy. The natural resources of the Gulf provide extensive recreational opportunities in the Freeport area. Outdoor recreation in the area includes fishing, birdwatching, windsurfing, boating, jet skiing, swimming, shelling, and beachcombing (among others).

Brazoria County was chosen as the location for the 2006 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*, 2006b).

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 Farm-to-Market Road (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, boardwalks, picnic areas, and shaded pavilions for group rentals. On the property is the Coveney House, which has a beach ecology laboratory featuring hands-on displays (Brazoria County Parks Department, 2010). One of the newest parks is the Surfside Jetty Park, which has a visitor's center, shuffleboard, 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, 2006a).

In 2009, Dow Chemical Co. donated 388 acres of Columbia Bottomlands to U.S. Fish and Wildlife Service (USFWS). The land, which is located ½ mile from the Angleton Road and FM 2004 intersection, will become the USFWS Dow Woods Unit. This habitat will benefit migratory songbirds and also provide hike and bike trails for visitors (*The Alliance*, 2009b).

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 ½ acre, adjacent to city hall, for a nature trail and home for Surfside Beach's Save Our Beach Association (*The Alliance*, 2005b). 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.

1.4.4 Community Values

Overall, the communities in the study area support development at Port Freeport. Future growth at the port includes 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 Port 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 Freeport LNG anticipates an additional 60 plant operator positions once the site is open (*The Alliance*, 2006c). The community is expected to benefit from the long-term investment of Freeport LNG through projects such as the maintenance of beaches, roads, and 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 study 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 ConocoPhillips expand their facilities (*The Alliance*, 2006d).

1.4.5 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.

1.4.6 Tax Base

In Texas, the state sales tax is 6.25 percent, with local sales/use tax not to exceed an additional 2 percent. 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, 2010). The predominant property tax jurisdictions within the study area include independent school districts, municipalities, and municipal utility districts (Table 12).

Activity at Port 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).

1.5 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 action would have a disproportionately 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 and environmental impacts and requires that representatives of minority or low-income populations who could be affected by the 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 project study area and within the region and the State are presented in Tables 13 and 14. The information is based on 2000 U.S. Census Bureau State, county, and block group level data for ethnicity and income.

In terms of ethnicity, the population living within the study area census tracts (CT) (with a total minority population of 37.6 percent) is less ethnically diverse than Brazoria County and the State of Texas. The percentage of white persons within the study area is 65.3 with the largest percentage of minority persons being Hispanic or Latino, with 22.8 percent of the total population. Within the study area, Freeport has the largest minority population (67.0 percent), which is predominantly composed of Hispanic (51.6 percent) and African American (13.2 percent) persons. Freeport also has the highest percent of persons living below poverty in the study area. The percentage of persons living below poverty within the study area is 10.2

percent. The poverty rates of the study area cities range from 3.0 percent (Bonney and Manvel) to 22.9 percent (Freeport).

EO 13166, "Improving Access to Services for Persons with Limited English Proficiency (LEP)," signed by President Bill 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 14 contains the percent LEP population for the study area.

A small 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 5 years old and over indicates that 3 percent of the population in the study area speak English "Not Well," while 1.2 percent of the population speak English "Not at All" (see Table 14).

2.0 LAND USE/AESTHETICS

2.1 Land Use

Brazoria County lies in the Coastal Bend region of Texas. The Freeport Channel is located in Brazoria County on the mid to upper Texas coast, about 40 miles southwest of Galveston, Texas. The authorized Federal navigation project (Freeport Channel) consists of channels and turning basins that begin in deep water in the Gulf, about 4.9 miles offshore. The Freeport Channel then passes through the jettied inlet and extends about 3.54 miles westward to Freeport. The project is geographically divided into four segments, the Entrance Channel, Main Channel reaches, Stauffer Channel, and Brazos Harbor. Because potential project-related impacts may affect resources outside the footprint of the proposed project, the study area for land use analysis is identified below. Land use within the study 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 percent of the land is used for agriculture, with 41 percent used for range and pastureland and the remaining 20 percent cultivated (Natural Resources Conservation Service, 2000). Within Brazoria County, only about 14 percent 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 percent 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 percent and livestock sales accounting for the remaining 48 percent (USDA, 2002).

As previously stated, the project area for the proposed action is located on the mid to upper Texas coast in Brazoria County, Texas, extending offshore at the 60-foot depth contour of the Gulf, through the jettied Freeport Harbor Entrance Channel upstream to the Stauffer Channel

Turning Basin. In addition, the project area encompasses upland placement areas and ocean dredged material disposal sites for disposal of dredged material from proposed channel improvements (Figure 2).

For the purposes of this analysis, the study area includes the following towns/cities: Alvin, Angleton, Bailey's Prairie, Bonney, Brazoria, Brookside Village, Clute, Danbury, Freeport, Hillcrest, Holiday Lakes, Iowa Colony, Jones Creek, Lake Jackson, Liverpool, Manvel, Oyster Creek City, Pearland, Quintana, Richwood, Surfside Beach, Sweeny, and West Columbia (see Figure 1).

The study area is approximately 1,110,643 acres in size. It primarily comprises open water (245,336 acres) and undeveloped land. The undeveloped land consists of grassland (335,531 acres), woody (forested) land (208,508 acres), agricultural (118,698 acres), nonwoody wetland (113,517 acres), and bare or transitional (3,418 acres). Developed land (28,833 acres high intensity, 19,919 acres low intensity) is primarily concentrated in the northeastern portion of the study area around Pearland and Alvin as well as the southern portion of the study area in communities near Port Freeport and along major roadways such as State Highway (SH) 36, SH 332, SH 288, and FM 523.

Port Freeport currently comprises 186 acres of developed land and 7,723 acres of undeveloped land (Port Freeport, 2006). Facilities along the west side of the Freeport Jetty Channel include the Exxon Quintana Station and LNG Quintana Terminal, as well as the Coast Guard boat basin and access channel located on the east side of the channel. Continuing northward along the Brazos River Channel, ConocoPhillips Petroleum facilities and the BASF Corporation Terminal are to the west and Dow Chemical is to the east of the channel. The northernmost facilities in the project area include Chiquita, American Rice, Inc., and Vulcan Materials Bulk Aggregate Facility, located just south of the Stauffer Turning Basin. All parcels are accessible by water, highway, and rail. Numerous golf courses and county parks are located within the study area, including those that provide beach access such as Bryan Beach, located southwest of the Village of Quintana; Quintana Beach Park, located southwest of the Freeport Jetty Channel; and Surfside Jetty Park and Surfside Pedestrian Beach, located on the east side of the Freeport Jetty Channel. In addition to public and private parks, there are State and Federal areas located in the study area. These include Nannie M. Stringfellow Wildlife Management Area (WMA) located in the southwestern portion of the study area as well as the Peach Point WMA, Brazoria National Wildlife Refuge (NWR), San Bernard NWR, and Christmas Bay State Park located along the coastline.

2.2 Transportation

Major roadways within the study area include FM 523, which provides access from Angleton to Oyster Creek; SH 288, the primary land route connecting the Freeport area with the Houston

Golf Courses
City Parks
Study Area
On-System Roads 2003
Freeport Harbor CIP Area
County Parks
State areas
Federal Refuges
Beaches

N S E W

10 5 0 10 Miles

Figure 2

Freeport Harbor Channel Improvement Project Study Area and Recreational Areas

Prepared for: USACE
Job No.: 044190100
Prepared by: Amy C./RCoop
Date: 03/24/2008

File: N:/Clients/U_Z/USACE/Projects/Freeport/044190100/projects/Figures/AppF_Fig2.mxd metropolitan area, approximately 50 miles to the north; SH 36, which provides north-south connection from Rosenberg to Freeport; and SH 332, which provides a direct route from Lake Jackson to Surfside Beach. There is direct access to the Gulf Intracoastal Waterway (GIWW) and the Freeport Harbor utilizing FM 523, SH 36, SH 288, and SH 332, with rail service provided by the Union Pacific Railroad (UPRR). These roadways provide for efficient shipping of goods from the port.

Rail transportation is integral to the operations of Port Freeport and numerous industrial sites located along the Freeport Jetty Channel, GIWW, Brazos River Channel, Brazos Harbor, Brazosport Turning Basin, and the Stauffer Turning Basin. The UPRR provides direct service to these facilities, with approximately 50,000 railcar transits per year at Port Freeport (Port Freeport, 2006).

2.3 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; and
- 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. Generally, the study area consists mostly of undeveloped areas. Within the southern portion of the study area, 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 that can detract or add, depending on the type and scale, to the overall aesthetic quality. The southern portion of the study area includes a variety of land uses, including 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, the study area is considered to be visually pleasing, with the exception of industrial and port facilities located in the southern portion along the Freeport Harbor. However, the area is distinguished in aesthetic quality from other adjacent areas within the region that lack the vast waterbodies 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.

2.4 Future Development

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 ConocoPhillips, plan to expand with major projects. Freeport will become BASF Corporation's manufacturing base for nylon intermediates and polymers in North America, with a new plant to be constructed on-site (*The Alliance*, 2005a). Food companies such as GrupoSOS began construction of the first phase of their $200 million expansion in 2006 (*The Alliance*, 2006d).

The City of Freeport is discussing the possible annexation of 122 acres along the GIWW adjoining the Bridge Harbor subdivision. If the annexation is approved, the 1-mile-long, 1,000-foot-wide parcel would likely be used for residential/commercial development (*The Alliance*, 2007a). Subsequently, Freeport has plans for a marina to be built on the Old Brazos River, which would potentially attract restaurants and hotels around the site (*The Alliance*, 2006e). In May 2007, the Velasco Drainage District gave the City of Freeport permission to make two cuts in the Old Brazos River levee for the dry-stack boat storage facility (*The Alliance*, 2007b).

Future development in Surfside includes a proposed 9-acre, 260-slip, dry dock marina that would be located off the SH 322 Intracoastal Bridge. The Surfside Marina would cater to the sport fishing and yachting community and would include a restaurant, retail shops, showers, and a laundry facility. In addition, the Surfside Marina would have 17-foot-deep water and two helipads (*The Alliance*, 2006e) as well as 16 acres of wetlands (*The Alliance*, 2007c). A joint venture among Surfside Beach, Brazoria County, and Texas Parks and Wildlife Department (TPWD) is planned to construct a four-bay boat ramp between Village Hall and the Coast Guard Station (*The Alliance*, 2007d).

Industrial construction and/or expansion projects include the construction of Shintech's new 500-acre site near current industrial plants in the Chocolate Bayou area. The plant is anticipated to produce 825,000 tons of vinyl chloride monomer and 550,000 tons of caustic soda per year (*The Alliance*, 2007e). Air Liquide plans to construct an air separation unit on 2 acres adjacent to its current Oyster Creek plant for the transmission of oxygen and nitrogen gas and liquid to its customers (*The Alliance*, 2007f).

There are approximately 8,000 acres of land adjacent to the Gulf available for future development in Port Freeport. Future expansion of Port Freeport includes an LNG facility (under construction), construction of new berths, and the building of a transit shed. The $750 million LNG facility would 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 2009 and is expected to generate increased funding for the port and provide facilities for the local petrochemical industry. In addition, the port has begun engineering design for Transit Shed 6 adjacent to Dock 5. The 125,000-square-foot facility would include rail service and may attract new business to the port (Port Freeport, 2006).

A multi-modal facility is planned for Parcel 14 located south of SH 36. Long-term use will include on-site warehouses and rail (Port Freeport, 2009).

In addition, future development of property located adjacent to Navigation Boulevard and the Brazos Harbor Entrance Channel (Parcel No. 25) would expand Port Freeport's warehousing and rail facilities (Port Freeport, 2006). With the increasing warehousing capabilities of the port, companies like Reliance Bulk Carriers of Houston (RBC) will be able to utilize the storage facilities. RBC could likely lease 30 acres to store parts of giant mills destined for West Texas, Oklahoma, and other regions (*The Alliance*, 2007g).

Transportation improvement projects include the construction of a four-lane County Road (CR) 220 from FM 521 to SH 288, widening of existing CR 220 from SH 288 to FM 523, widening of SH 332 from FM 521 to SH 288, construction of a six-lane toll highway (SH 99) from the Harris County line to FM 1093, the reconstruction of FM 2351 (CR 129) to a four-lane divided highway from SH 35 to the Galveston County line, widening of FM 523 from FM 2004 to SH 332, and the replacement of the CR 160 bridge at the Gulf Coast Water Canal (Texas Department of Transportation, 2007). Enhancements to highway and rail capabilities in the area will include widening SH 36 from two lanes to four lanes to facilitate hurricane evacuations and passenger and freight movement (*The Alliance,* 2009c). 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*, 2006f). In addition, Union Pacific plans to construct a new rail line through Angleton. The new line will parallel the existing track for 1.2 miles, starting at Loop 274 and ending just before Downing Street (*The Alliance*, 2006g).

Table 1
Population Trends 1980–2000

	Population			Percent Change		
Place	**1980**	**1990**	**2000**	**1980–1990**	**1990–2000**	**1980–2000**
Alvin	16,515	19,220	21,413	16	11	30
Angleton	13,929	17,140	18,130	23	6	30
Bailey's Prairie	NA	634	694	NA	9	NA
Bonney	NA	339	384	NA	13	NA
Brazoria	3,025	2,717	2,787	-10	3	-8
Brookside Village	NA	1,470	1,960	NA	33	NA
Clute	9,577	8,910	10,424	-7	17	9
Danbury	NA	1,447	1,611	NA	11	NA
Freeport	13,444	11,389	12,708	-15	12	-5
Hillcrest	NA	695	722	NA	4	NA
Holiday Lakes	NA	1,039	1,095	NA	5	NA
Iowa Colony	NA	675	804	NA	19	NA
Jones Creek	NA	2,160	2,130	NA	-1	NA
Lake Jackson	19,102	22,776	26,386	19	16	38
Liverpool	NA	396	404	NA	2	NA
Manvel	3,549	3,733	3,046	5	-18	-14
Oyster Creek	NA	912	1,192	NA	31	NA
Pearland	13,248	18,697	37,640	41	101	184
Quintana	NA	51	38	NA	-25	NA
Richwood	2,591	2,732	3,012	5	10	16
Surfside Beach	NA	611	763	NA	25	NA
Sweeny	3,538	3,297	3,624	-7	10	2
West Columbia	4,109	4,372	4,255	6	-3	4
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).

Table 2
Population Projections 2009–2040

	Population					Percent Change				
Place	**2009**	**2010**	**2020**	**2030**	**2040**	**2009–2010**	**2010–2020**	**2020–2030**	**2030–2040**	**2009–2040**
Alvin	24,584	23,231	25,123	26,935	28,605	-5	8	7	6	16
Angleton	20,133	18,951	19,805	20,623	21,377	–6	5	4	4	6
Bailey's Prairie	789	744	795	844	889	-6	7	6	5	13
Brazoria	3,120	2,845	2,906	2,964	3,017	–9	2	2	2	–3
Brookside Village	2,197	2,282	2,618	2,939	3,235	4	16	12	10	47
Clute	11,720	11,217	12,043	12,834	13,563	–4	8	7	6	16
Danbury	1,783	1,747	1,888	2,023	2,148	-2	8	7	6	20
Freeport	13,677	15,794	19,006	22,082	24,917	15	24	16	13	82
Hillcrest	766	744	767	789	810	-3	3	3	3	6
Holiday Lakes	1,204	1,141	1,189	1,235	1,278	–5	4	4	3	6
Iowa Colony	978	911	1,022	1,129	1,227	-7	12	10	9	25
Jones Creek	2,294	2,130	2,130	2,130	2,130	–7	0	0	0	–7
Lake Jackson	29,205	29,383	32,502	35,488	38,241	1	11	9	8	31
Manvel	6,444	3,046	3,046	3,046	3,046	–53	0	0	0	–53
Oyster Creek	1,429	1,424	1,666	1,897	2,110	-<1	17	14	11	48
Pearland	83,594	66,049	83,462	99,342	114,034	–21	26	19	15	36
Richwood	3,663	3,244	3,486	3,717	3,930	–11	7	7	6	7
Surfside Beach	922	889	1,020	1,146	1,262	-4	15	12	10	37
Sweeny	3,985	3,895	4,177	4,447	4,696	–2	7	6	6	18
West Columbia	4,519	4,158	4,057	3,960	3,871	–8	–2	–2	–2	–14
Brazoria County	304,844	285,850	331,731	375,664	416,157	–6	17	14	12	37
State of Texas	24,538,335	24,915,388	29,117,537	33,052,506	36,893,267	2	15	14	12	50

Source: TWDB (2005); Texas State Data Center (2010).

Table 3
Household Composition, 2000

Area	Number of Households	Family Households	% Family Households	Nonfamily Households	% Non-family Households	Average Household Size	Average Family Size
Alvin	7,826	5,600	72	2,226	28	2.71	3.22
Angleton	6,508	4,891	75	1,617	25	2.75	3.19
Bailey's Prairie	237	202	85	35	15	2.93	3.18
Bonney	126	101	80	25	20	3.05	3.45
Brazoria	1,063	737	69	326	31	2.62	3.18
Brookside Village	655	536	82	119	18	2.99	3.22
Clute	3,674	2,564	70	1,110	30	2.79	3.35
Danbury	554	442	80	112	20	2.91	3.30
Freeport	4,163	3,099	74	1,064	26	3.05	3.59
Hillcrest	262	222	85	40	15	2.76	3.02
Holiday Lakes	342	261	76	81	24	3.20	3.71
Iowa Colony	279	219	79	60	22	2.88	3.29
Jones Creek	772	607	79	165	21	2.76	3.14
Lake Jackson	9,588	7,344	77	2,244	23	2.74	3.18
Liverpool	152	115	76	37	24	2.66	3.03
Manvel	1,085	870	80	215	20	2.80	3.13
Oyster Creek	440	304	69	136	31	2.64	3.14
Pearland	13,192	10,654	81	2,538	19	2.84	3.17
Quintana	20	11	55	9	45	1.90	2.18
Richwood	1,138	825	73	313	28	2.65	3.13
Surfside Beach	352	197	56	155	44	2.15	2.68
Sweeny	1,338	974	73	364	27	2.65	3.14
West Columbia	1,607	1,099	68	508	32	2.60	3.19
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).

Table 4
Study Area Household Tenure, 2000

Area	# Occupied Housing Units	# Owner-Occupied Units	% Owner-Occupied Units	# Renter-Occupied Units	% Renter-Occupied Units
Alvin	7,826	4,292	55	3,534	45
Angleton	6,508	4,499	69	2,009	31
Bailey's Prairie	237	227	96	10	4
Bonney	126	66	52	60	48
Brazoria	1,063	712	67	351	33
Brookside Village	655	519	79	136	21
Clute	3,674	1,605	44	2,069	56
Danbury	554	419	76	135	24
Freeport	4,163	2,373	57	1,790	43
Hillcrest	262	250	95	12	5
Holiday Lakes	342	295	86	47	14
Iowa Colony	279	246	88	33	12
Jones Creek	772	661	86	111	14
Lake Jackson	9,588	6,821	71	2,767	29
Liverpool	152	127	84	25	16
Manvel	1,085	964	89	121	11
Oyster Creek	440	300	68	140	32
Pearland	13,192	10,480	79	2,712	21
Quintana	20	10	50	10	50
Richwood	1,138	645	57	493	43
Surfside Beach	352	207	59	145	41
Sweeny	1,338	901	67	437	33
West Columbia	1,607	987	61	620	39
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 5
Age Characteristics of the Study Area, 2000

Place	% Under 5	% 5 to 14	% 15 to 19	% 20 to 34	% 35 to 49	% 50 to 64	% 65 and over	Total Persons
	Years of Age							
Alvin	8.8	16.1	7.9	23.4	21.3	13.0	9.4	21,413
Angleton	7.7	16.6	8.4	19.5	24.2	12.7	10.8	18,130
Bailey's Prairie	6.5	15.4	8.1	10.7	29.1	22.6	7.6	694
Bonney	9.4	18.2	10.7	19.0	28.6	9.6	4.4	384
Brazoria	8.3	16.6	7.2	20.7	21.7	13.7	11.7	2,787
Brookside Village	4.9	15.8	7.4	18.7	26.1	14.1	13.0	1,960
Clute	9.9	16.8	8.2	26.9	19.8	10.8	7.6	10,424
Danbury	8.0	17.4	9.9	18.7	23.5	14.2	8.3	1,611
Freeport	10.0	20.1	9.0	22.0	20.2	10.6	8.1	12,708
Hillcrest	5.3	12.7	7.8	10.8	23.5	24.1	15.8	722
Holiday Lakes	9.5	20.0	9.7	20.3	20.1	13.2	7.3	1,095
Iowa Colony	7.1	16.5	6.8	18.2	25.0	16.2	10.2	804
Jones Creek	6.9	16.7	7.7	15.1	21.7	19.6	12.3	2,130
Lake Jackson	7.4	17.7	8.0	17.6	25.7	13.7	9.9	26,386
Liverpool	6.7	14.4	7.7	21.3	25.0	15.3	9.7	404
Manvel	6.5	14.9	6.8	15.7	28.0	19.5	8.5	3,046
Oyster Creek	8.6	15.9	8.0	19.0	22.5	15.3	10.7	1,192
Pearland	8.0	16.0	7.5	19.8	26.7	13.6	8.4	37,640
Quintana	0.0	7.9	5.3	10.5	36.8	23.7	15.8	38
Richwood	8.8	15.0	8.5	24.8	23.7	13.0	6.0	3,012
Surfside Beach	4.6	10.9	4.8	16.6	31.1	21.0	11.1	763
Sweeny	7.2	16.5	8.8	17.9	21.2	12.3	16.1	3,624
West Columbia	7.9	15.7	8.0	18.5	22.3	14.5	13.1	4,255
Brazoria County	7.7	16.0	7.7	20.2	25.6	13.9	8.8	241,767
State of Texas	7.8	15.8	7.8	22.5	22.7	12.4	11.0	20,851,820

Source: U.S. Census Bureau (2000b).

Table 6
Income Characteristics of the Study Area, 2000

Place	Number of Persons	Per Capita Income ($)	Median Household Income ($)	Number Below Poverty	Percent Below Poverty
Alvin	21,413	17,106	38,576	2,852	13.2
Angleton	18,130	17,915	42,184	1,993	11.1
Bailey's Prairie	694	32,267	73,125	29	4.3
Bonney	384	15,368	41,750	11	3.0
Brazoria	2,787	16,666	36,058	373	13.3
Brookside Village	1,960	18,609	44,650	316	16.1
Clute	10,424	14,008	32,622	1,838	18.2
Danbury	1,611	17,565	50,536	124	7.6
Freeport	12,717	12,426	30,245	2,896	22.9
Hillcrest	722	25,055	63,889	35	5.0
Holiday Lakes	1,095	12,463	33,938	175	15.8
Iowa Colony	804	18,935	47,019	48	6.1
Jones Creek	2,130	20,023	42,378	239	10.7
Lake Jackson	26,386	25,877	60,901	1,675	6.4
Liverpool	404	19,492	48,750	26	6.6
Manvel	3,046	23,751	57,344	88	3.0
Oyster Creek	1,200	15,000	35,144	225	19.2
Pearland	37,640	26,306	64,156	1,744	4.7
Quintana	44	15,900	25,500	8	18.2
Richwood	3,012	19,181	45,000	316	10.5
Surfside Beach	764	24,081	37,778	94	12.6
Sweeny	3,624	16,755	36,497	346	9.9
West Columbia	4,255	15,647	31,115	836	20.0
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).

Table 7
Educational Attainment of the Study Area, 2000 (Percent)

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
Alvin	8.8	14.1	29.0	27.5	7.1	9.2	4.3
Angleton	7.8	12.7	29.7	24.7	7.9	12.9	4.2
Bailey's Prairie	1.7	8.1	18.0	31.4	10.3	18.4	12.2
Bonney	0.9	7.5	36.2	33.3	11.7	7.0	3.3
Brazoria	6.8	17.9	36.6	23.8	9.0	2.9	2.9
Brookside Village	14.2	19.8	26.5	20.2	6.6	7.5	5.1
Clute	13.6	21.7	28.7	22.4	5.4	6.3	1.9
Danbury	7.8	10.6	36.0	29.1	7.4	7.1	1.9
Freeport	22.6	22.3	28.0	18.3	3.4	3.3	2.1
Hillcrest	1.3	5.0	22.1	27.5	8.2	23.9	12.0
Holiday Lakes	22.3	25.7	30.8	15.5	3.2	1.9	0.7
Iowa Colony	9.9	15.4	28.5	25.9	7.3	8.5	4.4
Jones Creek	7.7	11.2	38.1	25.5	7.7	8.1	1.8
Lake Jackson	1.6	6.5	20.1	27.3	9.2	25.1	10.3
Liverpool	4.7	15.1	30.6	25.6	14.0	4.7	5.4
Manvel	8.6	10.8	30.9	31.9	5.7	8.8	3.3
Oyster Creek	8.9	24.8	35.2	21.5	4.5	3.1	1.9
Pearland	4.2	7.9	22.7	29.1	7.0	21.9	7.2
Quintana	18.2	27.3	15.9	38.6	0.0	0.0	0.0
Richwood	4.6	9.2	30.0	30.0	8.6	11.7	6.0
Surfside Beach	2.3	17.0	27.7	32.3	5.4	8.4	6.8
Sweeny	6.7	15.2	23.0	35.3	6.7	10.7	2.5
West Columbia	11.0	15.8	32.2	24.3	5.2	8.1	3.3
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).

Table 8
Public Services and Utilities for Study Area, 2007

	Electric Utility Service	Natural Gas Service	Water	Wastewater	Solid Waste Disposal Service
City of Alvin	Texan Electric Choice	CenterPoint Energy	City of Alvin	City of Alvin	IESI Solid Waste Management
City of Angleton	First Choice Power	CenterPoint Energy	City of Angleton/ Brazosport Water Authority	City of Angleton	Republic Waste
City of Brookside Village	Reliant	CenterPoint Energy	Wells	Individual Septic System	NA
City of Clute	Reliant	CenterPoint Energy	City of Clute	City of Clute	City of Clute
City of Danbury	Reliant	None	City of Danbury	City of Danbury	Waste Management
City of Freeport	Reliant	CenterPoint Energy	City of Freeport	City of Freeport	City of Freeport
Village of Jones Creek	Reliant	CenterPoint Energy	Trent Waterworks	Trent Waterworks	Waste Management
City of Lake Jackson	Direct Energy	CenterPoint Energy	City of Lake Jackson	City of Lake Jackson	City of Lake Jackson
City of Manvel	Reliant	Reliant	City of Manvel	City of Manvel	City of Manvel
City of Oyster Creek	Luminant	None	Oyster Creek	Oyster Creek	Oyster Creek
City of Pearland	Reliant	CenterPoint Energy	City of Pearland	City of Pearland	City of Pearland
Village of Quintana	Reliant	CenterPoint Energy	Village of Quintana	Individual Septic System	IESI Solid Waste Management
City of Richwood	Reliant	CenterPoint Energy	Brazosport Water Authority	Brazosport Water Authority	City of Clute
City of Surfside Beach	Luminant	None	Surfside Beach	Surfside Beach	Surfside Beach
City of Sweeny	First Choice Power	City of Sweeny	City of Sweeny	City of Sweeny	Republic Waste Services
City of West Columbia	Texas-New Mexico	CenterPoint Energy	City of West Columbia	City of West Columbia	City of West Columbia

Source: Bricker (2007); CenterPoint Energy (2007); City of Freeport (2006b); City of Sweeny (2007); City of West Columbia (2007); Damian (2007); Gardner (2007); Greater Angleton Chamber of Commerce (2003); Kubeczka (2007); Murray (2007); Ortiz (2007); Pace (2007); Reliant Energy (2007); White (2007).

Table 9
Class of Worker in the Study Area, 2000 (Percent)

Place	Private Wage and Salary Workers	Government Workers	Self-employed Workers (not incorporated business)	Unpaid Family Workers
Alvin	80.6	14.2	4.9	0.3
Angleton	71.6	21.4	6.6	0.4
Bailey’s Prairie	61.4	29.2	9.4	0.0
Bonney	38.2	56.0	5.8	0.0
Brazoria	83.5	12.3	4.2	0.0
Brookside Village	81.4	10.6	6.7	1.2
Clute	87.1	9.8	2.5	0.7
Danbury	80.7	15.2	3.9	0.1
Freeport	83.7	10.5	4.7	1.0
Hillcrest	71.9	19.0	9.2	0.0
Holiday Lakes	80.1	13.5	6.5	0.0
Iowa Colony	77.7	13.3	9.0	0.0
Jones Creek	76.5	14.9	8.6	0.0
Lake Jackson	80.7	13.7	5.5	0.1
Liverpool	79.6	12.4	8.1	0.0
Manvel	80.0	11.5	7.5	1.0
Oyster Creek	79.7	12.2	8.1	0.0
Pearland	79.3	15.2	5.2	0.2
Quintana	76.9	0.0	23.1	0.0
Richwood	81.6	12.1	4.8	1.5
Surfside Beach	77.1	10.9	10.9	1.2
Sweeny	77.5	15.5	7.0	0.0
West Columbia	78.5	17.5	3.3	0.7
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).

Table 10
Study Area Major Employers, 2009

Top 20 Study Area Employers	Number of Employees
Dow Chemical USA (TX Operations)	4,300
Texas Dept. of Criminal Justice	2,641
Alvin ISD	2,379
Pearland ISD	2,196
Brazosport ISD	2,073
Infinity Group	1,957
Brand Energy Solutions, LLC	1,914
Wal-Mart	1,757
TEI Staffing	1,600
Brazoria County Government	1,432
Buc-cees	1,015
Angleton ISD	960
Schlumberger	950
ConocoPhillips	940
Dish Network	909
Kroger	903
Zachary Construction Co.	880
Miken Specialties	825
Gulf States	746
BASF	675

Source: Economic Development Alliance of Brazoria County (2010).

Table 11
Place of Work for Workers in the Study Area, 2000 (Percent)

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
Alvin	99.7	0.3	52.8	46.9	32.7	67.3
Angleton	99.2	0.8	84.8	14.4	35.6	64.4
Bailey's Prairie	100.0	0.0	86.7	13.3	6.9	93.1
Bonney	100.0	0.0	78.3	21.7	41.1	58.9
Brazoria	99.7	0.3	89.9	9.8	17.2	82.8
Brookside Village	99.4	0.6	35.0	64.5	6.4	93.6
Clute	99.1	0.9	89.7	9.4	25.8	74.2
Danbury	99.6	0.4	78.3	21.3	10.1	89.9
Freeport	96.8	3.2	89.7	10.3	40.2	59.8
Hillcrest	98.7	1.3	48.6	50.2	3.2	96.8
Holiday Lakes	99.4	0.6	76.9	22.6	3.3	96.7
Iowa Colony	99.1	0.9	33.4	65.7	7.2	92.8
Jones Creek	99.8	0.2	90.6	9.1	7.4	92.6
Lake Jackson	99.3	0.7	88.1	11.2	24.5	75.5
Liverpool	100.0	0.0	50.0	50.0	4.4	95.6
Manvel	97.7	2.3	30.2	67.5	10.5	89.5
Oyster Creek	99.4	0.6	90.3	9.7	9.9	90.1
Pearland	98.8	1.2	29.6	69.3	18.9	81.1
Quintana	100.0	0.0	100.0	0.0	23.0	76.9
Richwood	100.0	0.0	91.0	9.0	8.1	91.9
Surfside Beach	99.0	1.0	78.5	21.5	16.0	84.0
Sweeny	100.0	0.0	87.2	12.8	30.3	69.7
West Columbia	100.0	0.0	90.6	9.4	28.1	71.9
Brazoria County	99.1	0.9	59.7	40.3	24.3	75.6
State of Texas	99.0	1.0	78.6	20.4	55.4	44.6

Source: U.S. Census Bureau (2000b).

Table 12
Property Tax Jurisdictions, Brazoria County – 2009

Tax Jurisdictions	Tax Rate per $100 of Appraised Valuation
Brazoria County	0.366286
R&B Fund	0.06
Brazoria County Emergency Service District #2	0.03
Brazoria County Emergency Service District #1	0.08
Brazoria County Emergency Service District #3	0.093700
Brazos River Harbor Navigation District	0.0535
Brazoria County FWD #1	0.295
Alvin ISD	1.3041
Angleton ISD	1.4552
Brazosport ISD	1.2285
Damon ISD	1.17
Danbury ISD	1.1439
Pearland ISD	1.4194
Sweeny ISD	1.2117
Columbia-Brazoria ISD	1.2965
Alvin Community College	0.19983
Brazosport Junior College	0.175754
Angleton Drainage District	0.1839
Velasco Drainage District	0.08713
Brazoria County C&R #3	0.15
Brazoria County Drainage District #4	0.143845
Iowa Colony Drainage District	0.189727
Danbury Drainage District	0.366
West Brazoria County Drainage District #11	0.02
Sweeny Community Hospital	0.349917
Angleton-Danbury Hospital	0.2465
City of Alvin	0.8036
City of Angleton	0.706
City of Brazoria	0.7283
Village of Brookside	0.46
City of Clute	0.672
City of Danbury	0.762014
City of Freeport	0.708266
Hillcrest Village	0.374512
Town of Holiday Lakes	0.950737
Village of Jones Creek	0.4
City of Lake Jackson	0.39
City of Liverpool	0.236852
City of Manvel	0.587863
Village of Oyster Creek	0.401142
City of Pearland	0.6526
Town of Quintana	0.033365

Table 12 (Cont'd)

Tax Jurisdictions	Tax Rate per $100 of Appraised Valuation
City of Richwood	0.69366
Village of Surfside Beach	0.442056
City of Sweeny	0.741595
City of West Columbia	0.8319
Commodore Cove Improvement District	0.620318
Oak Manor Municipal Water District (MUD)	0.451178
Treasure Island MUD	1.258218
Varner Creek MUD	0.858
Brazoria County MUD #1	
Brazoria County MUD #2	0.5
Brazoria County MUD #3	0.63
Brazoria County MUD #4	0.63
Brazoria County MUD #6	0.63
Brazoria County MUD #16	0.95
Brazoria County MUD #17	0.6
Brazoria County MUD #18	0.56
Brazoria County MUD #19	0.63
Brazoria County MUD #21	1.45
Brazoria County MUD #22	Not Collecting
Brazoria County MUD #23	0.8
Brazoria County MUD #24	Not Collecting
Brazoria County MUD #25	1.1
Brazoria County MUD #26	0.71
Brazoria County MUD #28	0.82
Brazoria County MUD #29	0.8
Brazoria County MUD #31	1.3
Brazoria County MUD #34	0.85
Brazoria County MUD #35	0.89
Brazoria County MUD #36	0.7
Brazoria/Ft. Bend MUD #1	0.85

Source: Brazoria County Appraisal District (2010).

Table 13
Detailed 2000 Population Characteristics in Study Area

Area	Total Population	Population of One Race/Not Hispanic or Latino (%) White	Black or African American	American Indian/ Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Hispanic or Latino of Any Race	Total Minority Population (%)	Median Household Income ($)	% Below Poverty
Alvin	21,413	67.3	2.0	0.3	0.8	0.1	28.1	32.7	38,576	13.3
Angleton	18,130	63.2	11.2	0.3	1.1	<0.1	23.2	36.8	42,184	11.1
Bailey's Prairie	694	75.8	12.7	0.3	0.1	0.3	10.1	24.2	73,125	4.3
Bonney	384	56.3	10.2	0.8	1.3	0.0	29.9	43.7	41,750	3.0
Brazoria	2,787	76.4	10.3	0.6	0.7	0.0	11.4	23.6	36,058	13.3
Brookside Village	1,960	51.7	3.1	0.5	0.8	0.0	43.6	48.3	44,650	16.1
Clute	10,424	42.4	7.3	0.2	0.9	<0.1	48.1	57.6	32,622	18.2
Danbury	1,611	83.1	0.6	0.0	0.3	0.0	15.5	16.9	50,536	7.6
Freeport	12,717	33.0	13.2	0.1	0.3	0.1	51.6	67.0	30,245	22.9
Hillcrest	722	92.1	0.6	0.0	0.4	0.0	6.0	7.9	63,889	5.0
Holiday Lakes	1,095	47.9	2.6	0.9	0.0	0.0	47.2	52.1	33,938	15.8
Iowa Colony	804	60.0	6.7	0.1	7.3	0.0	25.1	40.0	47,019	6.1
Jones Creek	2,130	78.5	0.5	0.2	0.6	0.0	18.2	21.5	42,378	10.7
Lake Jackson	26,386	77.6	3.8	0.3	2.5	<0.1	14.7	22.4	60,901	6.4
Liverpool	404	87.4	0.0	0.2	0.2	0.0	9.9	12.6	48,750	6.6
Manvel	3,046	83.3	2.3	0.3	0.5	0.0	12.9	16.7	57,344	3.0
Oyster Creek City	1,200	75.7	4.7	0.4	0.4	0.0	17.6	24.3	35,144	19.2
Pearland	37,640	73.4	5.2	0.3	3.6	<0.1	16.2	26.6	64,156	4.7
Quintana	44	81.8	0.0	0.0	0.0	0.0	18.2	18.2	25,500	18.2
Richwood	3,012	66.5	8.3	0.2	0.5	0.1	23.4	33.5	45,000	10.5
Surfside Beach	764	90.1	3.1	0.3	0.0	0.0	2.4	9.9	37,778	12.6
Sweeny	3,624	69.0	15.5	0.5	0.4	0.0	13.7	31.0	36,497	9.9
West Columbia	4,255	60.6	19.3	0.4	0.4	<0.1	18.0	39.4	31,115	20.0
Brazoria County	241,767	65.3	8.3	0.4	1.9	< 0.1	22.8	34.7	48,632	10.2
CT 6639	2,175	43.1	6.1	0.2	0.5	0.0	49.6	56.9	39,509	11.8
CT 6641	5,323	65.5	4.8	0.4	0.5	<0.1	28.1	34.5	40,271	13.6
CT 6642	2,307	82.4	2.8	1.0	0.7	0.1	10.9	17.6	38,542	16.6
CT 6643	5,452	25.8	14.7	0.3	0.1	<0.1	58.0	74.2	23,415	27.3
CT 6644	7,092	38.2	11.8	0.3	0.4	0.0	48.4	61.8	34,592	19.5
CT 6645	5,378	75.0	9.4	0.1	0.3	0.0	13.5	25.0	42,083	11.2
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 14
Percentage of Limited English Proficiency Persons 5 Years Old and Older in the Study Area

Area	Percent of Persons that Speak English "Not Well"	Percent of Persons that Speak English "Not at All"
Alvin	2.8	1.5
Angleton	2.5	0.8
Bailey's Prairie	0.5	0.0
Bonney	0.0	0.6
Brazoria	2.2	0.2
Brookside Village	5.7	9.8
Clute	8.6	2.3
Danbury	2.3	1.0
Freeport	8.9	5.1
Hillcrest	0.3	0.0
Holiday Lakes	9.4	2.0
Iowa Colony	4.4	1.2
Jones Creek	2.3	0.8
Lake Jackson	0.9	0.3
Liverpool	0.8	0.0
Manvel	0.0	0.0
Oyster Creek City	1.1	0.5
Pearland	1.7	0.5
Quintana	0.0	0.0
Richwood	2.2	0.6
Surfside Beach	1.2	0.0
Sweeny	1.2	0.8
West Columbia	4.7	2.1
Brazoria County	3.0	1.2
State of Texas	4.7	2.7

Source: U.S. Census Bureau (2000b).

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Appendix G

Clean Water Act Section 404(b)(1) Evaluation

Document No. 070283
Job No. 441901

APPENDIX G
FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT
BRAZORIA COUNTY, TEXAS
SECTION 404(B)(1) EVALUATION

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

October 2010

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APPENDIX G
FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT
BRAZORIA COUNTY, TEXAS
SECTION 404(b)(1) EVALUATION

I. PROJECT DESCRIPTION

a. Location

The project area for the Freeport Harbor Channel Improvement Project (FHCIP) is located within Brazoria County, Texas, near Freeport, and is defined as areas that would be directly affected by implementation of the project (i.e., the proposed dredging footprint, existing and proposed placement areas [PAs] identified in Section 2.5 of the Environmental Impact Statement [EIS], and mitigation areas).

The project area for the proposed project is located on the mid to upper Texas coast in Brazoria County, Texas, and encompasses the communities of Surfside, Quintana, Oyster Creek City, and the city of Freeport. Freeport Harbor Channel provides deepwater access from the Gulf of Mexico (Gulf) to Port Freeport. Specifically, the existing Freeport Harbor channels begin approximately 4.9 miles seaward of the coastal jetty tips at the 47-foot depth contour in the Gulf, continuing upstream through the Freeport Harbor Outer Bar and Jetty channels, and winding westward for approximately 3.5 miles into Freeport to the Stauffer Channel Turning Basin. Upland and offshore PAs for disposal of dredged material from the proposed improvements are also included in the project area (see Figure 3.1-1 in the EIS).

Further descriptions of the FHCIP and study area can be found in Section 3.0 of the FHCIP EIS.

b. General Description

This Section 404(b)(1) evaluation addresses the discharge of dredged or fill material into the waters of the United States. The objectives of the FHCIP include improvements to the efficiency and safety of the deep-draft navigation system, and maintenance or enhancement of the quality of the area's coastal and estuarine resources. Maintenance and enhancement of the area's coastal and estuarine resources are associated with potential for reduced accidents and oil spills; beneficial use of dredged material, where feasible; minimization of effects to valuable habitats; and avoiding areas of known cultural resources.

Several alternatives were analyzed including a No Action Alternative, a National Economic Development (NED) Plan Alternative, and the Locally Preferred Plan (LPP) Alternative, which is the U.S. Army Corps of Engineers' (USACE) tentatively Recommended Plan; this 404(b)(1) evaluation only focuses on the LPP Alternative.

To achieve navigation efficiency and safety objectives, the USACE plans to widen the Freeport Harbor Entrance Channel (including the Outer Bar and Jetty channels) to 600 feet and deepen to 55 feet, deepen the Main Channel to 55 feet from the Lower Turning Basin to above the Brazosport Turning Basin and to 500 feet up-channel through the Upper Turning Basin, widen Lower Stauffer Channel to 300 feet and deepen to 50 feet, and redredge Upper Stauffer Channel to a 25-foot depth. Construction of the LPP Alternative would generate approximately 17.3 million cubic yards (mcy) of dredged material. Maintenance of the deepened and widened channel is calculated to generate a total of 175.9 mcy of maintenance-dredged material over the 50-year evaluation period. Material dredged from the Entrance Channel during construction would be placed in the new work ODMDS and the remainder of the new work material would be placed in PAs 1, 8, and 9. Material dredged from the Outer Bar and Jetty channels and the Lower Turning Basin during maintenance cycles would be placed in the maintenance material Ocean Dredged Material Disposal Site (ODMDS), and material from the remainder of the channel would be placed in PAs 1, 8, and 9.

c. Authority and Purpose

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 depth and 300-foot wide from the Gulf to inside the jetties and for interior channels of 36-foot depth and 200-foot wide 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 a 45-foot depth and 400-foot width and the Outer Bar Channel to a 47-foot depth and 400-foot width, with an extension of approximately 4.6 miles into the Gulf.

Since the completion of the Freeport Harbor Channel 45-Foot Project, the size of ships using the waterway has steadily increased so that many vessels currently have to be light-loaded to traverse the waterway. The current channel depth requires that large crude carriers remain offshore and transfer their cargo into smaller crude tankers for the remainder of the voyage. This lightering operation takes place in the Gulf where the two ships, the mother ship and the lightering ship, come together so that the cargo transfer can take place. Although this operation has been going on for years, the possibility for a collision, oil spill, fire, or other adverse environmental consequences is always present. Deepening the channel will reduce the number of lightering operations. Current projections suggest that crude imports will increase in the near future. As the imports increase, the number of lightering vessels and product carriers will also increase, adding to the shipping delays, congestion, and risk of collision or spill.

As a concurrent action, USACE and Port Freeport (non-Federal sponsor) propose to improve the navigation channels servicing Freeport Harbor as a Federal action by deepening and widening the current channel alignment, starting offshore at the 60-foot-depth contour, and terminating at the Stauffer Channel Turning Basin. The proposed project will also provide for the creation of two new upland confined PAs (PAs 8 and 9), adjacent to the Brazos River.

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material

It is estimated that the new work dredged material will consist of 72 percent clay, 21 percent silt, and 7 percent sand/shell. A description of the new work material and the existing maintenance material can be found in sections 3.5 and 4.3 of the EIS.

(2) Quantity of Material

It is estimated that approximately 17.3 mcy of new work material would be generated by dredging the LPP project, with 12.7 mcy of new work material to be placed at the existing New Work ODMDS, and the remainder to be placed at two new upland PAs, PA 8 (1.9 mcy) and PA 9 (2.7 mcy). Also, on the average, a total of 3.2 mcy of future maintenance dredged material per maintenance cycle will be placed in the existing Maintenance ODMDS, and 0.04 mcy, 0.12 mcy, and 0.19 mcy would be placed in PAs 1, 8, and 9, respectively, on a 3-year cycle.

e. Description of the Proposed Discharge

(1) Location

New work and maintenance material from the LPP Alternative would be placed into the designated ODMDSs and PAs 1, 8, and 9 (see Figure 3.1-1 in the EIS).

(2) Size

Two new PAs have been proposed for the project. These are PAs 8 and 9, located across the Brazos River diversion channel and slightly north from PA 1 (see Figure 2.5-1 in the EIS). These two PAs occur on adjacent real estate tracts Eight (254 acres) and Nine (442 acres), which are geographically separated by County Road 217 (CR 217). Tract Nine is situated north of CR 217, and Tract Eight lies south of CR 217, with its southern boundary bordering State Highway 36 (SH 36).

Approximately 5.82 mcy of new work dredged material from proposed channel improvements is targeted for confined, upland placement on these tracts. The footprint of PA 8 is approximately 168 acres, and the footprint of PA 9 is approximately 250 acres.

(3) Type of Site and Habitat

The ODMDSs are offshore ocean bottom. The inland PAs (8 and 9) comprise 21 acres of forest, 39 acres of wetlands, and 358 acres of grassland.

(4) Time and Duration of Discharge

Construction is estimated to take 2 years. Maintenance will be ongoing; estimates for the LPP Alternative include a 50-year project life.

f. Description of Disposal Method

Hydraulic pipeline dredges will be used and Best Management Practices (BMPs) will be implemented where appropriate to control and reduce turbidity during dredging and discharge from upland PAs. Dewatering structures would drain PAs 8 and 9 into the Brazos River. BMPs will also be employed during construction of temporary containment levees and spill boxes for restoration sites. Hopper dredges with BMPs to reduce impacts to threatened and endangered sea turtles would be used for material destined for offshore placement

II. FACTUAL DETERMINATIONS

a. Physical Substrate Determinations

(1) Substrate Elevation and Slope

Maximum mound height for ODMDS substrates would range from 8.5 and 12 feet for maintenance and new work material, respectively. Both sites are expected to return to ambient bathymetry within a reasonable time period, since these are dispersive sites (Appendix B of the EIS).

(2) Sediment Type

Dredged material will consist of 72 percent clay, 21 percent silt, and 7 percent sand/shell. A description of the new work material and the existing maintenance material can be found in sections 3.5 and 4.3 of the EIS.

(3) Dredged/Fill Material Movement

Physical oceanographic parameters were used to (1) develop the necessary buffer zones for the exclusion analysis, and (2) determine the minimum size of the preferred site in U.S. Environmental Protection Agency (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 ODMDSs. The sizes of the ODMDSs were modeled using MDFATE, which includes vertical mixing, to ensure that they were large enough to prevent significant mounding.

Upland PAs will have containment levees to control fill movement after deposition; small amounts of suspended solids may be present in the discharge. BMPs will be implemented to control and reduce discharge turbidity.

(4) Physical Effects on Benthos

Impacts to benthic organisms and their Gulf and estuarine water-bottom habitats would occur; however, benthic organisms are expected to quickly rebound from the short-term impacts of channel dredging, and the use of an ODMDS. BMPs will be used where appropriate to contain and control sediment and dredged material movement.

(5) Other Effects

None known.

(6) Actions Taken to Minimize Impacts

This project was fully coordinated with State and Federal resource agencies, and responses to their comments have been incorporated into the development of the dredged material PAs. Any unavoidable losses will be mitigated.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water

The use of the ODMDSs and PAs 1, 8, and 9 are expected to have only minor, short-term impacts on water quality in the area. Impacts to water quality are discussed more fully in Section 4.2 and Appendix B of the EIS.

(a) Salinity

The USACE has determined that salinity changes are not expected to result from the FHCIP because the channel is already as saline as the Gulf (Section 4.2 and Appendix B of the EIS).

(b) Water Chemistry

There are no indications of water or elutriate problems in the Freeport Harbor Jetty and Outer Bar channels (sections 3.4 and 4.2 and Appendix B of the EIS).

(c) Clarity

There will be some temporary increase in local turbidity during dredging and placement operations. Water clarity is expected to return to normal background levels shortly after operations are completed.

(d) Color

Water immediately surrounding the construction area will become discolored temporarily due to disturbance of the sediment. BMPs will be implemented to reduce and control turbidity.

(e) Odor

The new work material is not expected to be anoxic, so there should be no odors associated with dredging and placement, nor are any expected from ODMDS placement. Negligible amounts of hydrogen sulfide may be expected. There should be no change in the maintenance material.

(f) Taste

No detectable impacts in the marine environment.

(g) Dissolved Gas Levels

Negligible amounts of hydrogen sulfide may be expected.

(h) Nutrients

Nutrient levels may be slightly and temporarily elevated near the PAs since new work material is low in organics. Some maintenance material will be dredged along with the new work material. There should be no change in the maintenance material.

(i) Eutrophication

Nutrients are not expected to reach levels high enough for periods long enough to lead to eutrophication of the surrounding waters.

(j) Others as Appropriate

None known.

(2) Current Patterns and Circulation

The ODMDSs were not shown to significantly affect currents or circulation patterns (Appendix B of the EIS).

(a) Current Patterns and Flow

No impacts are expected.

(b) Velocity

No impacts are expected.

(c) Stratification

No impacts are expected.

(d) Hydrologic Regime

No impacts are expected.

(3) Normal Water Level Fluctuations

Negligible effects are expected (Section 4.2 of the EIS).

(4) Salinity Gradients

The USACE has determined that salinity changes are not expected (Section 4.2 of the EIS).

(5) Actions That Will Be Taken to Minimize Impacts

In addition to alternatives analyses, the selected dredged material placement areas avoid impacts to various resources such as threatened and endangered sea turtles, cultural resources, and essential fish habitat. BMPs will be implemented during construction and maintenance activities.

c. Suspended Particulate/Turbidity Determination

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site

An increase in suspended particulates and the concomitant turbidity levels is expected during dredging and placement operations of new work and maintenance material (Section 4.2 and Appendix B of the EIS). These are temporary and localized events.

(2) Effects on Chemical and Physical Properties of the Water Column

(a) Light Penetration

Turbidity levels will be temporarily increased during dredging and placement operations of new work and maintenance material associated with the ODMDSs.

(b) Dissolved Oxygen

No adverse impacts to dissolved oxygen are expected.

(c) Toxic metals and organics

No cause for concern is indicated for the construction material from any portion of the Freeport Ship Channel. However, during the Preconstruction, Engineering, and Design (PED) phase of the project, the USACE plans additional sampling of construction material from both the Stauffer Channel and from the extension of the Entrance Channel (Section 3.4 of the EIS). No cause for concern has been indicated by repeated testing of maintenance material.

(d) Pathogens

None expected or found.

(e) Aesthetics

The ODMDSs have been designed and selected in coordination with resource agencies to minimize environmental impacts and reduce or eliminate adverse aesthetic qualities.

(f) Others as Appropriate

None known.

(3) Effects on Biota

No impacts are expected on photosynthesis, suspension/filter feeders, and sight feeders, except for temporary impacts from dredging (e.g., temporary increases in local turbidity levels) or placement operations (e.g., burial of benthos).

(4) Actions Taken to Minimize Impacts

Construction and placement plans for the materials have been closely coordinated with the resource agencies to assure minimal impacts. BMPs will be applied to reduce and control turbidity and sediment discharge and impacts to threatened and endangered sea turtles.

d. Contaminant Determinations

No increase in contaminant levels is expected during construction and placement operations. The potential for contaminants has been evaluated through chemical analyses, grain-size analyses, and some bioassays and bioaccumulation tests (sections 3.4 and 4.2 and Appendix B of the EIS). However, during the PED phase of the project, the USACE plans additional sampling of construction material from both the Stauffer Channel and from the extension of the Entrance Channel.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on Plankton

Construction and placement operations are expected to have only minor temporary, local impacts on plankton from increased turbidity levels.

(2) Effects on Benthos

Impacts to benthic organisms and their Gulf and estuarine water-bottom habitats would occur; however, benthic organisms are expected to quickly rebound from the short-term impacts of channel dredging, and the use of offshore PAs. Repeated use of the new work ODMDS for the Widening Project and FHCIP could temporarily change the benthic community composition at the site (Section 4.12.1 of the EIS).

(3) Effects on Nekton

Wright (1978) indicates that nekton is not directly affected by dredged material placement since they can avoid areas of high turbidity. The benthos at the PAs, which would have been used as a food source, would be detrimentally affected, but PAs are relatively small in area compared to offshore areas near Freeport. The elutriate analyses with undisturbed virgin sediment yielded no expectation of short-term water column impacts from dredging or placement operations, except from increased turbidity. Therefore, no significant impacts to the nekton of the area from the proposed dredging and placement operations are expected.

(4) Effects on Aquatic Food Web

The estuarine and Gulf food web may temporarily benefit from greater productivity associated with creation of ODMDSs through structural diversity in the form of a topographical high (Clarke and Kasul, 1994), but benthos at the sites would be buried and the community would likely change. Reductions in primary productivity from turbidity would be localized around the immediate area of the construction and maintenance dredge operations and would be limited to the duration of the plume at a given site.

(5) Effects on Special Aquatic Sites

Construction of the LPP would impact 39 acres of wetlands by construction of PAs 8 and 9 and that these impacts would be fully compensated by the mitigation plan presented in FEIS Appendix H.

f. Proposed Disposal Site Determinations

(1) Mixing Zone Determination

Testing has demonstrated that adequate mixing exists to dilute the concentrations of effluents from the ODMDSs (Section 4.2 and Appendix B of the EIS). Mixing is not required due to the lack of contaminants.

(2) Determination of Compliance with Applicable Water Quality Standards

Sediment analyses of new work and maintenance material have been performed, and testing of elutriates prepared with the maintenance and construction material has not demonstrated any violation of applicable water quality standards. The State of Texas has issued a water quality certificate for current maintenance dredging of Freeport Harbor, indicating that water quality standards are being met.

(3) Potential Effects on Human Use Characteristics

(a) Municipal and Private Water Supply

No apparent private, public, or industrial water wells registered with the Texas Water Development Board (2006) would be destroyed and/or affected based on their proximal distances and completed depths below surface grade (Section 4.8 of the EIS).

(b) Recreational and Commercial Fisheries

Topographic highs created through ODMDSs would provide temporary structural diversity; otherwise, no long-term effects to recreational or commercial fisheries are anticipated as a result of the LPP Alternative.

(c) Water-related Recreation

The project will improve overall safety of navigation traffic, which may improve water-related recreation.

(d) Aesthetics

The project is designed to minimize any adverse impacts to the environment and aesthetic qualities in the area. Construction of two new PAs would change the aesthetics in the immediate vicinity. However, the PAs are consistent with current land uses in the area.

(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

No parks, national or historic monuments, national seashores, wilderness areas, or research sites will be negatively impacted by the project.

g. Determination of Cumulative Effects on the Aquatic Ecosystem

The project is not expected to result in negative cumulative impacts in the aquatic ecosystem. A Habitat Evaluation Procedure was performed to ensure adequate replacement of habitats and functions.

h. Determination of Secondary Effects on the Aquatic Ecosystem

No adverse significant secondary effects on the aquatic ecosystem should occur as a result of the recommended project.

REFERENCES

Clark D., and R. Kasul. 1994. Habitat value of offshore dredged material berms for fishery resources. Proc 2nd Int. Conf. on Dredging and Dredged Material Placement, Florida, ASCE.

Texas Water Development Board. 2006. Groundwater Database Reports, Brazoria County. Web Site: www.twdb.state.tx.us.

U.S. Environmental Protection Agency (EPA). 1989. Draft Environmental Impact Statement, Freeport Harbor (45-foot Project), Ocean Dredged Material Disposal Site Designation, EPA 906/01-80-003. U.S. EPA Region VI, Dallas, Texas.

Wright, T.C. 1978. Aquatic dredged material disposal impacts. U.S. Army Engineers Water Experiment Station Environmental Laboratory, Vicksburg, Mississippi. Technical Report DS-78-1.

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**FINDINGS OF COMPLIANCE WITH
SECTION 404 (b) (1) GUIDELINES
FREEPORT HARBOR CHANNEL
IMPROVEMENTS PROJECT
BRAZORIA COUNTY, TEXAS**

1. No significant adaptations of the Guidelines were made relative to the evaluation for this project.

2. The tentatively Recommended Plan is the result of evaluation of a preliminary array of several alternatives and thorough evaluation of three.

3. The tentatively Recommended Plan will not violate any applicable State or Federal water quality criteria or toxic effluent standards of Section 307 of the Clean Water Act.

4. The tentatively Recommended Plan will not jeopardize the existence of any federally or State-listed threatened or endangered species or their critical habitat or violate any protective measures for any sanctuary. Various resource agencies, including FWS and NMFS, have been consulted regarding potential issues of any federally or State-listed threatened or endangered species or their critical habitat (e.g., sea turtle avoidance measures will be implemented during operations).

5. The tentatively Recommended Plan will not result in adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. There are no significant adverse impacts expected to the estuarine ecosystem diversity, productivity, and stability or recreational, aesthetic, and economic values.

6. Appropriate steps to minimize potential adverse impacts on the estuarine system include close coordination with State and Federal resource agencies during final design prior to construction to incorporate all valid suggestions. Several habitats affected by channel widening, deepening, and expansion will be mitigated.

7. Based on the guidelines, the preferred alternative is specified as complying with the requirements of the Section 404(b)(1) guidelines.

Joanne Shaw (signature) March 16, 2011

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

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

February 2, 2011

Ms. Janelle Stokes
U.S. Army Corps of Engineers
Galveston District CESWG-PE-RE
P.O. Box 1229
Galveston, Texas 77553-1229

Re: USACE Project No. SWG-2004-02311 - Freeport Harbor Channel Improvement Project Draft Feasibility Report and Draft Environmental Impact Statement

Dear Ms. Stokes:

As described in the Public Notice, dated December 23, 2010, the applicant, Port Freeport, proposes the Freeport Harbor Channel Improvement Project (FHCIP) to deepen and widen the Freeport Harbor Channel. The project is located along the middle Texas Gulf Coast, south of the city of Freeport, Brazoria County, Texas.

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

1. Title 30, Texas Administrative Code (TAC), Chapter 279.11(c)(1), states that "No discharge shall be certified if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, ..." As noted in the Draft Feasibility Report and Draft Environmental Impact Statement, the proposed widening of the Outer Bay and Jetty channels (Widening Project) is approved and permitted for construction. The FHCIP, as proposed, will include deepening of the Outer Bay and Jetty channels and the widening and/or deepening of the Main Channel reaches, Brazos Harbor and Stauffer Channel. Since the FHCIP project boundaries completely overlap the Widening Project boundaries, economic and environmental impacts associated with the two projects can be substantially minimized through coordination and planning efforts that maximize the uses of available resources for the two projects. Please provide an overview of project design and coordination alternatives that would result in the least adverse impact to the aquatic ecosystem and maximum use of limited available resources.

2. FHCIP dredged material from the Outer Bar and Jetty Channels would be placed in the existing New Work Ocean Dredged Material Disposal Site (New Work ODMDS) and confined placement area (PA) 1 and proposed PAs 8 and 9. Development and construction of PAs 8 and 9 would result in the unavoidable adverse impact to 21 acres of riparian forest and 39.5 acres of wetlands. Proposed mitigation for adverse impacts to riparian forest and wetlands are based on the results of evaluations using Habitat Evaluation Procedures (HEP) and a habitat suitability index (HSI) value for the gray squirrel and veery. 30 TAC

February 2, 2011

Chapter 279.2(b) states that the policy of the commission is "to achieve no overall net loss of the existing wetlands resource base with respect to wetlands functions and values." It is recommended that a functional assessment methodology such as the Hydrogeomorphic (HGM) approach be used to adequately assess the aquatic resource function and values and appropriate compensatory mitigation of unavoidable adverse impacts.

3. Texas Commission on Environmental Quality (TCEQ) requires that total suspended solids (TSS) concentrations in effluent associated with dredging activities be controlled to a maximum of 300 milligrams per liter (mg/L). Please provide a list of best management practices (BMPs) and operational procedures that will be used to minimize TSS levels during dredging operations and the placement of dredged material.

4. Chinese tallow is identified in the DEIS as an invasive species in forested riparian habitats. In addition to tallow removal, the DEIS should include long-term management protocols (mechanical and manual removal; selective herbicide applications, etc.) to minimize the occurrence of the species, especially at mitigation sites.

5. Proposed mitigation is presented in Appendix H-1 of the DEIS. Continuity of adjacent mitigation parcels is critical for wildlife habitat. It is recommended that mitigation parcels be located as closely as possible to maximize wildlife habitat and resource function. It is also recommended that all mitigation parcels be protected in perpetuity by a conservation easement.

The TCEQ looks forward to receiving and evaluating other agency or public comments. Please provide any agency comments, public comments, as well as the applicant's comments, to Mr. Robert Hansen of the Water Quality Division MC-150, P.O. Box 13087, Austin, Texas 78711-3087. Mr. Hansen may also be contacted by e-mail at *Robert.Hansen@tceq.texas.gov*, or by telephone at (512) 239-4583.

Sincerely,

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

CWM/RSH/evm

Enclosure

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

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

February 23, 2011

Environmental Section

Mr. Charles W. Maguire
Director
Water Quality Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Dear Mr. Maguire,

Reference is made to your letter dated February 2, 2011 regarding the Freeport Harbor Channel Improvement Project (FHCIP) Draft Feasibility Study and Draft Environmental Impact Statement (DEIS), issued for public and agency review on December 23, 2010. We offer the following information in response to your comments.

1. You requested that USACE provide an overview of efforts to coordinate the design of the proposed FHCIP and the previously-permitted Port Freeport Widening Project (Widening Project) to demonstrate that the recommended plan would result in the least adverse impact to the aquatic ecosystem. The FHCIP project boundaries overlap the Widening Project in the Jetty and Outer Bar Channels, only. The FHCIP includes an offshore channel extension and inland channels and turning basins that are not part of the Widening Project. Offshore, the FHCIP project includes a channel extension that is needed for the proposed 57-foot deep channel to reach the corresponding depth in the Gulf of Mexico. Inland channel reaches and basins not included in the Widening Project are the Lower Turning Basin, the Channel to the Brazosport, and the Brazosport Turning Basin (all to be deepened to 55 feet), the Upper Turning Basin (to be deepened to 50 feet), and the Stauffer Channel (the lower 3,700 feet to be deepened to 50 feet and widened to 300 feet-wide, and the remainder deepened to 25 feet). Planning for both projects was coordinated to minimize adverse impacts to the greatest extent possible. The same New Work and Maintenance Offshore Dredge Material Disposal Sites (ODMDS) will be utilized for both projects. No upland placement areas were required for the Widening Project; all material will be placed in the ODMDS or used beneficially for beach nourishment at Quintana Beach. Sediment suitable for beach nourishment will be available from the surficial sediments to be dredged by the Widening Project, unlike the FHCIP which excavates deeper sediments that do not contain beach-quality sands. Hydraulic dredging of the FHCIP inland channels would require the use of upland, confined placement areas (PA). Only one existing PA with remaining capacity is located near the channels that would be deepened (PA 1), and it does not provide sufficient capacity for all material resulting from the proposed FHCIP, thereby requiring the development of new PAs 8 and 9. There is no practicable alternative to the proposed project that would have less adverse impact on the aquatic ecosystem.

2. You recommended that a functional assessment methodology such as the Hydrogeomorphic (HGM) approach be used, citing that it is the policy of the commission (30 TAC Chapter 279.2(b)) "to achieve no overall net loss of the existing wetlands resource base with respect to wetlands functions and values." The FHCIP is a USACE Civil Works water resources project; it does not require a Federal license or permit. USACE policy also requires that Federal projects result in no net loss of wetlands, but our policy requires the use of a habitat-based methodology to evaluate impacts and quantify necessary mitigation. The HEP methodology quantifies habitat quality and quantity, and as such evaluates the functional habitat suitability of the evaluated species. The evaluation of impacts and proposed mitigation for FHCIP adverse impacts to wetlands was based on HEP-based mottled duck and great egret HSI models. Impacts to riparian forest were evaluated using gray squirrel and veery HSI models. USFWS and TPWD participated in the selection and application of these HSI models. The appropriateness of the HEP methodology and the results of this specific application were evaluated and approved by an Agency Technical Review and an Independent External Peer Review. USACE believes that the ecological modeling utilized for the FHCIP has adequately captured impacts and quantified mitigation. The recommended mitigation will result in no net loss of wetlands, and fulfills requirements of USACE policy and applicable Federal laws and regulations.

3. You requested that we provide a list of best management practices (BMPs) and operational procedures that will be used to minimize total suspended solids (TSS) during dredging operations and the placement of dredged material. The TCEQ requirement that TSS concentrations in effluent associated with dredging activities be controlled to a maximum of 300 milligrams per liter would be met by the use outlet structures in PAs 1, 8 and 9 to control the ponding of water and the settling of TSS before release. Systematic elutriate and water sampling would be conducted during and after dredging contracts to ensure TCEQ requirements are met.

4. You recommended that protocols for the long-term management of chinese tallow be included to minimize the occurrence of this invasive species, especially at mitigation sites. Upland areas managed in conjunction with the FHCIP would be limited to the proposed mitigation areas and PAs 1, 8 and 9. Tallow control at the PAs would be accomplished during regular levee maintenance, and seedlings growing inside the PAs would be controlled by regular PA use. The Mitigation Monitoring and Contingency Plan (presented in Appendix H-2 of the DEIS) includes an annual invasive or exotic plant control program for the mitigation sites. This program provides for long-term controls over the growth of chinese tallow in proposed mitigation sites.

5. You recommended that mitigation sites be located as close together as possible to maximize habitat and resource function, and that mitigation sites be protected in perpetuity by a conservation easement. The mitigation proposed for the project, as described in Chapter 5, and Appendices H-1 and H-2 of the FHCIP DEIS, already meets these recommendations. A contiguous tract of riparian forest (approximately 131 acres in size) would be preserved under a permanent conservation easement with Texas Parks and Wildlife or another appropriate organization. A total of 12 acres of riparian forest would be reestablished in six natural clearings or tallow-dominated areas within this131-acre area, along with a 3-acre wetland pond. The proposed mitigation sites and pond would be connected to the surrounding riparian forest and therefore would maximize connectivity and habitat resource and function.

In conclusion, we hope this additional information will be helpful in your review. We trust that that we have provided sufficient information for you to provide §401 State Water Quality certification. However, we would be happy to meet with you to provide further information if needed. All public and agency comments on the DEIS and our responses will be available for your review when they are presented in the FEIS. Please do not hesitate to contact Ms. Janelle Stokes at 409/766-3039 should you need further assistance.

Sincerely,

Carolyn Murphy

Carolyn Murphy
Chief, Environmental Section

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

March 28, 2011

Ms. Janelle Stokes
Galveston District CESWG-PE-RE
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Re: USACE Permit Application Number SWG-2004-02311

Dear Ms. Stokes:

This letter is in response to the United States Army Corps of Engineers – Galveston District (Corps) correspondence dated February 23, 2011, requesting §401 Water Quality Certification and the Public Notice dated December 23, 2010 for review and comments on the Freeport Harbor Channel Improvement Project (FHCIP) Draft Feasibility Report and Draft Environmental Impact Statement (DEIS). The project is located along the middle Texas Gulf Coast, south of the city of Freeport, Brazoria County, Texas.

The Texas Commission on Environmental Quality (TCEQ) has reviewed the public notice and related application information provided by the Corps. On behalf of the Executive Director and based on our evaluation of the information contained in these documents, the TCEQ certifies that there is reasonable assurance that the project will be conducted in a way that will not violate water quality standards.

The applicant, Port Freeport, proposes the FHCIP to deepen and widen the Freeport Harbor Channel, including the deepening of the Outer Bay and Jetty channels and the widening and/or deepening of the Main Channel reaches, Brazos Harbor and Stauffer Channel. FHCIP dredged material from the Outer Bay and Jetty Channels would be placed in the existing New Work Ocean Dredged Material Disposal Site (New Work ODMDS) and confined placement area (PA)1 and proposed PAs 8 and 9. Development and construction of PAs 8 and 9 would result in the unavoidable adverse impact to 21 acres of riparian forest and 39.5 acres of wetlands.

Three mitigation sites adjacent to the proposed PAs are identified in the DEIS for compensatory mitigation for unavoidable adverse impacts. Mitigation Site 1 includes 117 acres of riparian forest, 5 acres of cleared forest, and approximately 9.8 acres of grassland. Riparian forest mitigation at this site would include the clearing of invasive tallows and planting a total of 12 acres with new native tree species. A three-acre ephemeral wetland pond would also be created at Mitigation Site 1. Mitigation Site 2 includes 9.5 acres of riparian forest and 5 acres of mixed tallow and scrub shrub vegetation. The 5-acre mixed tallow and shrub site would be cleared and replanted with hard-mast and flood tolerant native trees. Mitigation Site 3 includes 112 acres of riparian forest and 12.7 acres of dense

P.O. Box 13087 Austin, Texas 78711-3087 512-239-1000 Internet address: www.tceq.state.tx.us

tallow and scrub shrub vegetation. Approximately 30 percent of the site would be cleared and replanted with hard-mast native and flood tolerant native trees. A 3-acre ephemeral wetland pond would also be created within the scrub shrub area of the mitigation site. Impacts and the compensatory mitigation plan were evaluated and developed by the Corps using Habitat Evaluation Procedures (HEP) and based on field data obtained with the assistance of the United States Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department (TPWD).

The TCEQ has reviewed this proposed action for consistency with the Texas Coastal Management Program (CMP) goals and policies in accordance with the regulations of the Coastal Coordination Council and has determined that the proposed action is consistent with the applicable CMP goals and policies.

This certification was reviewed for consistency with the CMP's development in critical areas policy {Title 31, Texas Administrative Code (TAC), Chapter (§) 501.23} and dredging and dredged material disposal and placement policy {31 TAC §501.25}. This certification complies with the CMP goals {31 TAC §501.12(1, 2, 3, 5)} applicable to these policies.

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

If you require additional information or further assistance, please contact Mr. Robert Hansen, Water Quality Assessment Section, Water Quality Division (MC-150), at (512) 239-4583.

Sincerely,

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

CWS/RSH/mve

Attachment

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

WORK DESCRIPTION: As described in the public notice dated December 23, 2010, and additional information provided by the Corps, dated February 23, 2011.

SPECIAL CONDITIONS: None

GENERAL: This certification, issued pursuant to the requirements of Title 30, Texas Administrative Code, Chapter 279, is restricted to the work described in the December 23, 2010, Draft Environmental Impact Statement and Draft Feasibility Report. This certification may be extended to any minor revision of the Environmental Impact Statement (EIS) when such change(s) would not result in an impact on water quality. The Texas Commission on Environmental Quality (TCEQ) reserves the right to require full joint public notice on a request for minor revision. The applicant is hereby placed on notice that any activity conducted pursuant to the EIS and Corps project authorization which results in a violation of the state's surface water quality standards may result in an enforcement proceeding being initiated by the TCEQ or a successor agency.

STANDARD PROVISIONS: These following provisions attach to any permit issued by the Corps and shall be followed by the permittee or any employee, agent, contractor, or subcontractor of the permittee during any phase of work authorized by the Corps.

1. The water quality of wetlands shall be maintained in accordance with all applicable provisions of the Texas Surface Water Quality Standards including the General, Narrative, and Numerical Criteria.

2. The applicant shall not engage in any activity which will cause surface waters to be toxic to man, aquatic life, or terrestrial life.

3. Permittee shall employ measures to control spills of fuels, lubricants, or any other materials to prevent them from entering a watercourse. All spills shall be promptly reported to the TCEQ by calling the State of Texas Environmental Hotline at 1-800-832-8224.

4. Sanitary wastes shall be retained for disposal in some legal manner. Marinas and similar operations which harbor boats equipped with marine sanitation devices shall provide state/federal permitted treatment facilities or pump out facilities for ultimate transfer to a permitted treatment facility. Additionally, marinas shall display signs in appropriate locations advising boat owners that the discharge of sewage from a marine sanitation device to waters in the state is a violation of state and federal law

5. Materials resulting from the destruction of existing structures shall be removed from the water or areas adjacent to the water and disposed of in some legal manner.

6. A discharge shall not cause substantial and persistent changes from ambient conditions of turbidity or color. The use of silt screens or other appropriate methods is encouraged to confine suspended particulates.

7. The placement of any material in a watercourse or wetlands shall be avoided and placed there only with the approval of the Corps when no other reasonable alternative is available. If work within a wetland is unavoidable, gouging or rutting of the substrate is prohibited. Heavy equipment shall be placed on mats to protect the substrate from gouging and rutting if necessary.

8. Dredged Material Placement: Dredged sediments shall be placed in such a manner as to prevent any sediment runoff onto any adjacent property not owned by the applicant. Liquid runoff from the disposal area shall be retained on-site or shall be filtered and returned to the watercourse from which the dredged materials were removed. Except for material placement authorized by this permit, sediments from the project shall be placed in such a manner as to prevent any sediment runoff into waters in the state, including wetlands.

9. If contaminated spoil that was not anticipated or provided for in the permit application is encountered during dredging, dredging operations shall be immediately terminated and the TCEQ shall be contacted by calling the State of Texas Environmental Hotline at 1-800-832-8224. Dredging activities shall not be resumed until authorized by the Commission.

10. Contaminated water, soil, or any other material shall not be allowed to enter a watercourse. Noncontaminated storm water from impervious surfaces shall be controlled to prevent the washing of debris into the waterway.

11. Storm water runoff from construction activities that result in a disturbance of one or more acres, or are a part of a common plan of development that will result in the disturbance of one or more acres, must be controlled and authorized under Texas Pollutant Discharge Elimination System (TPDES) general permit TXR150000. A copy of the general permit, application (notice of intent), and additional information is available at: http://www.tceq.state.tx.us/nav/permits/wq_construction.html or by contacting the TCEQ Storm Water & Pretreatment Team at (512) 239-4671.

12. Upon completion of earthwork operations, all temporary fills shall be removed from the watercourse/wetland, and areas disturbed during construction shall be seeded, riprapped, or given some other type of protection to minimize subsequent soil erosion. Any fill material shall be clean and of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters.

13. Disturbance to vegetation will be limited to only what is absolutely necessary. After construction, all disturbed areas will be revegetated to approximate the pre-disturbance native plant assemblage.

14. Where the control of weeds, insects, and other undesirable species is deemed necessary by the permittee, control methods which are nontoxic to aquatic life or human health shall be employed when the activity is located in or in close proximity to water, including wetlands.

15. Concentrations of taste and odor producing substances shall not interfere with the production of potable water by reasonable water treatment methods, impart unpalatable flavor to food fish including shellfish, result in offensive odors arising from the water, or otherwise interfere with reasonable use of the water in the state.

16. Surface water shall be essentially free of floating debris and suspended solids that are conducive to producing adverse responses in aquatic organisms, putrescible sludge deposits, or sediment layers which adversely affect benthic biota or any lawful uses.

17. Surface waters shall be essentially free of settleable solids conducive to changes in flow characteristics of stream channels or the untimely filling of reservoirs, lakes, and bays.

18. The work of the applicant shall be conducted such that surface waters are maintained in an aesthetically attractive condition and foaming or frothing of a persistent nature is avoided. Surface waters shall be maintained so that oil, grease, or related residue will not produce a visible film of oil or globules of grease on the surface or coat the banks or bottoms of the watercourse.

19. This certification shall not be deemed as fulfilling the applicant's/permittee's responsibility to obtain additional authorization/approval from other local, state, or federal regulatory agencies having special/specific authority to preserve and/or protect resources within the area where the work will occur.

Appendix H

Mitigation and HEP/Cost Analysis Report

Appendix H-1

Mitigation and HEP/Cost Analysis Report

APPENDIX H-1
MITIGATION AND HEP COST REPORT

1.0 INTRODUCTION

Mitigation is required for the proposed Freeport Harbor Channel Improvement Project (FHCIP). Although channel improvements will not produce impacts that will require mitigation, the development of two new upland placement areas (PAs), PAs 8 and 9, will result in both wetland and riparian forest impacts. The PAs are being developed on land owned or leased by the project Sponsor, Port Freeport (Port) designated as tracts Eight and Nine (Figure 1). PAs 8 (168 acres) and 9 (250 acres) fall within tracts Eight (254 acres) and Nine (442 acres), respectively, and will contain approximately 19.3 million cubic yards (mcy) of new work and maintenance material from the proposed channel improvements. Impacts to these areas were evaluated using Habitat Evaluation Procedures (HEP) and IWR-Plan to develop a project mitigation plan.

Tracts Eight and Nine are currently degraded pasture with ephemeral wetland swales that are seasonally dry, and some second-growth riparian forest adjacent to the Brazos River Diversion Channel (Diversion Channel). Both tracts are overgrazed and contain substantial numbers of non-native invasives including pasture grasses and Chinese tallow trees (tallow), and native species indicative of disturbance. The wetland swale located in the southern part of Tract Eight is the most prominent swale on the properties, and PA 8 was designed to avoid this swale. The swales contain water seasonally, and are often dry, possessing minimal wetland habitat value.

Construction of PAs 8 and 9, including pipeline corridors and effluent ditches, will impact 418 acres of land, including 21 acres of secondary riparian forest, 39 acres of ephemeral wetlands, and 358 acres of degraded pasture with some scrub/shrub (Table 1). Of these habitats, mitigation is proposed for the riparian forest and wetland impacts.

Table 1
Project Impacts by Habitat Types

Project Feature	Habitat Impacts		
Proposed Upland Placement Areas	**Riparian Forest (Acres)**	**Wetlands (Acres)**	**Pasture (Acres)**
PA 8	0	23	145
PA 9	21	16	213
Totals	21	39	358

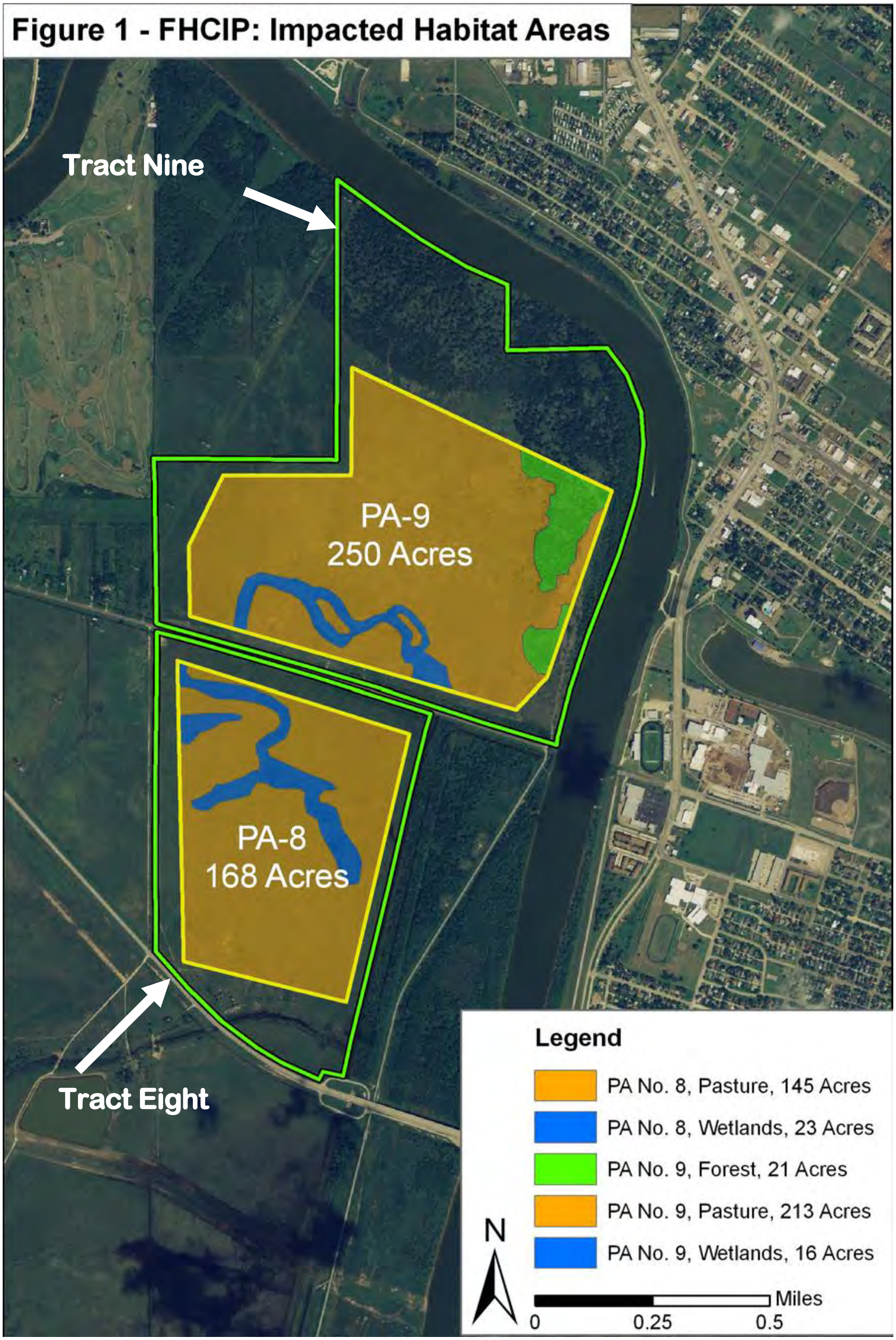


Figure 1 - FHCIP: Impacted Habitat Areas
Tract Nine
PA-9
250 Acres
PA-8
168 Acres
Tract Eight
Legend
PA No. 8, Pasture, 145 Acres
PA No. 8, Wetlands, 23 Acres
PA No. 9, Forest, 21 Acres
PA No. 9, Pasture, 213 Acres
PA No. 9, Wetlands, 16 Acres
N
Miles
0
0.25
0.5

2.0 RESOURCE AGENCY COORDINATION

Resource agency personnel from the U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD) participated in site visits and in collecting the required field data for conducting the HEP analysis for impacted wetlands and riparian forest, and provided valuable advice in completing the analysis. The agencies also provided significant input for siting and design of project mitigation for losses to forest and wetland habitats. During agency coordination for siting project mitigation features, emphasis was placed on in-kind mitigation located in close proximity to impacted habitats. Therefore, available mitigation lands situated immediately adjacent to impacted habitats were sites of primary consideration. Areas considered for project mitigation and coordinated with the resource agencies included land to the north and east of PA 9 adjacent to the Diversion Channel, and land east of Tract 8 to the Diversion Channel (Figure 2). The area between the proposed PAs and the Diversion Channel contains riparian forest and areas appropriate for wetland mitigation.

The agencies made a number of recommendations we could not concur with for project mitigation. For example, USFWS recommended that the entire riparian forest between the PAs and the Diversion Channel be selectively cleared of tallow, replanted with a combination of hard mast and flood-tolerant native trees, and be protected in perpetuity by a conservation easement. As demonstrated below, however, this would have resulted in excessive mitigation for project impacts and will not be implemented.

TPWD requested preservation in perpetuity of a 5-acre ephemeral wetland swale located between PA 8 and SH 36 as a mitigation feature. However, the Port does not wish to make this property available for project mitigation. The resource agencies also requested mitigation for the 358 acres of pasture impacted by PAs 8 and 9. The agencies classify these pastures as wet-coastal prairie. We do not concur with this habitat classification. Although the land may have at one time been coastal prairie, it is now degraded grassland primarily consisting of non-native pasture grasses of limited wildlife habitat value that does not merit mitigation.

3.0 USACE GUIDANCE CONCERNING ENVIRONMENTAL MITIGATION AND DEVELOPMENT OF THE MITIGATION PLAN

A project mitigation plan to address unavoidable impacts to significant habitat resulting from the construction of PAs 8 and 9 was developed that satisfies the USACE’s cost effectiveness and incremental cost analysis requirements as outlined in ER 1105-2-100. The plan considers the quality and regional significance of the impacted habitats and focuses on mitigating impacts to high-quality habitat while minimizing additional land acquisition costs. HEP models were considered adequate for both the riparian forest and wetland habitats impacted by this project.

4.0 POTENTIAL MITIGATION SITES

Once unavoidable project impacts had been identified, several tracts of land owned by the Port were considered for mitigation:

Peach Point: This land is owned by the Port and is located west of Freeport near Jones Creek in Brazoria County. The 408 acres offered by the Port for potential mitigation consists primarily of tidally influence wetlands near the Gulf Intracoastal Waterway (GIWW), which are brackish to saline in nature. These wetlands would not provide acceptable mitigation because they are out-of-kind mitigation substitutes for the freshwater ephemeral wetlands impacted by the project and were not considered further. Two additional sites near Peach Point were also considered for mitigation, but were dropped because they too would have provided out-of-kind mitigation like Peach Point.

Tracts Eight and Nine: Tract Eight is owned and Tract Nine is leased by the Port from Dow Chemical (Dow) for confined dredged material disposal and environmental mitigation purposes. All FHCIP mitigation could be located within and immediately adjacent to these tracts. One advantage of using this land is that no additional real estate acquisition costs would be incurred for the project. Potential mitigation sites 1, 2, and 3 (see Figure 2) were identified on these Tracts and are discussed in more detail in later sections of this document. From an ecological standpoint, this land provides for in-kind, on-site mitigation, which is desirable. In addition, the Port is willing to obtain a conservation easement from Dow, which will protect the riparian forest in Tract Nine in perpetuity. Given the potential of tracts Eight and Nine to provide not only PA sites but also mitigation lands, these tracts were selected. A detailed evaluation of tracts Eight and Nine based on HEP modeling is documented below. HEP modeling was used to quantify project impacts and mitigation compensation. Cost effectiveness (CE) and incremental cost analysis (ICA) was also performed to identify an optimal mitigation plan that fully compensates for project impacts.

5.0 HABITAT EVALUATION PROCEDURE

An HEP analysis was used to determine the amount of mitigation required to compensate for project impacts. HEP uses evaluation species as representative of habitat quality by determining a Habitat Suitability Index (HSI) for each species using a particular habitat. Each species has an associated HSI model, which is based upon the assumption that a positive relationship exists between the HSI and habitat carrying capacity, and that habitat suitability can be summarized on a scale ranging from 0.0 to 1.0 (USFWS, 1996). Data from field measurements of habitat variables are run through the respective suitability index model to generate a baseline HSI for each species or group of species utilizing the same habitats.


Figure 2 - FHCIP: Potential Mitigation Areas
Site-1
131.8 Acres
PA-9
250 Acres
Site-2
14.5 Acres
PA-8
168 Acres
Site-3
124.7 Acres
Legend
Potential Mitigation

The number of habitat units (HU) available in the habitat is calculated by multiplying the HSI by the area of habitat being analyzed. The final step in the process is to project the condition of the habitat into the future, over the period of analysis, and determine what the value of the habitat will be at certain points in time (target years – TY), when a change in habitat conditions is likely to occur. HUs are then summed for each species and divided by the years in the period of analysis.

The foregoing procedure provides the average annual habitat units (AAHUs) that can be compared to the AAHUs calculated for the same habitat type and species, at different locations or different conditions (management plans) at the same location. AAHUs for the future without project (FWOP) and future with project (FWP) conditions are calculated in this manner. The difference between these two conditions is used to calculate project impact and determine the mitigation needed to compensate for habitat losses to the evaluation species.

It should be noted that for this project, the focus of the mitigation is to replace the riparian forest and ephemeral wetland habitats lost through project construction and maintenance with another forest or wetlands of nearly equal value, using the evaluation species only as surrogates for quantifying habitat quality. No attempt is made to replace the habitat for each evaluation species. The assumptions and procedures used to calculate the AAHUs for the FWOP and FWP conditions are described below.

6.0 SITE DESCRIPTIONS AND SELECTION OF EVALUATION SPECIES

Tract Eight is utilized as a pasture. The site retains perhaps 30 percent of its original prairie habitat function and value and is vegetated by a large number of non-native invasives and species indicative of pasture maintenance, such as mowing. Species found at the site include rattlebox (*Sesbania drummondii*), Gulf cordgrass (*Spartina spartinae*), St. Augustine grass (*Stenotaphrum secundatum*), sedges (*Juncus* sp.), and tallow (*Sapium sebiferum*). Sparse concentrations of seacoast sumpweed (*Iva annua* L.), Carolina wolfberry (*Lycium carolinianum* var. *quadrifidum*), marsh-hay cordgrass (*Spartina patens*), sea ox-eye daisy (*Borrichia frutescens*), and frogfruit (*Phyla lanceolata*) were also observed. Evidence of overgrazing exists. Tract Eight also contains two small stock ponds. At the time of the site visit, these ponds were dry and vegetated with common arrowhead (*Sagittaria* L.), seacoast sumpweed (*Iva annua* L.), tallow (*Sapium sebiferum*), and were surrounded by Gulf cordgrass (*Spartina spartinae*), marsh-hay cordgrass (*Spartina patens*), and scattered native flowers.

Tract Nine is adjacent to the Diversion Channel and, although similar to Tract 8, is drier and the ground cover is sparser. The majority of the site consists of heavily overgrazed pasture vegetated with bermudagrass (*Cynodon dactylon*), rattlebox (*Sesbania drummondii*), frogfruit (*Phyla lanceolata*), and scattered Gulf cordgrass (*Spartina spartinae*). The pasture retains perhaps 10 percent of its original prairie habitat function and value and is considered substantially degraded. Tract Nine also includes two areas of riparian forest totaling 21 acres, both of which are situated adjacent to the Diversion Channel. The riparian forest is an open, second-growth, mixed-species forest, approximately 40 years in age, with a grazed understory. The forest consists of a diverse range of non-native invasive and native tree and brush species including sugar hackberry (*Celtis laevigata.*), cedar elm (*Ulmus crassifolia*), tallow (*Sapium sabiferum*), toothache tree (*Zanthoxylum fraxineum*), pecan trees (*Carya illinoinensis*), red mulberry (*Morus rubra* L.), honey locust (*Gleditsia aquatica*), gum bumelia (*Sideroxylon lanuginosum*), Jerusalem tree (*Parkinsonia aculeata*), chinaberry (*Melia azedarach*), yaupon holly (*Ilex vomitoria*), palmetto (*Serenoa repens*), green briar (*Smilax* sp.), peppervine (*Ampelopsis brevipedunculata*), trumpet creeper (*Campsis radicans*), poison ivy (*Toxicodendron radicans*), dewberry (*Rubus eubatus*), blackberry (*Rubus* sp.), native chili peppers (*Capsicum annuum* L.), iron weed (*Iva* sp.), Turk's cap (*Malvaviscus arboreus*), and frogfruit (*Phyla lour*). The height of this mixed-species canopy reaches 35 feet, and its density, maturity, diversity, and location along the Diversion Channel near the Gulf of Mexico adds to its value as a neotropical migrant songbird "fallout" site.

<u>Tracts Eight and Nine Wildlife Species</u> included the northern bobwhite (*Colinus virginianus*), marsh harrier (*Circus aeruginosus*), black-shouldered kite (*Elanus axillaris*), great egret (*Egretta alba*), snowy egret (*Egretta garzetta*), great blue heron (*Ardea herodias*), eastern meadowlark (*Sturnella magna*), red-winged blackbird (*Agelaius phoeniceus*), and others. Species seen in the forested portion of Tract Nine included the red-shouldered hawk (*Buteo lineatus*), black-crowned night heron (*Nycticorax nycticorax*), northern mockingbird (*Mimus polyglottos*), northern cardinal (*Cardinalis cardinalis*), white-eyed vireo (*Vireo griseus*), tufted titmouse (*Baelophus bicolor*), and Brewer's blackbird (*Euphagus cyanocephalus*).

For purposes of habitat evaluation, the HSI models for the mottled duck (*Anas fulvigula maculosa*) and great egret (*Egretta alba*) were used. These species served as surrogates for calculating the quality of the ephemeral wetlands at PAs 8 and 9. Ephemeral wetland swales at these sites generally consist of a semipermanent water regime, with water depths possibly approaching 3–5 inches during wet winter months, and drying up during the summer months.

Two evaluation species, the gray squirrel (*Sciurus carolinensis*) and veery (*Catharus fuscescens*), were used as surrogates to calculate the quality of the riparian forest The eastern meadowlark (*Sturnella magna*) was used as an evaluation species for calculating the quality of the grasslands, and only the HSI value for the food component of its model was used in the HEP analysis.

While the gray squirrel, veery, and mottled duck were not observed in the riparian forest or wetland habitats during the site visit, the forest may support squirrels and could provide fallout sanctuary for the veery. Similarly, the mottled duck could use the stock ponds and ephemeral swales and potholes within the project area. It should be noted that use of an HSI model for a species does not necessarily mean that the species occurs in the project area. The model only provides an estimate of the relative suitability of habitat in the project area for that species.

Field measurements were collected by USACE assisted by USFWS and TPWD biologists at PAs 8 and 9 on December 4, 2006. Data were collected from representative sampling sites in the riparian forest and at wetland and grassland areas to assess the suitability of these habitats for their respective evaluation species. The initial field data collected from this site visit was compiled by USFWS to establish baseline HSI values for the evaluation species, and was reviewed by TPWD and USACE.

7.0 HEP MODELING

Future Without Project (FWOP). Table 2 provides the average baseline condition HSI values and HUs for each evaluation species in each of the three habitats. The HSI was obtained by averaging the HSI values for each of the habitats surveyed. Before performing calculations for AAHUs, anticipated changes that will occur in the quality or quantity of each habitat must be determined and expressed as target years, over the designated period of analysis, which is 50 years for this project.

Table 2
Average HSI Values and HUs for All Habitats in Project Impact Areas
(Baseline Conditions)

Evaluation Species	Area of Available Habitat (Acres)	Average HSI Values	Habitat Units
Forest			
Gray Squirrel	21	0.21	4.4
Veery	21	0.47	9.9
Average HSI:		0.34	7.14
Wetlands			
Mottled Duck	39	0.13	5
Great Egret	39	0.29	11.3
Average HSI:		0.21	8.15
Grasslands			
Eastern Meadowlark	358	0.39	139.6

When determining the target years for the FWOP condition, it was assumed that the forest habitat on PA 9 would not likely experience any meaningful changes (losses) in habitat quality or quantity resulting from tree removal or other activities for development.

Currently, the forested areas function in part as a buffer for Dow operations, and, according to Port Freeport, will continue providing that function. Also, the current use of grasslands as maintained pasture for cattle would likely continue. However, the wetland and grassland habitats on PA 8 are expected to experience a change in habitat value for each evaluation species for the FWOP condition, due to planned development actions by the Port on Tract Eight. According to Port officials, these changes would probably occur approximately 15 years into the future. Prior to this potential development time frame, the wetlands and grasslands on PA 8 are assumed to experience no change in habitat value for each evaluation species.

In general, the assumption of no change in wetlands for both PAs 8 and 9 is due to their control by the Port and Dow. No change to the grasslands is expected because they are maintained pasture and periodically mowed, preventing any meaningful successional change. Table 3 provides the target years and area of impact for the FWOP condition, based on the assumptions described above.

Table 3
Future Without Project Target Years and Impact Area
for Each Habitat in the Construction Areas

Habitat	Target Years	Area (Acres)
Forest	Baseline	21
	1	21
	15	21
	25	21
	51	21
Wetlands	Baseline	39
	1	39
	2	39
	15	16
	51	16
Grasslands	Baseline	358
	1	358
	2	358
	15	213
	51	213

The final step in calculating the AAHUs for each habitat is to calculate the HUs contained in a habitat for each evaluation species at each target year, and summing all HUs to get cumulative HUs. The cumulative HUs are then divided by the period of analysis (50 years) to derive the AAHUs, which can be compared with similar habitats in a mitigation plan to ensure adequate compensation for project impacts (losses). Table 4 presents the HUs calculated for the evaluation species in each habitat, the cumulative HUs for all evaluation species in a habitat, and the AAHUs for the FWOP condition.

Table 4 shows that without the project in place, the forests will retain a habitat value of approximately 7.4 AAHUs for the two evaluation species over the 50-year period of analysis.

The wetlands and the grasslands will have approximate values of 1.1 and 67 AAHUs, respectively.

Table 4
FWOP AAHUs in Evaluation Species' Habitats

Habitat	Species	Target Years (TY) Compared	Acres	HSI Values	Habitat Units Between TY	Average Annual Habitat Units
Forest	Gray Squirrel and Veery	$TY_1 - TY_0$	21	0.34	7.14	
		$TY_{15} - TY_1$	21	0.46	81.20	
		$TY_{25} - TY_{15}$	21	0.55	74.23	
		$TY_{51} - TY_{25}$	21	0.58	210.50	
Cumulative Habitat Units:					373.07	
AAHUs:						7.4
Wetlands	Mottled Duck and Great Egret	$TY_1 - TY_0$	39	0.21	9.2	
		$TY_2 - TY_1$	39	0.20	9.00	
		$TY_{15} - TY_2$	16	0	39.36	
		$TY_{51} - TY_{15}$	16	0	0	
Cumulative Habitat Units:					57.56	
AAHUs:						1.15
Grasslands	Eastern Meadowlark	$TY_1 - TY_0$	358	0.39	138.7	
		$TY_2 - TY_1$	358	0.39	138.7	
		$TY_{15} - TY_2$	358	0.39	317.5	
		$TY_{51} - TY_{15}$	213	0.4	2755	
Cumulative Habitat Units:					3350	
AAHUs:						67.0

Future With Project (FWP). The next step in the HEP analysis involves calculating the AAHUs for each habitat with the dredged material disposal action in place. Because the analysis examines only the construction areas where dredged material placement will occur, resulting in displacement of all surface features (habitats), we would expect that the AAHUs for this condition will be very low. At the end of TY_1 when project construction terminates and when project features are in place, the habitat will not recover, so no habitat units exist from this point through the period of analysis, which is 50 years with the project features in place. The AAHUs are calculated using the same formula as in the FWOP analysis, and the results are presented in Table 5.

Table 5
FWP AAHUs in Evaluation Species' Habitats

Habitat	Species	Target Years (TY) Compared	Acres	HSI Values	Habitat Units Between TY	Average Annual Habitat Units
Forest	Gray Squirrel and Veery	TY_1 - TY_0	21	0.34	2.38	
		TY_{15} - TY_1	0	0	0	
		TY_{25} - TY_{15}	0	0	0	
		TY_{51} - TY_{25}	0	0	0	
Cumulative Habitat Units:					2.38	
AAHUs:						0.047
Wetlands	Mottled Duck and Great Egret	TY_1 - TY_0	39	0.21	3.15	
		TY_2 - TY_1	0	0	0	
		TY_3 - TY_2	0	0	0	
		TY_{51} - TY_3	0	0	0	
Cumulative Habitat Units:					3.15	
AAHUs:						0.063
Grasslands	Eastern Meadowlark	TY_1 - TY_0	358	0.39	46.3	
		TY_2 - TY_1	0	0	0	
		TY_3 - TY_2	0	0	0	
		TY_{51} - TY_3	0	0	0	
Cumulative Habitat Units:					46.3	
AAHUs:						0.93

As expected, with project implementation, the AAHUs are greatly diminished compared to the without-project condition. AAHUs for the FWP conditions range from 0.047 for the forest habitat, to 0.063 for the wetlands, and 0.93 for the grasslands.

8.0 PROPOSED MITIGATION STRATEGIES FOR FOREST AND WETLANDS

To determine the amount of new habitat required for compensating project impacts to riparian forests and wetlands, the AAHUs for each habitat in the FWOP condition are subtracted from the AAHUs for each habitat in the FWP condition. Based on this calculation, the approximate AAHUs required in the new habitats to offset project losses are:

– Riparian Forests: 7.41
– Wetlands: 1.1

Three sites located on project lands adjacent to the proposed PAs were selected for project mitigation planning and were used for developing the CE/ICA. The CE/ICA identifies the most-cost-effective plans for accomplishing the required levels of mitigation at these sites. The three alternative mitigation sites and their associated measures are:

<u>Mitigation Site 1</u> (Riparian and wetland mitigation; see Figure 1; riparian forest area north of PA 9 and adjacent pasture area bordering the forest's southern edge). This 131.8-acre site includes 117 acres of riparian forest, 5 acres of cleared forest, and about 9.8 acres of grassland. It is large enough for both wetland and riparian mitigation features (Figure 3), and is supported by the resource agencies as a mitigation site because it will be protected by a conservation easement. Field surveys revealed that approximately 10 percent of the riparian forest in Mitigation Site 1 (11 acres) is composed of tallows. Riparian mitigation at this site would consist of clearing the tallows, primarily around natural openings in the forest, and planting native trees. After clearing, the openings would be planted with a variety of small, hard-mast and flood-tolerant native seedlings or sapling trees to enhance the existing forest. Additionally, 1 acre of these native tree species would be planted around the perimeter of a proposed wetland creation area, described below. A total of 12 acres of new native trees would be planted for riparian mitigation at this site, and the entire 117-acre riparian forest would be preserved as part of the proposed project mitigation plan.

Wetland mitigation would be accomplished by creating a 3-acre ephemeral wetland (pond) in the grassland area of Site 1 (see Figure 3). The pond would be sloped to reach a maximum center depth of about 12 inches, the limit of accessibility of the mottled duck, and will have areas of between 4 to 9 inches in depth as required by the great egret for wade feeding. A variety of wetland plant species plugs (submerged and emergent) would be planted on 5- to 6-foot centers on the slopes and water's edge of the pond at different elevations, dependent upon the aquatic plant species, for a medium-density planting.

<u>Mitigation Site 2</u> (Riparian mitigation; see Figure 1; riparian forest located east of PA 9). This 14.5-acre site includes 9.5 acres of riparian forest and 5 acres of mixed tallow and scrub/shrub vegetation. The 5-acre tallow and scrub/shrub area would be cleared and planted with small, hard-mast and flood-tolerant native seedlings or sapling trees for riparian forest mitigation.

<u>Mitigation Site 3</u> (Riparian and wetland mitigation; see Figure 1; riparian forest located east of PA 8). This 124.7-acre site includes 112 acres of riparian forest and 12.7 acres of very dense tallow stands and scrub/shrub. Riparian forest mitigation would be accomplished by clearing tallows from 30 percent (33 acres) of the 112-acre riparian forest. This 33-acre area would then be planted with small, hard-mast native and flood-tolerant seedlings or sapling trees. Additionally, 1 acre of native trees would be planted around the perimeter of the proposed wetland creation area at this site, for a total of 34 acres of newly planted trees. A 3-acre

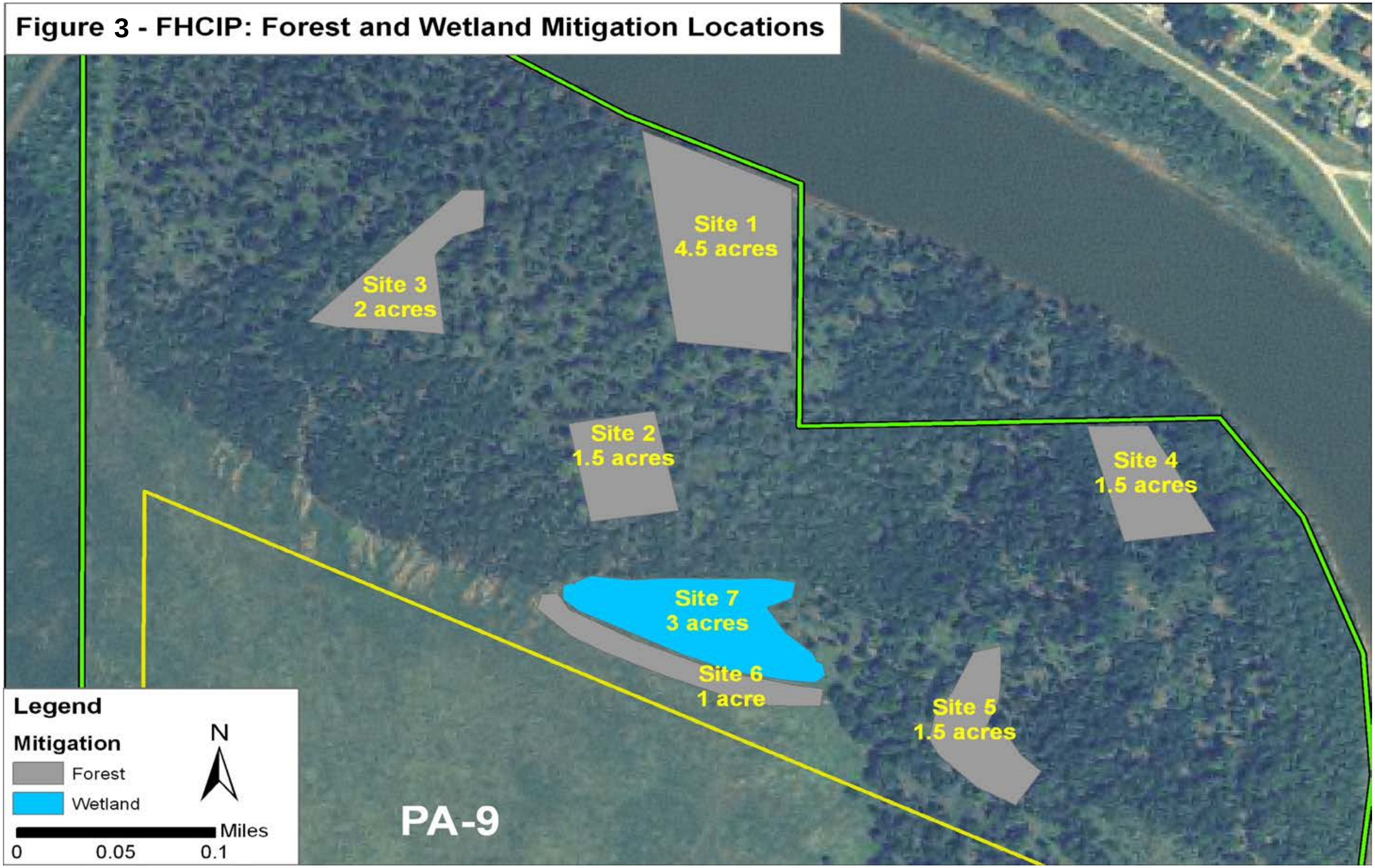


Figure 3 - FHCIP: Forest and Wetland Mitigation Locations
Site 1
4.5 acres
Site 3
2 acres
Site 2
1.5 acres
Site 4
1.5 acres
Site 7
3 acres
Site 6
1 acre
Site 5
1.5 acres
Legend
Mitigation
Forest
Wetland
N
Miles
0 0.05 0.1
PA-9

ephemeral wetland area (pond) would be created within the scrub/shrub area of the site. The same design features and aquatic planting scheme proposed at Site 1 for pond creation would be used.

Native tree and wetland vegetation that could be used for mitigation planting include water oak, willow oak, overcup oak, pecan, green ash, planar tree, water hickory, bald cypress, black willow, red maple, smart weed, common or soft rush, sawgrass, sedge, pickerel weed, Gulf cordgrass, and swamp lily.

9.0 COST EFFECTIVENESS (CE) AND INCREMENTAL COST ANALYSIS (ICA)

Based on the initial assessment of the three mitigation site alternatives described above, a CE/ICA analysis was performed to determine which of the three sites or combinations of sites would be the most-cost-effective and incrementally justified.

Forest Mitigation (Scales and Assumptions). Sufficient acreage exists between mitigation sites (sites 1, 2, and 3) for planting a mixture of tree species to compensate for project losses. To determine the AAHUs the mitigation forest and mitigation wetlands contain, certain TYs representing the time of expected change in habitat values were chosen to measure the gains in habitat value over the 50-year period of analysis. Habitat gains will be reflected in AAHUs calculated for each evaluation species as the trees mature.

Scales. Two scales of trees were considered for planting at the sites: seedlings and saplings. For seedlings, a mixture of tree species would be utilized. The seedlings would be 0.5 to 1 inch in diameter; 2 to 4 feet tall; planted at a density of 150 trees per acre; and spaced as forest openings permit. Tree mortality for this size is expected to approach 30 to 40 percent over the 50-year period of analysis, with most of the mortality occurring within the first 2 years after planting. The more expensive saplings would range between 1.5- to 2-inch-diameter plants; 5–7 feet in height; and be planted at a density of 40 trees per acre as forest openings permit. Mortality for this size tree is expected to approach 25 percent over the 50-year period of analysis, with most of the mortality occurring within the first 2 years after planting.

In a straight cost comparison, the seedlings are less expensive than the saplings, but the saplings are expected to provide value to the forest habitat earlier due to their size. While the larger and more expensive saplings may initially provide a faster recovery of the forest habitat compared to seedlings, the differences between these two tree sizes with respect to their contribution of value to the existing forest would be negligible over the 50-year period of analysis. Therefore, both tree sizes are deemed to provide the same habitat value, and this was reflected in the HEP analysis by assigning them both the same HSI scores. Specific tree species and management details will be coordinated with the resource agencies prior to actual mitigation construction.

A review of the variables that influence habitat quality for the two forest evaluation species revealed that the most important variables common to these species are:

- Percent canopy closure of trees that produce hard mast, which are greater than or equal to 10 inches diameter at breast height (dbh);
- Percent of tree canopy closure;
- Number and diversity of tree species that produce hard mast; and
- Soil moisture regime.

Assumptions. The variables listed above for the evaluation species were used to identify the TYs for the HEP analysis. The soil moisture regime variable is dependent in part on prevailing climate conditions and rainfall, and on land elevation. In general, the proposed mitigation forest areas have damp conditions due to their location on mostly flat or low-lying terrain. The other three variables depend on forest maturity and will increase as the trees grow in diameter and canopy cover increases as tree crowns increase in size. While growth is highly variable among species and even among individuals of the same species, it is not unreasonable to expect some of the faster growing trees, such as the oaks, to achieve large crowns that could easily approach 25–30 feet in diameter within 20 years. Therefore, with a mixture of species in the plantings and about a 25–30 percent mortality rate, it is not unreasonable to expect a 40–60 percent canopy closure in about 25 years.

9.1 Forest Assumptions: Mitigation Using Seedling Trees

Baseline (TY_0) – Assume the habitat value for the first year is zero. Existing shrub crown cover consisting of approximately 32 percent is unchanged.

TY_1 – It is assumed there will be little measurable change in forest habitat value after planting of seedlings following construction. Existing shrub crown cover consisting of approximately 32 percent will be reduced to about 20 percent as a result of tallow removal, because some shrubs and tallows are entwined in some areas of the forest.

TY_{15} – Forest is composed of 6–8 inch trees (dbh). Canopy closure of trees is about 30 percent (for the original plantings and any new volunteers and progeny of the original plantings), with about 20 percent canopy closure of the hard-mast-producing trees. Existing shrub crown cover will have increased to approximately 25 percent.

TY_{25} – Forest is composed of 10–12 inch trees (dbh). Canopy closure of trees is approximately 40 percent, with about 35 percent canopy closure of the hard-mast-producing trees. Existing shrub crown cover will have increased to approximately 30 percent.

TY_{51} – Forest overstory is composed of 20-inch dbh trees. Younger trees vary from saplings to 12–14 inches or more dbh. Canopy closure of trees is about 50–60 percent with hard-mast-producing trees having a canopy closure of about 45 percent. Existing shrub crown cover may be as much as 35 percent.

9.2 Forest Assumptions: Mitigation Using Sapling Trees

As noted earlier, the overall value added to the forest habitat is approximately the same as for the seedlings over the 50-year period of analysis, but costs are higher for sapling planting.

Using all the above assumptions, the habitat value was calculated for each evaluation species, and a cost for mitigation for each site was developed. Table 6 presents the FWOP and projected FWP HSI values for each species for each target year used in the analysis. It also displays FWOP AAHUs at each of the proposed sites and projects FWP mitigation AAHUs for the proposed sites, if the planting scheme for seedlings was implemented.

Table 6
AAHUs for Forest Species at Proposed Mitigation Sites
FWOP vs. FWP Mitigation

Site 1 (Seedlings) Gray Squirrel and Veery	**Target Years (TY) Compared**	**Acres (FWOP)**	**HSI Value (FWOP)**	**Habitat Units Between TYs (FWOP)**	**Average Annual Habitat Units (FWOP)**	**Acres (FWP)**	**HSI Value (FWP)**	**Habitat Units Between TYs (FWP)**	**Average Annual Habitat Units (FWP)**	**AAHUs Gained at Site 1 (FWP minus FWOP AAHUs)**
	$TY_1 - TY_0$	117	0.34	39.78		117	0.34	39.9		
	$TY_{15} - TY_1$	117	0.47	460.8		118	.55	507.6		
	$TY_{25} - TY_{15}$	117	0.56	425.8		118	.66	499.7		
	$TY_{51} - TY_{25}$	117	0.6	1204		118	0.75	1469.6		
AAHUs:					42.6				50.3	7.73
Site 2 (Seedlings) Gray Squirrel and Veery	**Target Years (TY) Compared**	**Acres (FWOP)**	**HSI Value (FWOP)**	**Habitat Units Between TYs (FWOP)**	**Average Annual Habitat Units (FWOP)**	**Acres (FWP)**	**HSI Value (FWP)**	**Habitat Units Between TYs (FWP)**	**Average Annual Habitat Units (FWP)**	**AAHUs Gained at Site 2 (FWP minus FWOP AAHUs)**
	$TY_1 - TY_0$	9.5	0.34	3.2		9.5	0.34	4.0		
	$TY_{15} - TY_1$	9.5	0.25	27		14.5	0.35	48.3		
	$TY_{25} - TY_{15}$	9.5	0.36	20.4		14.5	0.46	41.1		
	$TY_{51} - TY_{25}$	9.5	0.40	64.2		14.5	0.52	126.1		
AAHUs:					2.3				4.39	2.09
Site 3 (Seedlings) Gray Squirrel and Veery	**Target Years (TY) Compared**	**Acres (FWOP)**	**HSI Value (FWOP)**	**Habitat Units Between TYs (FWOP)**	**Average Annual Habitat Units (FWOP)**	**Acres (FWP)**	**HSI Value (FWP)**	**Habitat Units Between TYs (FWP)**	**Average Annual Habitat Units (FWP)**	**AAHUs Gained at Site 3 (FWP minus FWOP AAHUs)**
	$TY_1 - TY_0$	112.7	0.07	7.8		112.7	0.07	7.9		
	$TY_{15} - TY_1$	112.7	0.08	81.7		113.7	0.25	175.8		
	$TY_{25} - TY_{15}$	112.7	0.10	71.0		113.7	0.40	260.0		
	$TY_{51} - TY_{25}$	112.7	0.11	214.0		113.7	0.55	959.1		
AAHUs:					7.49				28.0	20.51

9.3 Wetland Mitigation (Scales and Assumptions)

Sufficient acreage is available at all proposed mitigation sites, except for Site 2, for wetland creation. Site 2 will not be considered for any wetland habitat creation due to reasons stated earlier.

In determining the AAHUs the mitigation wetlands contain, certain TYs representing the time of expected change in habitat value were chosen to measure the gains in habitat value over the 50-year period of analysis. Habitat gains will be reflected in AAHUs calculated for each evaluation species as the wetland vegetation matures.

9.4 Assumptions for Habitat Evaluation and Future with Project Wetland Mitigation

Fewer common variables exist between the two evaluation species for wetland habitat than for the forest. The mottled duck is more dependent in the HSI model on the density of potential nesting and brooding sites. The variable of most importance to the great egret at the mitigation sites is the availability of feeding habitat, consisting of substrate zones with 4–9 inches of water depth, covered by submerged or emergent vegetation.

Many factors affect the amount of time required for a created wetland to become functional. However, existing data suggest that most aquatic plant species are fast growing and will achieve coverage and density equivalent to naturally occurring wetlands after about 2 years, which is the assumption used for this planting scheme.

<u>Wetland Assumptions – Mitigation Planting (medium density) with Mixed Wetland Plant Species</u>:

Baseline (TY_0) – Assume the habitat value for the first year is zero as wetlands are nonexistent.

TY_1 –Some habitat value may be found in the wetland after initial planting following construction, but it is assumed the value is insignificant.

TY_2 – Aquatic plants would cover approximately 40–60 percent of the wetland substrate, producing approximately 50 percent of the wildlife value required for the evaluation species.

TY_3 – Approximately 85–100 percent of the wetland substrate would be covered by submerged or emergent vegetation. Aquatic plants would be producing nearly 100 percent of the wildlife value required for the evaluation species.

TY_{51} – The wetland substrate would essentially be covered by submerged or emergent vegetation, and the habitat will have reached its optimal, long-term value.

Using these assumptions, the habitat value was calculated for each evaluation species and a cost of mitigation for each site was developed. Table 7 presents the FWOP and projected FWP HSI values for the evaluation species for each target year used in the analysis. It also displays FWOP AAHUs at each of the proposed sites, and projects FWP mitigation AAHUs for the proposed sites, if the wetland creation scheme was implemented.

Table 7
AAHUs for Wetland Species at Proposed Mitigation Sites
FWOP vs. FWP Mitigation

Site 1 (Wetlands) Mottled Duck and Great Egret	Target Years (TY) Compared	Acres (FWOP)	HSI Value (FWOP)	Habitat Units Between TYs (FWOP)	Average Annual Habitat Units (FWOP)	Acres (FWP)	HSI Value (FWP)	Habitat Units Between TYs (FWP)	Average Annual Habitat Units (FWP)	AAHUs Gained at Site 1 (FWP minus FWOP AAHUs)
	$TY_1 – TY_0$	0	0	0		3	0.13	0.13		
	$TY_2 – TY_1$	0	0	0		3	0.45	0.87		
	$TY_3 – TY_2$	0	0	0		3	0.71	1.74		
	$TY_{51} – TY_3$	0	0	0		3	0.79	72.9		
AAHUs:					0				1.5	1.5
Site 3 (Wetlands) Mottled Duck and Great Egret	**Target Years (TY) Compared**	**Acres (FWOP)**	**HSI Value (FWOP)**	**Habitat Units Between TYs (FWOP)**	**Average Annual Habitat Units (FWOP)**	**Acres (FWP)**	**HSI Value (FWP)**	**Habitat Units Between TYs (FWP)**	**Average Annual Habitat Units (FWP)**	**AAHUs Gained at Site 3 (FWP minus FWOP AAHUs)**
	$TY_1 – TY_0$	0	0	0		3	0.13	0.13		
	$TY_2 – TY_1$	0	0	0		3	0.45	0.87		
	$TY_3 – TY_2$	0	0	0		3	0.71	1.74		
	$TY_{51} – TY_3$	0	0	0		3	0.79	72.9		
AAHUs:					0				1.5	1.5

Based upon hydrologic evaluation of the proposed project, it is anticipated that the grasslands and/or forest surrounding the ephemeral pond would periodically flood, but inundation of the ephemeral pond and fringing area proposed for planting would likely not exceed 5 days duration in any flood event. The suggested plants, once established, can tolerate this duration of flooding without significant impacts to their growth and use for wildlife. Occasionally, some impacts to nesting species like the mottled duck might occur on the land near the ephemeral pond; however, the frequency of such events would not greatly disrupt overall habitat values that would develop.

<u>IWR-PLAN</u>. IWR-PLAN software was used to perform a cost analysis of the proposed woodland seedling-tree planting and the wetland aquatic planting schemes at each of the proposed alternative mitigation sites. The software identifies combinations of mitigation measures that produce alternative plans that are cost effective and/or incrementally justified. Plans are identified as cost effective, or as Best Buy Plans which are also cost-effective plans.

IWR-PLAN analyzed each of the proposed mitigation sites and measures and generated 27 possible plan combinations. A total of four cost-effective and four Best Buy mitigation plans were identified and are presented in Table 8. Table 9 provides incremental costs for Best Buy Plan combinations, and Figure 4 compares the Best Buy Plan of interest to other identified Best Buy Plans.

Table 8
IWR-PLAN Analysis
Costs and Outputs for Cost-effective and Best Buy Plans

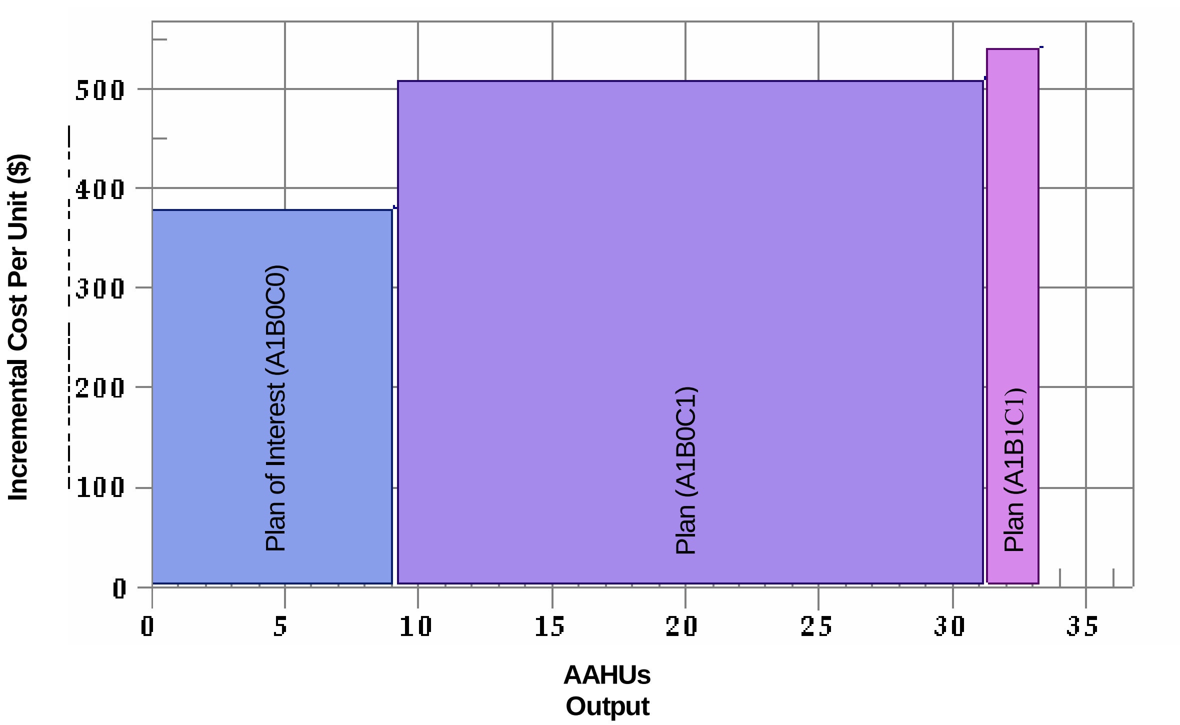
Plan (Alternative)	Total Annual Cost ($)	Forest Output (AAHUs)	Wetland Output (AAHUs)	Total Output (AAHUs)	Cost Effective
No Action Plan	0	0	0	0	Best Buy
A1B0C0	3,484	7.7	1.5	9.2	Best Buy
A2B0C0	6,485	7.7	1.5	9.2	No
A0B1C0	1,134	2.1	0	2.1	Yes
A0B2C0	2,385	2.1	0	2.1	No
A1B1C0	4,618	9.8	1.5	11.3	Yes
A2B1C0	7,619	9.8	1.5	11.3	No
A1B2C0	5,869	9.8	1.5	11.3	No
A2B2C0	8,870	9.8	1.5	11.3	No
A0B0C1	11,240	20.6	1.5	22.1	Yes
A0B0C2	19,744	20.6	1.5	22.1	No
A1B0C1	14,724	28.3	3	31.3	Best Buy
A2B0C1	17,725	28.3	3	31.3	No
A1B0C2	23,228	28.3	3	31.3	No
A2B0C2	26,229	28.3	3	31.3	No
A0B1C1	12,374	22.7	1.5	24.2	Yes
A0B2C1	13,625	22.7	1.5	24.2	No
A0B1C2	20,878	22.7	1.5	24.2	No
A0B2C2	22,129	22.7	1.5	24.2	No
A1B1C1	15,858	30.4	3	33.4	Best Buy
A2B1C1	18,859	30.4	3	33.4	No
A1B2C1	17,109	30.4	3	33.4	No
A2B2C1	20,110	30.4	3	33.4	No
A1B1C2	24,362	30.4	3	33.4	No
A2B1C2	27,363	30.4	3	33.4	No
A1B2C2	25,613	30.4	3	33.4	No
A2B2C2	28,614	30.4	3	33.4	No

KEY: A1=Site 1 - North of PA 9 (seedling and wetland measures); A2=Site 1 - North of PA 9 (sapling and wetland measures); B1=Site 2 - East of PA 9 (seedling measure only); B2=Site 2 - East of PA 9 (sapling measure only); C1=Site 3 - East of PA 8 (seedling and wetland measures); C2=Site 3 - East of PA 8 (sapling and wetland measures).

Table 9
Incremental Cost of Best Buy Plan Combinations
(Ordered By Output)

Plan (Alternative)	Total Output (AAHUs)	Cost ($1)	Average Cost ($1/AAHUs)	Incremental Cost ($1)	Incremental Output (AAHUs)	Incremental Cost Per Output
No Action Plan	0.00	0.00				
A1B0C0	9.20	3,484.00	378.69	3,484.00	9.20	378.69
A1B0C1	31.30	14,724.00	470.41	11,240.00	22.10	508.59
A1B1C1	33.40	15,858.00	474.79	1,134.00	2.10	540.00

Figure 4
Planning Set CE/ICA for Wetlands and Forest
(Incremental Cost and Total Output)
Best Buy Plan Alternatives



IWR-Plan results indicate that implementation of the woodland seedling and wetland planting schemes would be a Best Buy Plan at one individual site and also leads to additional Best Buy Plans when other sites are combined. To fully compensate for project impacts to riparian/hardwood forests and ephemeral wetland habitats, 7.41 and 1.1 AAHUs, respectively, were required for mitigation.

Table 9 shows that Plan A1B0C0 (Site 1) is the most cost effective of all Best Buy Plans presented. Table 8 reveals that this plan contributes approximately 7.7 AAHUs to the forest habitat, and generates about 1.5 AAHUs for newly created wetland habitat, at a total annual cost of $3,484. The incremental cost per AAHU (see Table 9) is $378.69. The AAHU outputs provided adequately compensate for the losses to forest and wetland habitats resulting from project impacts. The projected first-cost of implementing this plan is approximately $46,500.

9.5 Cost Effectiveness and Incremental Cost Analysis Summary

Based on the analysis that was conducted, it was concluded that establishing woodlands on Site 1 by planting mixed tree species consisting of about 150 seedling trees per acre would compensate for the woodland impacts of 7.41 AAHUs on 21 acres, by providing 7.7 AAHUs of woodlands on about 12 acres. In addition, establishing wetlands on Site 1 by creating a 3-acre pond planted with a variety of aquatic plant plugs on 5- to 6-foot centers would compensate for wetland impacts of 1.1 AAHUs on 39 acres, by providing 1.5 AAHUs for wetland habitat on about 3.0 acres. The first cost for implementing the mitigation plan at Site 1, based on the updated October 2009 cost basis, is $192,000 for planting seedling trees and creating wetlands. Operation and Maintenance (O&M) for the 50-year period of analysis would consist of additional tallow tree clearing from the mitigation forest area, replanting seedling trees and aquatic vegetation to offset expected mortality, and implementation of mitigation monitoring and contingency plans. These O&M costs would amount to approximately $495,770 for the period of analysis.

10.0 REFERENCES

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Appendix H-2

Mitigation Monitoring and Contingency Plans

APPENDIX H-2
MITIGATION MONITORING AND CONTINGENCY PLANS

1.0 INTRODUCTION

Monitoring of mitigation sites is a critical part of the mitigation process. The purpose of monitoring is to:

- obtain an objective assessment of project progress towards predetermined project goals and success criteria;
- identify and correct problems through an adaptive management approach; and
- ensure that U.S. Army Corps of Engineers (USACE) Galveston District and Port Freeport (local sponsor) meet their compensatory mitigation obligations.

Monitoring of the mitigation sites developed for this proposed project will be a cooperative process. According to ER 1105-2-100, Section C-3(e) (10), the local sponsor is primarily responsible for mitigation monitoring to determine the success of mitigation measures. While the local sponsor is responsible for implementing the monitoring plan, the Galveston District will lead initial monitoring efforts, in cooperation with the local sponsor and the resource agencies (U.S. Fish and Wildlife Service [USFWS] and Texas Parks and Wildlife Department [TPWD]), to ensure successful establishment of the mitigation features (i.e., riparian tree planting and creation of a pond with aquatic vegetation). The Galveston District will review monitoring results and will make decisions regarding corrective actions.

The local sponsor (Port Freeport) has stated its intent to enter into an agreement with TPWD under terms of a “land conservation easement.” The conservation easement would protect and preserve all created mitigation features and would protect the entire 117-acre riparian forest, which would encompass the proposed mitigation seedling plantings. All mitigation lands would be managed and monitored as one continuous ecological unit and would be protected in perpetuity from future development. Under the terms of the conservation easement, TPWD would be responsible for conducting long-term monitoring, once mitigation features are successfully established, to ensure continued success of these features.

2.0 SUCCESS CRITERIA

Success criteria are used to objectively evaluate the progress of mitigation projects in achieving predetermined objectives and to determine whether corrective actions need to be implemented. Because habitat functions are difficult to measure directly, success criteria may be based on an assessment of the structural attributes of restored habitats. In this way, structural attributes serve as surrogate measures of habitat function. Once site conditions have met or surpassed the predetermined structural thresholds, it is assumed that the desired functions are either currently being provided or will be provided given time.

Separate success criteria have been established for riparian and aquatic pond vegetation plantings. For the riparian forest mitigation feature, success criteria would be based on tree seedling survival. For the aquatic pond plantings, success criteria would be based on area of aquatic plant cover.

2.1 RIPARIAN TREE PLANTINGS

2.1.1 Establishment Year

The initial contract for the riparian plantings would require the survival of 90 percent of seedling trees at the end of the first year after completion of planting. To ensure successful establishment, seedlings would be regularly watered, mulched, and fertilized during the first year. A program of pest/invasive plant control within the seedling planting areas would also be maintained for the establishment year. If the 90 percent targeted survival rate is not met, replacement seedlings would be planted to reach the original planting density of 150 trees per acre. Costs for this survival warranty would be included in the cost of the initial planting contract. Following the establishment year, a 15-year postestablishment monitoring plan would begin.

2.1.2 Postestablishment Monitoring

Success criteria for tree seedling survivability are:

- Annually for 5 years after the end of the establishment year, a minimum survival target of 80 percent of original planting density
- At 10 years after the end of the establishment year, a minimum survival target of 75 percent of original planting density
- At 15 years after the end of the establishment year, a minimum survival target of 70 percent of original planting density

Tree mortality for seedlings is expected to approach 30 to 40 percent over the 50-year period of analysis. Supplemental seedling planting to offset tree mortality would occur in years 1–5, 10, and 15 if monitoring indicates that the minimum survival targets for the respective years have not been met. See Section 3.1 for more information on the adaptive management plan.

Success criteria for invasive or exotic plants is:

- Annually for 15 years after the end of the establishment year, invasive or exotic plants cover a maximum of 5 percent of the total acreage planted with tree seedlings

Inasmuch as a known invasive (Chinese tallow) is already present in the mitigation area, it is assumed that monitoring will confirm the presence of invasive/exotic plants in excess of the target maximum in the early years of the monitoring program. Therefore, costs for an annual plant control program are included in the mitigation monitoring cost estimate. Control methods, determined in consultation with resource agencies, would be developed to address specific species of concern.

2.1.3 Monitoring Methods, Timing, and Duration

The goal for the monitoring program for the riparian tree plantings is to determine the survival rate of the planted seedlings and document the presence/extent of invasive/exotic plant species. Monitoring for survivability would be conducted in years 1–5, 10, and 15 after the end of the establishment year. Monitoring for invasive/exotic species would be conducted annually after the establishment year for 15 years. Field data would be compared to success criteria to determine whether the project has met or exceeded predetermined criteria.

Seedling survival would be recorded by pedestrian survey and photo-documentation. Monitoring data sheets would also document other relevant information such as general site conditions, damage by herbivory or vandalism, and erosion. Photographic monitoring would be conducted (1) prior to project implementation to document preexisting site conditions; (2) following project implementation; and (3) at the end of annual monitoring of the growing season. Key project areas would be photographed from fixed photo-points (i.e., same station, same angle) to provide a consistent basis for visually comparing seedling growth and development through time. The exact number and location of photo-monitoring stations would be determined in the field during project implementation.

The extent of invasive/exotic species coverage would be documented annually for 15 years after the end of the establishment year by pedestrian survey and photographic monitoring, using the methodology described for tree seedling monitoring above.

2.1.4 Project Closure

The riparian mitigation component could be certified as successful at the end of 15 years with a minimum tree seedling survival rate of 70 percent and maximum invasive/exotic plant cover of 5 percent of the total acreage planted with tree seedlings.

2.2 AQUATIC POND VEGETATION

2.2.1 Establishment Year

The initial contract for the creation and planting of a wetland pond would require the survival of 60 percent of the planted aquatic vegetation clumps or plugs 1 year after pond creation. Viable herbaceous and grass plants shall be indicated by the evidence of one or more new live plant shoots arising from each separate plant plug or clump. Plugs/clumps would be watered as necessary, and invasive/exotic plants would be removed as needed during the establishment year. If the 60 percent targeted survival rate is not met, replacement plugs/clumps would be replanted to reach the original medium planting density. Corrective actions for pond size, depth, or slope, if needed, would be accomplished during the establishment year. Costs for corrective construction and the plant survivability warranty would be included in the cost of the initial construction and planting contracts. Following the establishment year, a 5-year postestablishment monitoring plan would begin.

2.2.2 Postestablishment Monitoring

Success criteria for aquatic plant survivability are:

- At 1 year after the end of the establishment year, a minimum of 30–35 percent aquatic vegetation cover over the pond's total acreage
- At 3 years after the end of the establishment year, a minimum of 65–70 percent aquatic vegetation cover over the pond's total acreage
- At 5 years after the end of the establishment year, a minimum of 70–75 percent aquatic vegetation cover over the pond's total acreage

Supplemental planting to offset aquatic plant mortality or failure to spread naturally would occur in years 1, 3, and 5 if monitoring indicates that the minimum percentage coverage targets for the respective years have not been met. See Section 3.2 for more information on the adaptive management plan.

Success criteria for invasive or exotic plants

- Annually for 5 years after the end of the establishment year, invasive or exotic plants cover a maximum of 5 percent of the total pond acreage

Inasmuch as a known invasive (Chinese tallow) is already present in the mitigation area, it is assumed that monitoring will confirm the presence of invasive/exotic plants in excess of the target maximum in the early years of the monitoring program. Therefore, costs for an annual plant control program are included in the mitigation monitoring cost estimate. Control methods, determined in consultation with resource agencies, would be developed to address specific species of concern.

2.2.3 Monitoring Methods, Timing, and Duration

The monitoring goal for evaluation of aquatic pond vegetation is to determine whether the percentage cover of aquatic vegetation is meeting the success criteria for target years. Monitoring would determine whether the aquatic vegetation is establishing itself along the pond perimeter and within the pond by natural colonization, or whether efforts to assist development of aquatic vegetation may be necessary in order to meet minimum percentage cover targets.

Evaluation of aquatic pond vegetation would entail visually assessing and documenting development of vegetation areas within and along the perimeter of the pond, along with the substrates that support aquatic vegetation establishment. Monitoring would include (1) determining area of cover of aquatic vegetation and invasive/exotic species, and (2) documenting overall site conditions through same-station, same-angle photo-monitoring. These monitoring tasks would be performed by pedestrian survey and photographic documentation. Key locations would be photographed from fixed photo-points (i.e., same station, same angle) to provide a consistent basis for visually comparing vegetation growth and development through time. The exact number and location of photo-monitoring stations would be determined in the field during project implementation.

Monitoring for percentage cover of desirable aquatic vegetation would be conducted at years 1, 3, and 5 after the end of the establishment year. Monitoring for invasive/exotic species would be conducted annually after the establishment year for 5 years. Field data would be compared to the success criteria to determine whether the project has met or exceeded predetermined criteria.

2.2.4 Project Closure

The aquatic pond mitigation component could be certified as successful at the end of 5 years with a minimum percentage aquatic plant cover of 70–75 percent and maximum invasive/exotic plant cover of 5 percent of the total pond acreage.

3.0 CORRECTIVE ACTIONS (ADAPTIVE MANAGEMENT)

Corrective actions are actions or measures undertaken to address expected plant mortality as well as unforeseen changes to the mitigation features resulting from natural or anthropogenic causes. Corrective actions will be implemented where necessary in order to meet predetermined success criteria to ensure survival of the mitigation measures.

3.1 RIPARIAN TREE PLANTINGS

If monitoring indicates that the minimum tree seedling survival rates for the respective monitoring years have not been met, supplemental plantings would be conducted according to original planting specifications. However, the original species composition may be altered to favor those species exhibiting the highest survival rates based on monitoring data. A maximum of two curative replanting responses could be performed, using original planting specifications to achieve success criteria.

3.2 AQUATIC PLANTINGS

If monitoring indicates that the minimum percentage aquatic vegetation cover for the respective monitoring years has not been met, supplemental plantings would be conducted using original planting specifications. Replanted areas would be inspected within 60 days following replanting to determine whether those replanting efforts meet the threshold of a satisfactory stand. “Satisfactory stand” is defined as planting areas with at least a 50–60 percent survival rate within 60 calendar days following the planting effort. Viable herbaceous and grass plants shall be indicated by the evidence of one or more new live plant shoots arising from each separate plant plug or clump.

3.3 ADAPTIVE MANAGEMENT COSTS

Adaptive management costs are included in the operations and maintenance (O&M) cost for the mitigation plan and described in the Operations and Maintenance Manual. Potential adaptive management costs for the 50-year period of analysis are contained in Table 1 below.

Table 1
Adaptive Management Costs

Task Description	Frequency	Cost ($)
Replant Trees (12 acres @50 trees/acre)	Twice (As Required)	31,680
Replant Aquatic Vegetation for Pond (3 acres using original planting specifications)	Twice (As Required)	7,920
	Total	39,600

4.0 MONITORING REPORTS

4.1 ANNUAL MONITORING REPORTS

Monitoring reports would be prepared by the local sponsor and submitted to the Galveston District annually during the 15-year and 5-year monitoring periods for the riparian trees and aquatic vegetation, respectively. Copies of this report would be provided to representatives of the consulting State and Federal agencies. Monitoring would continue until it has been demonstrated that the mitigation has met the ecological success criteria as documented by the District Engineer and determined by the Division Commander. It is anticipated that ecological success criteria for the riparian tree and aquatic vegetation planting would be met by Year 15 and Year 5, respectively, and that monitoring will cease when certification is achieved.

Monitoring reports would contain all monitoring data and photographs, and all annual results will be presented in cumulative fashion. Monitoring reports would be submitted to the Galveston District within 3 months of when the monitoring was conducted.

The first report would be submitted after initial mitigation construction has been completed (i.e., riparian tree planting and planting of aquatic vegetation). This report would document and detail the mitigation effort. Any variances from the work plan or standard practices described in the mitigation plan would be noted in this document. A summary of work activities and their respective start and completion dates would be included.

Monitoring reports would consist of introduction, methods, results, and discussion sections. The introduction would include a brief narrative description of existing conditions, a site location map, maps showing key sampling locations (i.e., transects, photo-stations, etc.), and a review of success criteria. The methods section of the report would detail the methodology used to assess project performance for the mitigation features. Results from monitoring riparian tree plantings and aquatic vegetation would be summarized in the results section in tables and/or as text. Monitoring data sheets would be included as an appendix. The results section would also include one set of labeled photographs taken at each of the fixed-point photo-monitoring stations.

The discussion section of monitoring reports for both the riparian and aquatic components would include an assessment of project success based on the monitoring results directly related to set success criteria. The need for any corrective actions (i.e., supplemental planting) would also be identified in this section. If necessary, a proposed schedule for implementing corrective actions would be included. The discussion section would also include a description of any problems observed within the project site including, but not limited to, excessive inundation, drought, invasion by undesirable plant species, herbivory damage, plant diseases, excessive erosion, and evidence of vandalism or inadvertent damage.

4.2 FINAL CLOSE-OUT MONITORING REPORT

A final “close-out” monitoring report would be submitted following certification that success criteria have been met for the riparian trees and aquatic vegetation mitigation areas. This report would include data and a description of the final monitoring evaluation. It would also provide a summary and analyses of annual monitoring results for the monitoring period for the entire mitigation site.

5.0 MITIGATION MONITORING AND REPORTING COSTS

Monitoring and reporting costs would be included in the O&M cost for the mitigation plan and described in the Operations and Maintenance Manual. Projected monitoring and reporting costs for the 50-year period of analysis are found in Table 2.

Table 2
Mitigation Monitoring and Reporting Costs

Task Description	Monitoring Interval	Cost ($)
Monitoring of Trees/Pond	Annual (Years 1–5, 10, 15)	44,330
Monitoring of Pond Aquatic Vegetation	(Years 1, 3 and 5)	27,280
Invasive Plant Control	Years 1, 2, 3, 4, and 5 (estimated)	66,000
Monitoring Report	Annual	82,500
	Total	220,110

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December 21, 2009

Colonel David Weston
U. S. Army Corps of Engineers
Galveston District
P. O. Box 1229
Galveston, Texas 77553-1229

Re: Freeport Harbor Improvement Project Feasibility Study
Proposed Conservation Easement

Dear Colonel Weston,

As part of the Freeport Harbor Improvement Project, environmental mitigation will be required to offset for the loss of habitat in the area of the proposed Upland Confined Dredged Material Placement Site Nos. 8 and 9 as shown in the Draft Environmental Impact Statement. It is the Port's intention that should the project proceed into the Construction Phase to grant a conservation easement for the portion of the lands used for mitigation to one of the regulatory agencies (probably Texas Parks & Wildlife Services) or a recognized nature conservancy.

Sincerely,

Phyllis Saathoff
Managing Director
Port Freeport

PS/dmk

Appendix I

Biological Assessment

Document No. 070270
Job No. 441901

FINAL
BIOLOGICAL ASSESSMENT FOR THE PROPOSED FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT BRAZORIA COUNTY, TEXAS

Prepared for:

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

October 2010

Printed on recycled paper

Contents

Page

Page

Page

Appendices

Figures

Tables

Acronyms and Abbreviations

AOU	American Ornithologist's Union
BA	Biological Assessment
BO	Biological Opinion
CR	County Road
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FHCIP	Freeport Harbor Channel Improvement Project
FR	Federal Register
FWOP	Future without Project
GIWW	Gulf Intracoastal Water Way
GRBO	Gulf of Mexico Regional Biological Opinion
Gulf	Gulf of Mexico
HEP	Habitat Evaluation Procedure
km	kilometer(s)
LPP	Locally Preferred Plan
mcy	million cubic yards
MMPA	Marine Mammal Protection Act
NED	National Economic Development
NFWL	National Fish and Wildlife Laboratory
NMFS	National Marine Fisheries Service
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
SH	State Highway
STSSN	Sea Turtle Stranding and Salvage Network
TED	turtle excluder device
TPWD	Texas Parks and Wildlife Department
TXNDD	Natural Diversity Database
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

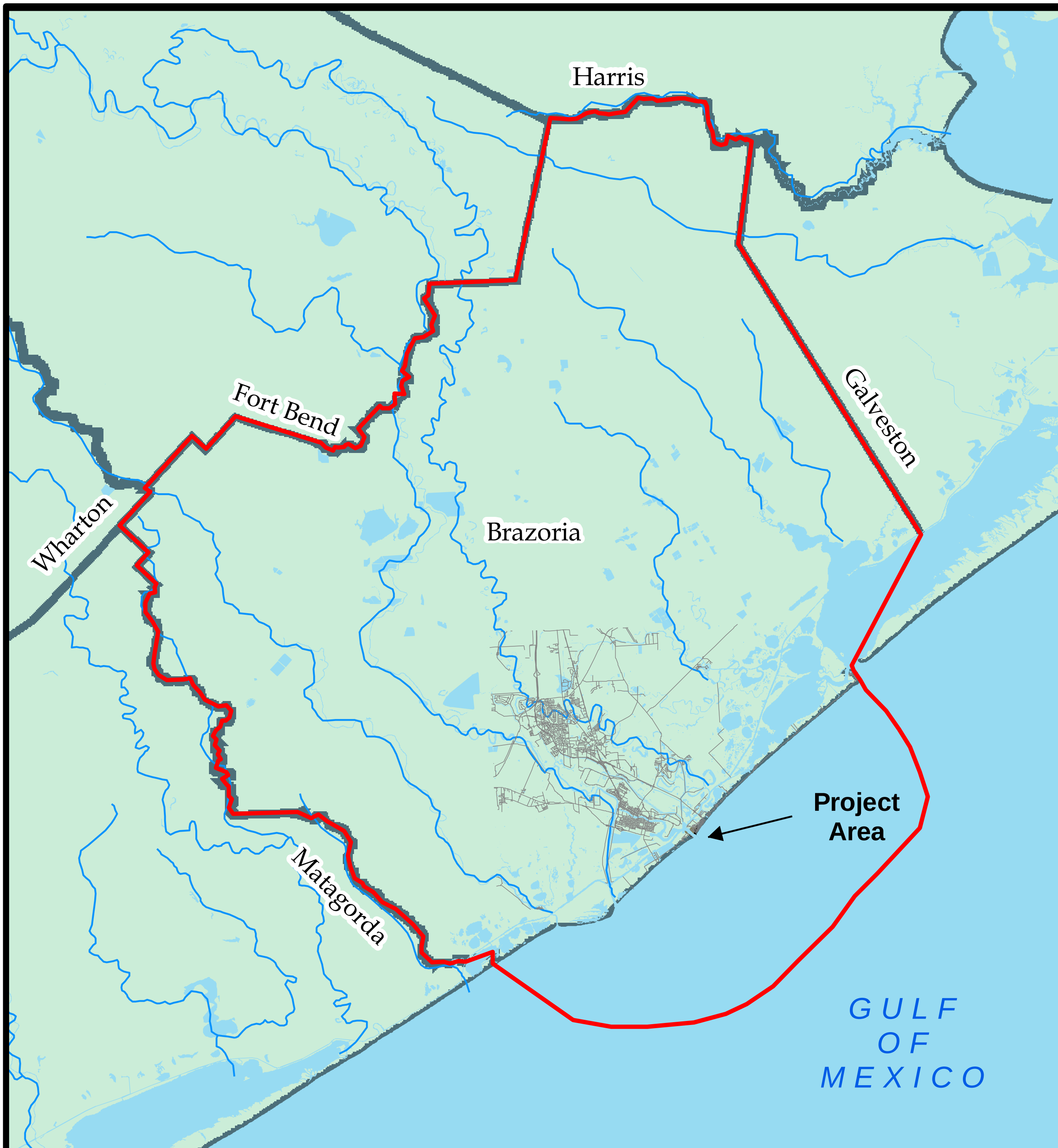
1.0 INTRODUCTION

1.1 PURPOSE OF THE BIOLOGICAL ASSESSMENT

This Biological Assessment (BA) has been prepared to fulfill the Galveston District U.S. Army Corps of Engineers' (USACE) requirements as outlined under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended. The Federal action requiring this assessment is the proposed deepening and widening of Port Freeport (formerly Freeport Harbor) navigation project in Brazoria County, Texas. Section 216 of the Flood Control Act of 1970, Public Law 91-611, authorizes the proposed improvements to the existing navigation project. 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 with a 1-mile buffer and where impacts from dredged material placement might be expected (existing and proposed upland placement areas [PAs] and existing open-water PAs) (Figure 2). This BA evaluates the potential impacts the proposed Freeport Harbor Channel Improvement Project (FHCIP) may have on federally listed threatened and endangered species identified by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS).

Agency coordination (Appendix A) was initiated with the NMFS and USFWS to determine which species protected under the ESA should be included in this BA. The NMFS identified 11 species: smalltooth sawfish (*Pristis pectinata*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), blue whale (*Balaenoptera musculus*), finback whale (*B. physalus*), humpback whale (*Megaptera novaengliae*), sei whale (*B. borealis*), and sperm whale (*Physeter macrocephalus*). The five whale species receive additional protection under the Marine Mammal Protection Act (MMPA) (NMFS, 2007a). The USFWS identified several of the same marine species and the following two additional species: piping plover (*Charadrius melodus*) and whooping crane (*Grus americana*). Agency coordination letters and the subsequent Biological Opinion (BO) for the Freeport Widening Project (similar project area and impacts) were also reviewed (NMFS, 2007b).

Additional federally protected species are listed by Texas Parks and Wildlife Department (TPWD) as potentially occurring in Brazoria County (Appendix B: Annotated County List): Eskimo curlew (*Numenius borealis*), Gulf Coast jaguarundi *(Herpailurus yaguarondi cacomitli)*, Louisiana black bear (*Ursus americanus luteolus*), ocelot (*Leopardus pardalis*), red wolf (*Canis rufus*) (extirpated), and West Indian manatee (*Trichechus manatus*) (TPWD, 2007a). These additional species are not covered in this BA as they are not likely to occur in the study area and were not identified by the jurisdictional Federal agencies (NMFS and USFWS). Recently removed from the Federal list of threatened and endangered species, the American peregrine



Legend

← Freeport Harbor Project Area

Study Area

N W E S

10 5 0 10 Miles

Figure 1

Freeport Harbor Deepening & Widening Study Area

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Prepared by: A. Christiansen | Date: 6/08/2008
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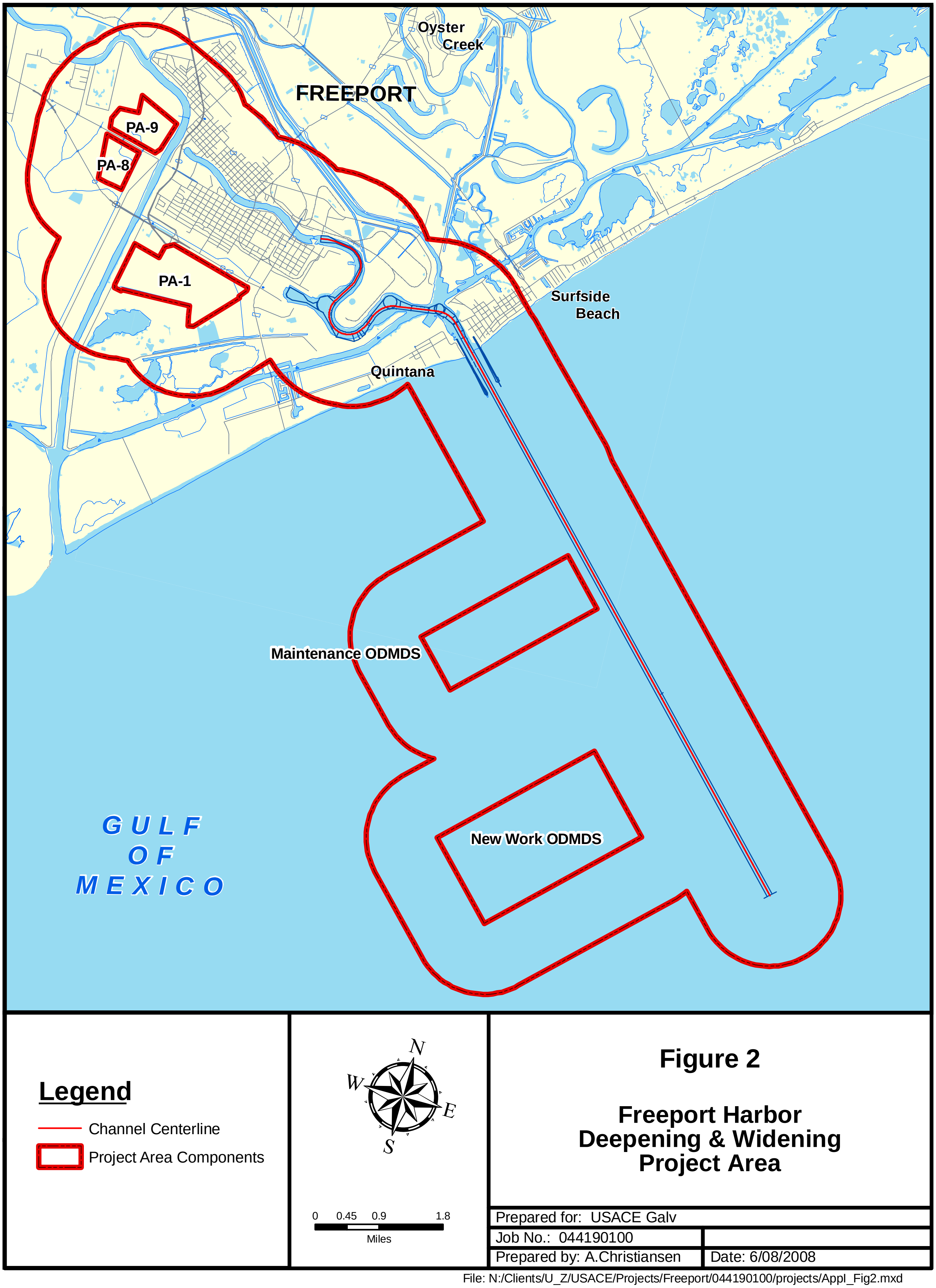
Oyster
Creek
FREEPORT
PA-9
PA-8
PA-1
Surfside
Beach
Quintana
Maintenance ODMDS
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Miles
Figure 2
Freeport Harbor
Deepening & Widening
Project Area
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Prepared by: A.Christiansen
Date: 6/08/2008
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falcon, Arctic peregrine falcon, peregrine falcon, brown pelican, and bald eagle are protected under the Migratory Bird Treaty Act, and the bald eagle continues to receive additional protection under the Bald and Golden Eagle Protection Act (64 *Federal Register* [FR] 164:46542–46558; 72 FR 130:37346–37372); however, these bird species are not included in this BA as they are no longer protected under the ESA. Table 1 presents a list of the 13 federally listed threatened and endangered species that are addressed in this BA.

This BA also describes the avoidance, minimization, and conservation measures proposed for this project relative to habitat and species covered in the BA. This BA is offered to assist USFWS and NMFS personnel in fulfilling their obligations under the ESA. An Environmental Impact Statement (EIS) has been prepared to further address the potential effects resulting from the proposed project.

TABLE 1
FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

Common Name[1]	Scientific Name[1]	Status[2]	
		USFWS	NMFS
FISH			
Smalltooth sawfish	*Pristis pectinata*	E	E
REPTILES			
Green sea turtle	*Chelonia mydas*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
BIRDS			
Piping plover	*Charadrius melodus*	T w/CH	NA
Whooping crane	*Grus americana*	E, EXPN	NA
MAMMALS			
Blue whale	*Balaenoptera musculus*		E/D
Finback whale	*B. physalus*		E/D
Humpback whale	*Megaptera novaengliae*		E/D
Sei whale	*B. borealis*		E/D
Sperm whale	*Physeter macrocephalus*		E/D

[1] Nomenclature follows American Ornithologist's Union (AOU, 1998, 2000, 2002, 2003, 2004, 2005, 2006), Crother et al. (2000, 2001, 2003), TPWD (2007a), USFWS (2007), and NMFS (2007a).

[2] USFWS – U.S. Fish and Wildlife Service; NMFS – National Marine Fisheries Service.

D – Depleted, as defined by the Marine Mammal Protection Act; E – Endangered; T – Threatened; w/CH – with designated Critical Habitat; NA – Status Not Applicable for that Agency; EXPN – Experimental Population.

1.2 ALTERNATIVES CONSIDERED

This section summarizes alternatives considered during the preparation of the proposed FHCIP EIS. Deepening and widening navigation improvement alternatives and dredged material placement alternatives were addressed in the EIS alternatives analysis. The No Action Alternative always remains an alternative to the proposed action.

1.2.1 No Action Alternative

The No Action Alternative is the existing project. The 45-foot Project depth would be maintained throughout the Freeport Harbor Entrance and Jetty channels. The remainder of the Freeport Harbor Main Channel, turning basins, and Stauffer Channel would remain as they are currently. Under the No Action Alternative, current navigation restrictions would continue and Freeport Harbor would not benefit from the elimination of the existing operational constraints. Vessels entering Freeport Harbor would continue to be delayed by one-way traffic and daylight-only restrictions, and vessel safety would not be improved. Dredged material would continue to be placed at current designated locations.

1.2.2 Future without Project (FWOP) Alternative

The FWOP is defined as the No Action Alternative combined with permit widening (the Widening Project). Construction of channel widening by the Port will occur before Federal construction of the FHCIP, in the event the permit is issued. Under the FWOP, the channel would be maintained at the authorized depth of 45 feet, with a permitted width of up to 600 feet for the Outer Bar and Jetty channels. The Freeport Harbor Jetty Channel from Channel Station 63+46 would be gradually widened, at the authorized depth, from 400 to 550 feet up to Channel Station 43+00. From that station to Channel Station 38+00, the channel width would be between 550 and 600 feet. The remainder of the Jetty Channel and the entire Freeport Harbor Entrance Channel (to approximately Channel Station –300+00) would be approximately 600 feet wide. The 45-foot Project depth would be maintained throughout the Freeport Harbor Outer Bar and Jetty channels. The remainder of the Freeport Harbor Main Channel, turning basins, and Stauffer Channel would remain as they are currently. For the FHCIP, the FWOP is the condition against which all proposed project alternatives are evaluated, rather than the No Action Alternative.

1.2.3 Channel Improvement Alternatives

Several channel configuration combinations were considered by USACE to identify the National Economic Development (NED) Plan. Although several channel improvement alternatives were considered in a preliminary screening analysis, only two alternatives in addition to the No Action and FWOP alternatives were identified for thorough analysis and evaluation in the EIS: the NED

Plan and the Locally Preferred Plan (LPP). The total channel length proposed for improvement is approximately 60,600 feet (11.5 miles).

The National Economic Development (NED) Plan generally proposes a 60-foot-deep by 540-foot-wide channel resulting in 23.2 million cubic yards (mcy) of new work dredged material. The LPP proposes to deepen and widen the channel to approximately 55 feet deep by 600 feet wide using a combination of mechanical, pipeline, and hopper dredges. Construction of the Locally Preferred Plan (LPP) would generate approximately 17.3 mcy of new work material, which includes the quantity for a constant advance maintenance prism of 2 feet and a constant allowable overdepth of 2 feet for the entire length of the channel.

The LPP is the USACE tentatively Recommended Plan (Preferred Alternative) in the EIS and is, therefore, the alternative evaluated in this BA. Specifically, the LPP proposes to do the following:

- Restore the Stauffer Turning Basin to 25-foot depth and 500-foot diameter;
- Reauthorize and improve the upper reach of the Stauffer Channel to 25 feet by 200 feet;
- Reauthorize and improve the lower reach of the Stauffer Channel to 50 feet by 300 feet;
- Deepen the Upper Turning Basin to 50 feet;
- Improve the Channel to Upper Turning Basin (52) to 50 feet by 400 feet;
- Increase the footprint of the Brazosport Turning Basin to 1,200 feet in diameter and deepen to 55 feet;
- Deepen the Channel to Brazosport Turning Basin to 55 feet;
- Deepen the Lower Turning Basin to 55 feet;
- Widen the Jetty Channel up to 600 feet and deepen to 55 feet;
- Widen the Outer Bar Channel to 600 feet and deepen to 57 feet; and
- Extend the Outer Bar Channel from the present offshore terminus to the 57-foot contour.

All dredged material will be placed in an existing upland PA (PA 1), two newly designated PAs (PA 8 and PA 9), a new work material ocean dredged material disposal site (ODMDS), and a maintenance material ODMDS (see Figure 2).

Dredged material placement alternatives considered by the USACE during the process of identifying the NED Plan included beneficial use, placement in existing upland confined PAs, placement in new upland confined PAs, and placement in ODMDSs. Several combinations of placement alternatives were considered in a preliminary screening analysis. Combinations that provided the most benefit at the least cost were incorporated into the LPP and NED Plans.

1.2.4 Dredged Material Placement Area Alternatives

Implementation of the proposed channel improvements under the LPP (Preferred Alternative) would result in approximately 14.6 mcy of new work dredged material and approximately 6.03 mcy of maintenance material each maintenance dredging cycle.

1.3 HABITAT IMPACTS

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

The communities of Surfside and Quintana Beach, to the northeast and southwest of the Entrance Channel, respectively, are adjacent to the Port Freeport Ship Channel. Very little undeveloped area occurs in the immediate vicinity of the ship channel other than the beach and dunes complex. This complex includes the Gulf shoreline and interior wetlands that are hydrologically connected to the ship channel via natural and manmade (e.g., Gulf Intracoastal Waterway [GIWW]) channels.

The LPP (Preferred Alternative) project area encompasses the proposed channel improvement area, one existing and two new upland PAs, and two previously designated ODMDSs (see Figure 2). Presently, it is anticipated that the existing PA 1 and newly designated PA 8 and PA 9 will accommodate dredged material removed from the Lower Turning Basin upstream through the channel to the Stauffer Turning Basin. Dredged materials removed from the Jetty Channel and the Entrance Channel seaward to the proposed channel extension near the vicinity of the 60-foot depth contour in the Gulf would be placed in an existing one-time-use ODMDS, provided concurrence is obtained from the U.S. Environmental Protection Agency (EPA). Placement of dredged material may impact areas within and immediately adjacent to the project area. Maintenance dredging is anticipated to stay on the current cycle for the existing Freeport Channel; material from these activities will be placed in the previously designated maintenance material ODMDS and three upland PAs (PA 1, PA 8, and PA 9).

The existing PA 1 lies south of Freeport, east of State Highway (SH) 288, and south of SH 36. It has limited existing capacity already designated for use; therefore, two new upland confined PAs are proposed as part of the LPP (Preferred Alternative), PA 8 and PA 9. These PAs are located west of the terminus of the Freeport Channel on land referred to as tracts Eight and Nine. Tract Eight is 254 acres south of County Road (CR) 217, bordered by SH 36 to the south, and will contain PA 8 (168 acres). Tract Nine is 442 acres north of CR 217 and will contain PA 9 with a footprint of 250 acres. Both parcels can be predominantly classified as grasslands with some wetland and forest habitat. Habitat on these two parcels has been classified by the USFWS and

TPWD as wet-coastal prairie. Potential impacts from construction of PA 8 and PA 9 include the total conversion of approximately 350 acres of grassland, almost 40 acres of freshwater ephemeral wetlands, and just over 20 acres of riparian forested habitat. The USACE coordinated with the USFWS and TPWD to apply a Habitat Evaluation Procedure (HEP) and Cost Effectiveness/Incremental Cost Analysis on proposed plans to identify the preferred mitigation plan for unavoidable impacts of the LPP.

2.0 STATUS OF THE LISTED SPECIES

To assess the potential impacts of the proposed project on federally listed threatened and endangered species, PBS&J personnel (1) requested the list of species from the NMFS and USFWS to include in this BA; (2) reviewed the TPWD Natural Diversity Database (TXNDD), NMFS and USFWS literature, and other scientific data to determine species distributions, habitat needs, and other biological requirements; (3) interviewed recognized experts on the listed species, including local and regional authorities and Federal and State wildlife personnel; and (4) conducted an on-site evaluation, where possible, of the biological resources within the project area.

Literature sources consulted for this report include the USFWS series on endangered species of the seacoast of the U.S. (National Fish and Wildlife Laboratory [NFWL], 1980), Federal status reports and recovery plans, TPWD Federal aid project reports, peer-reviewed journals, and other standard references including agency websites. Habitat assessments were initially based on aerial photography and National Wetlands Inventory (NWI) mapping and then field-verified. The USACE, Galveston District provided information on the two proposed upland PAs including a description of habitats, HEP analysis, and an evaluation of mitigation alternatives. Input was also solicited from State and Federal resource agency personnel.

Species identified by the USFWS and NMFS for this BA are listed in Table 1 (Section 1.1). The following sections present the natural history of each considered species relevant to its potential occurrence in the study area. Section 3.0 presents the potential of the LPP (Preferred Alternative) to affect these species and USACE determinations.

2.1 SMALLTOOTH SAWFISH

2.1.1 Reasons for Status

Smalltooth sawfish (*Pristis pectinata*) populations have declined due to commercial fisheries (bycatch) and recreational fisheries (unsuccessful catch and release, “trophy” pursuits, and injury from saw removal), habitat loss and degradation (decline/loss of mangrove shoreline habitats, modified freshwater inflows affecting salinities, agricultural and urban development and runoff, commercial activities, channel dredging, and boating), and entanglement in marine debris, pollution, and disturbance of natural behavior by divers and other marine activities. Sawfish are slow growing, late maturing, and produce small numbers of young; hence, recovery will take decades, even if all threats are effectively eliminated (NMFS, 2006).

2.1.2 Habitat

Shallow coastal waters of tropical and temperate seas and estuaries along the Atlantic Coast (New York to Brazil) and the Gulf (primarily Louisiana to southern Florida) provide habitats for the sawfish. Sawfish are found in shallow waters very close to shore over muddy and sandy bottoms, sheltered bay areas, shallow banks, and in estuaries or river mouths. Mangrove habitats are key to juvenile success. Larger individuals of this species are also found offshore at depths up to at least 122 meters (NMFS, 2006).

2.1.3 Range

Smalltooth sawfish distribution is circumtropical. Historically, in U.S. waters this species was more common in the Texas and northern inshore Gulf and lower river segments than in the Atlantic area north of Florida. Additionally, this species was known from Mexican waters; however, there is no evidence of a remaining resident population (NMFS, 2006). As of 2006, NMFS has determined that this species' range has contracted by approximately 90 percent, now restricted primarily to the extreme southern portion of peninsular Florida between the Caloosahatchee River and the Florida Keys.

2.1.4 Distribution in Texas

Between 1971 and 2006, there have been only three published or museum reports of smalltooth sawfish captured from the Texas-Florida Gulf region; all of these have been from Texas. Potential mangrove habitats for juveniles exist only infrequently along the Texas Gulf Coast in Jefferson, Galveston, Calhoun, Aransas, Nueces, Kleberg, and Cameron counties (U.S. Department of Agriculture, 2007).

2.1.5 Presence in the Study Area

The smalltooth sawfish is unlikely to occur in the project area as the declining population currently remains only off the coast of Florida and suitable habitats are limited within the project area.

2.2 GREEN SEA TURTLE

2.2.1 Reasons for Status

The green turtle (*Chelonia mydas*) was listed on July 28, 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 turtle excluder devices (TEDs) 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, 2007c). 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.

2.2.2 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).

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). 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 (Allard et al., 1994; Meylan et al., 1990), although an individual might switch to a different nesting beach within a single nesting season.

2.2.3 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 (Hirth, 1997; NMFS and USFWS, 1991a).

2.2.4 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 marketed 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 (National Park Service [NPS], 2006; Shaver, 2000). Between 2001 and 2005, up to five nests per year were recorded from the Texas coast (Shaver, 2006). Two green turtle nests were recorded each year at Padre Island National Seashore during 2006 and 2007 (NPS, 2007). Green turtles, however, nest more in Florida and in Mexico. Since long migrations of green turtles from their nesting beaches to distant feeding grounds are well documented (Green, 1984; Meylan, 1982), 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.

2.2.5 Presence in the Study Area

The USACE Sea Turtle Data Warehouse (USACE, 2010) maintains records of documented incidental takes of sea turtles as a result of hopper dredging activities throughout southeastern coastal waters. Incidences involving impacts to two green sea turtle individuals within Freeport Harbor Channel were recorded in 2006. One incident regarding impact to an individual green sea turtle within the Freeport Harbor Entrance Channel was documented in 2007. These documented events provide clear indication of the likelihood of these turtles occurring within the project area. No green turtle nests have been recorded from the study area (NPS, 2007; Shaver, 2006).

2.3 HAWKSBILL SEA TURTLE

2.3.1 Reasons for Status

The hawksbill sea turtle (*Eretmochelys imbricata*) was federally listed as endangered on June 2, 1970 (35 FR 8495) with critical habitat designated in Puerto Rico on May 24, 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, 2007c).

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 USFWS (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 feet. 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 re-enter 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, 2007c).

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 have been reported as food items for this turtle (Carr, 1952; Mortimer, 1982; Musick, 1979; Pritchard, 1977; Rebel, 1974). The young are reported to be somewhat more herbivorous than adults (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 (National Research Council [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, 2007c). 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, 2007c). 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, 2007; Shaver, 2006).

2.3.5 Presence in the Study Area

No documented records of hawksbills exist from Brazoria County, Texas (Dixon, 2000); however, this species is of potential occurrence in the study area (TPWD, 2007a).

2.4 KEMP’S RIDLEY SEA TURTLE

2.4.1 Reasons for Status

Kemp’s ridley sea turtle (*Lepidochelys kempii*) was listed as endangered throughout its range on December 2, 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 (NMFS, 2007c; USFWS and NMFS, 1992). The NRC Committee on Sea Turtle Conservation estimated in 1990 that 86 percent of the human-caused deaths of juvenile and adult loggerheads and Kemp’s ridleys resulted from shrimp trawling (Campbell, 1995). Before the implementation of TEDs, estimates showed that the commercial shrimp fleet killed between 500 and 5,000 Kemp’s ridleys each year (NMFS, 2007c). 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 percent (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 (USFWS 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 may also 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 4 nests in 1995 to 51 nests in 2005 (NPS, 2006; Shaver, 2006). Some of these nests were from head-started ridleys. Of 46 Kemp's ridley nests encountered in the continental U.S. during 2004, 42 were on Texas beaches (NPS, 2006). The increase can likely 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, 2007c).

2.4.2 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 (USFWS 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 (Campbell, 1995; Pritchard and Marquez, 1973; Shaver, 1991).

2.4.3 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 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).

2.4.4 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); 2005 (51 nests); and 2006 (102 nests) (NPS, 2007; Shaver, 2000, 2006; Yeargan, 2006, 2007). As noted above, some of these nests were from head-started ridleys. Of the 102 Kemp's ridley nests recorded for Texas in 2006, 64 were at the Padre Island National Seashore (NPS, 2007). In 2007, 128 Kemp's ridley nests were recorded on Texas beaches, already surpassing the total for 2006 (NPS, 2007). Such nestings, together with the proximity of the Rancho Nuevo rookery, probably account 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.

2.4.5 Presence in the Study Area

Kemp's ridley has been recorded from the study area. In 1994, a head-started ridley was accidentally caught by a fisherman on a rod and reel in the GIWW and released alive (TPWD, 2006). This species has also nested in the study area. One nest was found on Quintana Beach in 2002, a second was found near Surfside Beach in 2003, and another was found on Surfside Beach in 2006 (Yeargan, 2006, 2007). Two of the 128 Kemp's ridley nests recorded to date in 2007 are from Surfside Beach and one is from Bryan Beach (NPS, 2007). The USACE Sea Turtle Data Wharehouse (USACE, 2010) documents the taking of two Kemp's ridley turtles within the Freeport Harbor Entrance Channel in 2007.

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 June 2, 1970 (35 FR 8495), with critical habitat designated in the U.S. Virgin Islands on September 26, 1978, and March 23, 1979 (43 FR 43688–43689 and 44 FR 17710–17712, respectively). In 1999, in a rule conforming and consolidating various regulations, NMFS amended and redesignated this habitat while also establishing a "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 (64 FR 14067, March 23, 1999).

This species' decline is attributable to overexploitation and incidental mortality, generally 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). Egg collection, nest destruction, and habitat degradation are major adverse impacts to the species' nesting beaches and hatch success (NatureServe, 2006). 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 USFWS, 1992). This species may be susceptible to drowning in shrimp trawlers equipped with TEDs because adult leatherbacks are too large to pass through the TED exit opening. 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, 2007b), 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 deep-water 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 waterbodies 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, 2007c).

The leatherback migrates farther 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 USFWS, 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: cabbagehead (*Stomolophus* sp.) and moon (*Aurelia* sp.) (NMFS and USFWS, 1992). According to USFWS (1981), leatherbacks have never been common in Texas waters. No nests of this species have been recorded in Texas for at least 70 years (NPS, 2007). 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 Study 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 LOGGERHEAD SEA TURTLE

2.6.1 Reasons for Status

The loggerhead sea turtle (*Caretta caretta*) was listed by the USFWS as threatened throughout its range on July 28, 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, 2007c).

2.6.2 Habitat

The loggerhead sea 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 USFWS, 1991b).

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 stars, fish (carrion or slow-moving species), and even hatchling loggerheads have all been recorded as loggerhead prey (Hughes, 1974; Mortimer, 1982; Rebel, 1974). 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).

2.6.3 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 (Iverson, 1986; Rebel, 1974; Ross, 1982). 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, 2007c).

2.6.4 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 are 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). Between 2001 and 2005, up to five loggerhead nests per year were recorded from the Texas coast (Shaver, 2006). Two loggerhead nests were recorded in 2006: one at Padre Island National Seashore and the other on South Padre Island; and six loggerhead nests were recorded on Texas beaches in 2007 (NPS, 2007). 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 with protection, insufficient loggerheads exist to support a fishery.

2.6.5 Presence in the Study Area

This species has been recorded in the study area. Between 1995 and 2000, eight loggerheads were caught in Freeport Harbor Channel, and during the Freeport Harbor Project (July 13 to September 24, 2002), a relocation trawler captured one loggerhead (NMFS, 2003). More recently, an additional loggerhead was incidentally taken in the Freeport Harbor Entrance

Channel in 2006 as a result of dredging activities (USACE, 2010). No nests have been recorded in the study area.

2.7 PIPING PLOVER

2.7.1 Reasons for Status

The USFWS listed the piping plover (*Charadrius melodus*) as threatened and endangered on December 11, 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. Additional threats include human disturbances through recreational use of habitat and predation of eggs by feral pets (USFWS, 1995).

2.7.2 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 (AOU, 1998; USFWS, 1995).

2.7.3 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, December 11, 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.

2.7.4 Distribution in Texas

Approximately 35 percent of the known global population of piping plovers winters along the Texas Gulf Coast, where they spend 60 to 70 percent 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 (Lockwood and Freeman, 2004; Richardson et al., 1998). Piping plover concentrations in Texas occur in the following counties: Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kleberg, Matagorda, Nueces, San Patricio, and Willacy (USFWS, 1988). In Louisiana, the piping plover is a rare migrant statewide and uncommon winter resident along the Gulf Coast in Cameron and Jefferson parishes (USFWS, 1994). Piping plovers may occur in the study area, but suitable habitat is of limited extent.

2.7.5 Presence in the Study Area

Because of a lawsuit, USFWS 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 July 10, 2001 (66 FR 17:36038–36143), and was modified in 2009 (74 FR 23475–23600). Critical habitat includes the land from the seaward boundary of mean lower low water to where densely vegetated habitat, not used by the species, begins and where the constituent elements no longer occur.

Critical Habitat Unit TX-33 encompasses approximately 211 acres between the mouth of the Brazos River and Farm-to-Market Road 1495 and includes Bryan Beach and adjacent beach habitat (74 FR 23475–23600, May 19, 2009), just southwest of the project area. TPWD TXNDD data (2006) 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.

2.8 WHOOPING CRANE

2.8.1 Reasons for Status

The whooping crane (*Grus americana*) was federally listed as endangered on March 11, 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, January 22, 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 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.

2.8.2 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 principal 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*) compose the diet. Foods taken at upland sites include acorns, snails, crayfish, and insects (Campbell, 1995).

2.8.3 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 (USFWS, 1995). 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 nonmigratory (NatureServe, 2006).

2.8.4 Distribution in Texas

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 (USFWS, 1995).

2.8.5 Presence in the Project Area

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 habitat. TPWD's TXNDD (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.

2.9 WHALES

The NMFS identified five whale species of potential occurrence in the Gulf (see Appendix A). These species are generally restricted to offshore waters; therefore, it is unlikely that any of these five species would occur in the study area and furthermore unlikely in the project area.

3.0 EFFECTS ANALYSIS AND AVOIDANCE, MINIMIZATION, AND CONSERVATION MEASURES

In this document, the USACE presents their determinations about each species potentially occurring within the affected area of the FHCIP, using language recommended by USFWS:

- *No effect* – USACE determines that its proposed action will not affect a federally listed species or critical habitat;
- *May affect, but not likely to adversely affect* – USACE determines that the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial; or
- *Likely to adversely affect* – USACE determines adverse effects to listed species and/or critical habitat may occur as a direct result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or completely beneficial. Under this determination, an additional determination is made whether the action is likely to jeopardize the continued survival and eventual recovery of the species.

Once the USACE has made the effect determinations of this project on federally listed species and provides them to the USFWS and NMFS, the agencies will review the information and complete the Section 7 consultation process under the ESA.

The following sections provide the USACE's findings and species-specific avoidance, minimization, and conservation measures that support the effect determinations.

3.1 SMALLTOOTH SAWFISH

This species is highly unlikely to occur in the project area; therefore, no effect on this species is anticipated from the proposed action.

3.2 MARINE (SEA) TURTLES

Sea turtles may be present in the project area during certain times of the year; therefore, construction, postconstruction maintenance, and operational activities may result in impacts to sea turtles.

3.2.1 Channel Construction Dredging (New Work) and Maintenance

New work and maintenance dredging for the FHCIP LPP (Preferred Alternative) are combined in this section as these actions are implemented with similar equipment. For the channel widening and deepening (new work), a pipeline dredge may be used in the upper project area and a hopper dredge will most likely be used for the Entrance Channel construction (new work) and ongoing maintenance. Sea turtles easily avoid pipeline dredges because of the slow movement of the dredge; however, hopper dredge incidental take is possible. The potential adverse effects to sea turtles from dredges are well studied and documented in previous NMFS-issued BOs for other Gulf navigation projects, including the "Biological Opinion on Dredging of Gulf of Mexico Navigation Channels and Sand Mining ("Borrow") Areas Using Hopper Dredges by Corps of Engineers, Galveston, New Orleans, Mobile, and Jacksonville Districts (Consultation Number F/SER/2000/01287)" (also known as the Gulf of Mexico Regional Biological Opinion or GRBO). NMFS first issued the GRBO in 2003 and amended the document in 2005; the 2005 amendment was superceded by the 2007 amendment (NMFS, 2003, 2005, 2007d). This is discussed further in Section 3.2.3 below.

Green, loggerhead, Kemp's ridley, and hawksbill sea turtles may occur in the study area. Of the five species of sea turtle known to potentially occur in Texas waters, the leatherback is the least likely to occur in the project area due to its pelagic nature. USACE, Galveston District turtle incidental take monitoring began in fiscal year 1995 (USACE, 2010). Between 1995 and 2008, a total of 73 turtles have been taken as a result of Gulf-wide hopper dredging, in decreasing order by species: loggerheads (29), greens (29), Kemp's ridley (15); hawksbills and leatherbacks are not known to have been caught in hopper dredges since monitoring began (USACE, 2010). In the Texas coastal area (Galveston District), the total annual (fiscal year) documented incidental take by injury or mortality during hopper dredging under the GRBO is expected to be 7 Kemp's ridleys, 5 green, 1 hawksbill, and 15 loggerhead sea turtles (NMFS, 2007d). This level of take is the same as that authorized by previous BOs, including the original 2003 NMFS GRBO. Documented incidental takes during hopper dredge operations in Freeport Harbor (including Entrance and Jetty channels) are listed in Table 2. Although the level of Freeport Channel hopper dredging has increased over time, the Galveston District has never exceeded the anticipated annual level of take for any sea turtle species (NMFS, 2003).

The LPP (Preferred Alternative) hopper dredging may cause incidental take to individual sea turtles. Based on past incidental take reporting, the most likely affected species are the loggerhead and green sea turtles; Kemp's ridley and hawksbill sea turtles may occur in the study area and may also be affected. For these four species, hopper dredging is likely to adversely affect individuals, but is not anticipated to jeopardize the continued existence of the species. Because the leatherback sea turtle is not likely to be present in the project area, dredging activities may affect, but are not likely to adversely affect, individuals; additionally, dredging activities are not anticipated to jeopardize the continued existence or recovery of this species.

TABLE 2
FREEPORT HARBOR (including Entrance and Jetty Channels)
INCIDENTAL MARINE TURTLE TAKES, 1995–2007

Incidental Take Date	Marine Turtle Species
November 10, 2009	Green
November 23, 2008	Green
October 25, 2008	Green
October 23, 2008	Loggerhead
November 4, 2007	Kemp's ridley
November 3, 2007	Kemp's ridley
November 2, 2007	Green
November 14, 2006	Loggerhead
January 17, 2006	Green
February 2, 2006	Green
August 10, 2000	Loggerhead
August 15, 2000	Loggerhead
October 29, 1998	Loggerhead
July 22, 1996	Loggerhead
July 13, 1996	Loggerhead
July 11, 1996	Loggerhead
June 28, 1996	Loggerhead
October 9, 1995	Loggerhead

USACE (2010).

3.2.2 Placement of Dredged Materials

Kemp's ridley is known to nest in the study area: one nest was found on Quintana Beach in 2002; a second was found near Surfside Beach in 2003; and another was found on Surfside Beach in 2006 (Yeargan, 2006, 2007). Two of the 128 Kemp's ridley nests recorded on Texas beaches in 2007 are from Surfside Beach and 1 is from Bryan Beach (NPS, 2007). Both the loggerhead and green sea turtles have been recorded from the study area (USACE, 2010) and both species nest in Texas (NPS, 2007); therefore, these species could potentially nest in the study area. One hawksbill nest has been recorded in Texas (NPS, 2007; Shaver, 2006); however, this species is unlikely to nest in the study area. No nests of the leatherback sea turtle have been recorded in Texas for at least 70 years (NPS, 2007).

Existing (PA 1) and proposed (PA 8 and PA 9) upland PA activities are not on beach areas (potential turtle nesting sites), and no beach nourishment activities are proposed as part of the LPP (Preferred Alternative); therefore, upland placement of dredged materials will not affect sea turtles. The effects of placing dredged material at the proposed ODMDSs may include (1) potential collision with placement 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. The effects from dredged material placement in ODMDSs would be confined to a relatively small area over a limited time period. Factoring in sea turtle mobility and the lack of limestone ledges in the proposed ODMDSs, the turtles should be able to avoid a descending depositional plume, and although temporarily affected, available food sources should not be seriously reduced. Dredged maintenance material placement activities currently being conducted and proposed to be continued may affect, but are unlikely to adversely affect, sea turtles (NMFS, 2003). The new use of the ODMDSs may affect, but is not likely to adversely affect, sea turtles.

3.2.3 Avoidance, Minimization, and Conservation Measures

In other navigation project BOs, the NMFS anticipated incidental take, either by injury or mortality, due to dredging activities. To address potential incidental take during maintenance and other dredging activities, the USACE and NMFS collaborated on avoidance, minimization, and other conservation measures, formalized by NMFS in the GRBO (NMFS, 2003, 2007d).

The GRBO was based on review of regular maintenance dredging of navigation channels and offshore sand mining for beach nourishment and restoration activities; it addresses, among other species, the five sea turtles that could potentially occur in the LPP study area. Any maintenance activities following implementation of the proposed LPP (Preferred Alternative) would be covered under the GRBO; the GRBO does not address channel improvement projects that have not been authorized by Congress.

Proposed avoidance and minimization measures include reasonable and prudent precautions and actions that have largely been incorporated in USACE regulatory and civil works projects throughout the Gulf for more than a decade and are acknowledged by the USFWS and NMFS to reduce impacts to marine turtles. These measures, implemented in full, are necessary and appropriate to authorize any incidental take of marine turtles during construction of the LPP (Preferred Alternative). The Galveston District has demonstrated a commitment to such measures. During Galveston District hopper dredging activities since 1995, operations have had 100 percent observer coverage, 100 percent inflow/overflow screening, rigid deflector dragheads, and dragarm operators have attempted to disengage dredge pumps when dragheads were suspended in the water column (NMFS, 2003). The bulleted list below is a summary of avoidance, minimization, and conservation measures that would be employed during hopper dredging operations (NMFS, 2007b, 2007d):

- *Seasonal Hopper Dredging Window*: Hopper dredging in the Gulf and up to 1 mile in river channels will be completed, whenever possible, between December 1 and March 31, when sea turtle abundance is lowest throughout Gulf coastal waters due to temperature of offshore waters.

- *Nonhopper-type Dredging*: Pipeline or hydraulic dredges, which are not known to take turtles, must be used whenever possible between April 1 and November 30 in Gulf waters up to 1 mile into rivers.

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

- *Screening*: 100 percent 4-inch inflow screening of dredged material is required. If conditions prevent 100 percent inflow screening using 4-inch mesh, the Galveston District, observers, and draghead operator must consult and USACE must notify NMFS before reducing or eliminating inflow screening and provide details regarding effective overflow screening. If deemed necessary, screening may be modified gradually (increasing mesh size to 6 inch by 6 inch, then 9 inch by 9 inch, then 12 inch by 12 inch). If clogging is still an issue after gradual changes, then effective 100 percent overflow screening is required.

- *Sea Turtle Deflecting Draghead and Dredging Pumps*: A state-of-the-art rigid deflector draghead will be used on all hopper dredges at all times of the year. Dredging pumps will be disengaged by the operator when the dragheads are not firmly on the bottom, to prevent impingement or entrainment of sea turtles within the water column (especially important during dredging cleanup).

- *Dredge Lighting*: From May 1 through October 1, all lighting aboard hopper dredges and hopper dredge pumpout barges operating within 3 nautical miles of sea turtle nesting beaches will be limited to the minimal lighting necessary to comply with U.S. Coast Guard and/or Occupational Safety and Health Administration requirements. Nonessential lighting will be minimized through reduction, shielding, lowering, and appropriate placement to minimize illumination of nesting beaches and reduce disorientation effects on female sea turtles and hatchlings.

- *Dredge Take Reporting*: Observer reports of incidental take by hopper dredges will be submitted by fax or email to NMFS Southeast Regional Office by onboard protected species observers within 24 hours of any observed sea turtle take. An end-of-project summary report of the hopper dredging results and any documented sea turtle takes will be submitted to NMFS Southeast Regional Office within 30 working days of completion of the dredging project. USACE will submit an annual report to NMFS Southeast Regional Office summarizing hopper dredging projects and documented incidental takes. This report must include a complete explanation why alternative dredges (other than hopper dredges) were not used for maintenance dredging, if that activity occurs between April and November.

- *Sea Turtle Stranding and Salvage Network (STSSN) Notification*: USACE or its representative will notify the STSSN state representative of start-up and completion of hopper dredging, bed-leveler dredging, and relocation trawling operations and ask to be notified of any turtle strandings in the project area that may bear the signs of draghead impingement or entrainment or interaction with a bed-leveling type dredge. Dredge-relevant stranding information will be reported in the end-of-project summary report and end of year annual report (these strandings will not be counted against USACE take limit during maintenance).

- *Relocation Trawling*: Relocation trawling will be implemented as circumstances dictate in a manner consistent with the GRBO and as outlined in the BO for construction. Handling of sea turtles captured during relocation trawling in association with hopper dredging would be conducted by NMFS-approved protected species observers in a manner designed to ensure their safety and viability. When safely possible, not jeopardizing the health of the individual turtle, scientific measurements/procedures may be taken (see GRBO for details). An end-of-project report would be generated upon completion and incorporated into the hopper dredging annual summary report.

- *Operations*: During periods when hopper dredges are operating and NMFS-approved protected species observers are not required, USACE will (1) advise inspectors, operators, and vessel captains that take, harm, and harassment of turtles is prohibited; (2) instruct the hopper dredge captain to avoid any turtles during travel or activity and to immediately contact USACE if turtles are seen in the vicinity; (3) notify NMFS if sea turtles are observed in the dredging area to coordinate further take-avoidance precautions; and (4) notify NMFS if a sea turtle (or any other protected species) is taken by the dredge.

3.2.4 Effect Determinations

In summary, construction and postconstruction maintenance hopper dredging activities may result in incidental take of individual sea turtles, although upland and ocean placement of dredged materials are not expected to impact sea turtles. Feeding opportunities within the proposed channel and nearby nesting beaches could attract sea turtles, where they might be exposed to additional cumulative risks from boat traffic, contaminants, fishing and fishing gear, and accumulated plastic debris. Because there are no beach impacts related to the LPP (Preferred Alternative), there is no effect to nesting sea turtles. Effect determinations, based on the information presented in this document and in the EIS, are presented in Table 3. The likelihood of adverse effects, including incidental take, during construction and maintenance are greatly reduced by full implementation of the avoidance, minimization, and conservation measures outlined above. Incidental take, if it occurs, is not likely to jeopardize the continued existence or potential recovery of any of the sea turtle species.

TABLE 3
SEA TURTLE EFFECT DETERMINATIONS RELATIVE TO THE PROPOSED LPP

Common Name[1]	Scientific Name[1]	Dredging Activity Determination	Placement of Dredged Materials Determination
Green sea turtle	*Chelonia mydas*	Likely to adversely affect*	May affect, but not likely to adversely affect
Hawksbill sea turtle	*Eretmochelys imbricata*	Likely to adversely affect*	May affect, but not likely to adversely affect
Kemp's ridley sea turtle	*Lepidochelys kempii*	Likely to adversely affect*	May affect, but not likely to adversely affect
Leatherback sea turtle	*Dermochelys coriacea*	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Loggerhead sea turtle	*Caretta caretta*	Likely to adversely affect*	May affect, but not likely to adversely affect

*The likelihood of adverse effects (incidental take) of sea turtles due to dredging activities is greatly reduced by implementation and adherence to the conservation measures. Adverse effects are not expected to jeopardize the continued survival or recovery of the species.

[1] Nomenclature follows AOU (1998, 2000, 2002, 2003, 2004, 2005, 2006), Crother et al. (2000, 2001, 2003), TPWD (2007a), and USFWS (2007).

3.3 PIPING PLOVER

Open-water dredging would not directly affect the piping plover. Wintering piping plovers are of potential occurrence on beaches and sand and mudflats along the open-water Gulf margins within the study area. USFWS-designated critical habitat for the piping plover (Critical Habitat Unit TX-33) encompasses approximately 211 acres between the mouth of the Brazos River and FM 1495 and includes portions of Bryan Beach and other adjacent beach habitat (74 FR 23475–23600, May 19, 2009). The LPP (Preferred Alternative) does not include beach nourishment, which would affect piping plover principal wintering habitats. Wintering piping plovers have been observed using upland PAs for resting between placement activities. PA 1 is currently used every 10 months for maintenance-dredged material placement, and no change in that placement schedule is anticipated. The habitats found in tracts Eight and Nine are not the types typically used by piping plovers; therefore, potential loss of habitat from construction of PA 8 and PA 9 is not expected to adversely affect piping plovers in the project area. Once PA 8 and PA 9 are constructed and in use, piping plovers may use these areas for resting. The proposed LPP (Preferred Alternative) will have no effect on the piping plover.

3.4 WHOOPING CRANE

This species is not expected to occur in the project area; therefore, no effect is anticipated from the proposed action.

3.5 WHALES

None of the five whale species are expected to occur in the project area; therefore, no effects to the five whale species are anticipated from the proposed action.

4.0 SUMMARY

Table 4 presents a summary of effect determinations for the federally threatened and endangered species covered in this BA. Potential adverse effects from hopper dredging activities would be avoided and minimized to the greatest extent possible through adherence to the measures outlined in this document. Although some adverse affects are expected, none of the actions proposed with the LPP (Preferred Alternative) is anticipated to jeopardize the continued existence and potential recovery of these species.

TABLE 4
EFFECT DETERMINATIONS SUMMARY For The PROPOSED LPP

Common Name[1]	Scientific Name[1]	Dredging Activity	Placement of Dredged Materials
FISHES			
Smalltooth sawfish	*Pristis pectinata*	No effect	No effect
REPTILES			
Green sea turtle	*Chelonia mydas*	Likely to adversely affect*	May affect, but not likely to adversely affect
Hawksbill sea turtle	*Eretmochelys imbricata*	Likely to adversely affect*	May affect, but not likely to adversely affect
Kemp's ridley sea turtle	*Lepidochelys kempii*	Likely to adversely affect*	May affect, but not likely to adversely affect
Leatherback sea turtle	*Dermochelys coriacea*	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Loggerhead sea turtle	*Caretta caretta*	Likely to adversely affect*	May affect, but not likely to adversely affect
BIRDS			
Piping plover**	*Charadrius melodus*	No effect	No effect
Whooping crane	*Grus americana*	No effect	No effect
MAMMALS			
Blue whale	*Balaenoptera musculus*	No effect	No effect
Finback whale	*B. physalus*	No effect	No effect
Humpback whale	*Megaptera novaengliae*	No effect	No effect
Sei whale	*B. borealis*	No effect	No effect
Sperm whale	*Physeter macrocephalus*	No effect	No effect

*The likelihood of adverse effects (incidental take) of sea turtles due to dredging activities is greatly reduced by implementation and adherence to the conservation measures. Adverse effects are not expected to jeopardize the continued survival or recovery of the species.

**No effect to piping plover critical habitat is expected.

[1]Nomenclature follows AOU (1998, 2000, 2002, 2003, 2004, 2005, 2006), Crother et al. (2000, 2001, 2003), TPWD (2007a), and USFWS (2007).

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Appendix A

Agency Coordination

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Ave. South
St. Petersburg, FL 33701
(727) 824-5312, FAX (727) 824-5309
http://sero.nmfs.noaa.gov

F/SER3:TM

OCT - 2 2007

Ms. Carolyn Murphy
Chief, Environmental Branch
Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Dear Ms. Murphy:

This correspondence responds to the Department of the Army's letter dated September 20, 2007, regarding an Environmental Assessment Statement to address proposed improvements to the Freeport Harbor 40-Foot Navigation Project located on the mid to upper Texas coast in Brazoria County, Texas.

As requested, enclosed is a list of federally-protected species under the jurisdiction of the National Marine Fisheries Service for the state of Texas.

We look forward to continued cooperation with the Army in conserving our endangered and threatened resources. If you have any questions regarding the ESA consultation process, please contact Mr. Robert Hoffman, fishery biologist, at (727) 824-5312, or by e-mail at Robert.Hoffman@noaa.gov.

Sincerely,

David M. Bernhart
Assistant Regional Administrator
Protected Resources Division

Enclosure

File: 1514-22.F.1.TX

Endangered and Threatened Species and Critical Habitats under the Jurisdiction of the NOAA Fisheries Service

Texas

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			
smalltooth sawfish	*Pristis pectinata*	Endangered	04/01/03

Designated Critical Habitat
None

Species Proposed for Listing
None

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

Texas

Candidate Species[2]	Scientific Name
none	

Species of Concern[3]	Scientific Name
Fish	
dusky shark	*Carcharhinus obscurus*
largetooth sawfish	*Pristis pristis*
night shark	*Carcharhinus signatus*
saltmarsh topminnow	*Fundulus jenkinsi*
sand tiger shark	*Carcharias 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 Service 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.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real #211
Houston, Texas 77058-3051

February 2007

This responds to your request for threatened and endangered species information in the Clear Lake Ecological Services Field Office's area of responsibility. According to Section 7(a)(2) of the Endangered Species Act and the implementing regulations, it is the responsibility of each federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any federally listed species. Therefore, we are providing information to assist you in meeting your obligations under the Endangered Species Act.

A county by county listing of federally listed threatened and endangered species that occur within this office's work area can be found at http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm. You should use the county by county listing and other current species information to determine whether suitable habitat for a listed species is present at your project site. If suitable habitat is present, a qualified individual should conduct surveys to determine whether a listed species is present.

After completing a habitat evaluation and/or any necessary surveys, you should evaluate the project for potential effects to listed species and make one of the following determinations:

No effect – the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.

Is not likely to adversely affect – the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. You should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation you used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.

Is likely to adversely affect – adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but also is likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species. An "is likely to adversely affect" determination requires formal Section 7 consultation with this office.

Regardless of your determination, the Service recommends that you maintain a complete record of the evaluation, including steps leading to the determination of affect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related articles.

The Service's Consultation Handbook is available online to assist you with further information on definitions, process, and fulfilling Endangered Species Act requirements for your projects at http://endangered.fws.gov/consultations/s7hndbk/s7hndbk.htm.

If we can further assist you in understanding your obligations under the Endangered Species Act, please contact Kathy Nemec, Edith Erfling, or Catherine Yeargan at 281/286-8282.

Sincerely,

Stephen D. Parris

Stephen D. Parris
Field Supervisor, Clear Lake Field Office

U.S. Fish & Wildlife Service

Endangered Species List

Back to Start

List of species by county for Texas:

Counties Selected: Brazoria

Select one or more counties from the following list to view a county list:

Anderson
Andrews
Angelina
Aransas
Archer

View County List

Brazoria County

Common Name	Scientific Name	Species Group	Listing Status	Species Image	Species Distribution Map	Critical Habitat	More Info
bald eagle	*Haliaeetus leucocephalus*	Birds	DM				
brown pelican	*Pelecanus occidentalis*	Birds	DM, E				
green sea turtle	*Chelonia mydas*	Reptiles	E, T				
hawksbill sea turtle	*Eretmochelys imbricata*	Reptiles	E				
Kemp's ridley sea turtle	*Lepidochelys kempii*	Reptiles	E				
leatherback sea turtle	*Dermochelys coriacea*	Reptiles	E				
loggerhead sea turtle	*Caretta caretta*	Reptiles	T				
piping Plover	*Charadrius melodus*	Birds	E, T				
whooping crane	*Grus americana*	Birds	E, EXPN				

Appendix B

Annotated County List of Rare Species, Brazoria County

BRAZORIA COUNTY

BIRDS

		Federal Status	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	DL	E

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	T

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald Eagle	*Haliaeetus leucocephalus*	DL	T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Black Rail	*Laterallus jamaicensis*		

salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous year's dead grasses; nest usually hidden in marsh grass or at base of Salicornia

Brown Pelican	*Pelecanus occidentalis*	LE	E

largely coastal and near shore areas, where it roosts and nests on islands and spoil banks

Eskimo Curlew	*Numenius borealis*	LE	E

historic; nonbreeding: grasslands, pastures, plowed fields, and less frequently, marshes and mudflats

Henslow's Sparrow	*Ammodramus henslowii*		

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Peregrine Falcon	*Falco peregrinus*	DL	E T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, thus the species level shows this dual listing status; because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Piping Plover	*Charadrius melodus*	LT	T

wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats

Reddish Egret	*Egretta rufescens*		T

resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear

BRAZORIA COUNTY

BIRDS		Federal Status	State Status
Snowy Plover	*Charadrius alexandrinus*		

formerly an uncommon breeder in the Panhandle; potential migrant; winter along coast

Sooty Tern	*Sterna fuscata*		T

predominately 'on the wing'; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July

Southeastern Snowy Plover	*Charadrius alexandrinus tenuirostris*		

wintering migrant along the Texas Gulf Coast beaches and bayside mud or salt flats

Western Snowy Plover	*Charadrius alexandrinus nivosus*		

uncommon breeder in the Panhandle; potential migrant; winter along coast

White-faced Ibis	*Plegadis chihi*		T

prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats

White-tailed Hawk	*Buteo albicaudatus*		T

near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May

Whooping Crane	*Grus americana*	LE	E

potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties

Wood Stork	*Mycteria americana*		T

forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

FISHES		Federal Status	State Status
American eel	*Anguilla rostrata*		

coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally

Sharpnose shiner	*Notropis oxyrhynchus*	C	

endemic to Brazos River drainage; also, apparently introduced into adjacent Colorado River drainage; large turbid river, with bottom a combination of sand, gravel, and clay-mud

MAMMALS		Federal Status	State Status
Jaguarundi	*Herpailurus yaguarondi*	LE	E

BRAZORIA COUNTY

MAMMALS		Federal Status	State Status

thick brushlands, near water favored; 60 to 75 day gestation, young born sometimes twice per year in March and August, elsewhere the beginning of the rainy season and end of the dry season

Louisiana black bear	*Ursus americanus luteolus*	LT	T

possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas

Ocelot	*Leopardus pardalis*	LE	E

dense chaparral thickets; mesquite-thorn scrub and live oak mottes; avoids open areas; breeds and raises young June-November

Plains spotted skunk	*Spilogale putorius interrupta*		

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Red wolf	*Canis rufus*	LE	E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

West Indian manatee	*Trichechus manatus*	LE	E

Gulf and bay system; opportunistic, aquatic herbivore

MOLLUSKS		Federal Status	State Status

False spike mussel *Quincuncina mitchelli*

substrates of cobble and mud, with water lilies present; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins

Pistolgrip *Tritogonia verrucosa*

stable substrate, rock, hard mud, silt, and soft bottoms, often buried deeply; east and central Texas, Red through San Antonio River basins

Rock pocketbook *Arcidens confragosus*

mud, sand, and gravel substrates of medium to large rivers in standing or slow flowing water, may tolerate moderate currents and some reservoirs, east Texas, Red through Guadalupe River basins

Smooth pimpleback *Quadrula houstonensis*

small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins

Texas fawnsfoot *Truncilla macrodon*

little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins

BRAZORIA COUNTY

REPTILES		Federal Status	State Status
Alligator snapping turtle	*Macrochelys temminckii*		T
perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October			
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	LE	E
Gulf and bay system			
Green sea turtle	*Chelonia mydas*	LT	T
Gulf and bay system; shallow water seagrass beds, open water between feeding and nesting areas, barrier island beaches; adults are herbivorous feeding on sea grass and seaweed; juveniles are omnivorous feeding initially on marine invertebrates, then increasingly on sea grasses and seaweeds			
Gulf Saltmarsh snake	*Nerodia clarkii*		
saline flats, coastal bays, and brackish river mouths			
Kemp's Ridley sea turtle	*Lepidochelys kempii*	LE	E
Gulf and bay system			
Leatherback sea turtle	*Dermochelys coriacea*	LE	E
Gulf and bay system			
Loggerhead sea turtle	*Caretta caretta*	LT	T
Gulf and bay system			
Texas diamondback terrapin	*Malaclemys terrapin littoralis*		
coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide			
Texas horned lizard	*Phrynosoma cornutum*		T
open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September			
Timber/Canebrake rattlesnake	*Crotalus horridus*		T
swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto			

PLANTS		Federal Status	State Status
Coastal gay-feather	*Liatris bracteata*		
endemic; black clay soils of prairie remnants; flowering in fall			
Giant sharpstem umbrella-sedge	*Cyperus cephalanthus*		

BRAZORIA COUNTY

PLANTS

Federal Status State Status

remnant coastal prairies in poorly to moderately drained sites

Texas meadow-rue *Thalictrum texanum*

endemic; mesic woodlands or forests, including wet ditches on partially shaded roadsides; flowering March-May

Texas windmill-grass *Chloris texensis*

endemic; sandy to sandy loam soils in open to sometimes barren areas in prairies and grasslands, including ditches and roadsides; flowering in fall

Threeflower broomweed *Thurovia triflora*

endemic; black clay soils of remnant grasslands, also tidal flats; flowering July-November

Appendix J

Compliance with the Texas Coastal Management Program

Document No. 070284
Job No. 441901

APPENDIX J
COMPLIANCE WITH GOALS AND POLICIES – DREDGING AND DREDGED MATERIAL DISPOSAL AND PLACEMENT
FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT
BRAZORIA COUNTY, TEXAS
TEXAS COASTAL MANAGEMENT PROGRAM
CONSISTENCY DETERMINATION

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

October 2010

Printed on recycled paper

Appendix J

Compliance with Goals and Policies – Section 501.25 (a)–(f)
Dredging and Dredged Material Disposal and Placement
Freeport Harbor Channel Improvement Project
Environmental Impact Statement
Brazoria County, Texas
Texas Coastal Management Program

INTRODUCTION

To achieve navigation efficiency and safety objectives, the U.S. Army Corps of Engineers (USACE) plans to widen the Freeport Harbor Entrance Channel (including the Outer Bar and Jetty channels) to 600 feet and deepen to 57 feet, deepen the Main Channel to 55 feet from the Lower Turning Basin to above the Brazosport Turning Basin and to 50 feet up channel through the Upper Turning Basin, widen Lower Stauffer Channel to 300 feet and deepen to 50 feet, and redredge Upper Stauffer Channel to a 25-foot depth. Construction of the proposed project would generate approximately 17.3 million cubic yards (mcy) of dredged material. Maintenance of the deepened and widened channel would generate a total of 175.9 mcy of maintenance-dredged material over the 50-year evaluation period. Material dredged from the Outer Bar and Jetty channels during construction would be placed in the new work Ocean Dredged Material Disposal Site (ODMDS), and the remainder of the new work material would be placed in dredged material placement areas (PAs) 1, 8, and 9. Material dredged from the Outer Bar and Jetty channels and from the Lower Turning Basin during maintenance cycles would be placed in the maintenance material ODMDS, and material from the remainder of the channel would be placed in PAs 1, 8, and 9. Several alternatives were analyzed including a No Action Alternative, a National Economic Development (NED) Plan Alternative, and the Locally Preferred Plan (LPP) Alternative, which is the USACE tentatively Recommended Plan.

The existing Freeport Harbor Channel 45-Foot Project (45-foot Project) was authorized by the Rivers and Harbor Acts (RHA) of May 1950 and July 1958, providing for an Entrance Channel of 38-foot depth and 300-foot width from the Gulf to inside the jetties and for interior channels of 36-foot depth and 200-foot width up to and including the Upper Turning Basin. In 1970, Congress passed Section 101 of RHA 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 a 45-foot depth and 400-foot width and the Outer Bar Channel to a 47-foot depth and 400-foot width, with an extension of approximately 4.6 miles into the Gulf.

Since the completion of the 45-foot Project, the size of ships using the waterway has steadily increased so that many vessels currently have to be light-loaded to traverse the waterway. The current channel depth requires that large crude carriers remain offshore and transfer their cargo into smaller crude tankers for the remainder of the voyage. This lightering operation takes place in the Gulf where the two ships, the mother ship and the lightering ship, come together so that the cargo transfer can take place. Although this operation has been going on for years, the possibility for a collision, oil spill, fire, or other adverse environmental consequences is always present. Deepening the channel will reduce the number of lightering operations. Current projections suggest that crude imports will increase in the near future. As the imports increase, the number of lightering vessels and product carriers will also increase, adding to the shipping delays, congestion, and risk of collision or spill.

The USACE and the Brazoria County Navigation District (referred to as Port Freeport), as the non-Federal sponsor, propose to improve the navigation channels servicing Freeport Harbor as a Federal action by deepening and widening the current channel alignment, starting at the 57-foot depth contour, and terminating at the Stauffer Channel Turning Basin. This project is referred to as the Freeport Harbor Channel Improvement Project (FHCIP). The proposed FHCIP will also provide for the creation of two new upland confined PAs (8 and 9), adjacent to the Brazos River. The LPP Alternative, as described above, has been adopted by the USACE and Port Freeport as the tentatively Recommended Plan.

IMPACTS ON COASTAL NATURAL RESOURCE AREAS

Several of the Coastal Natural Resource Areas (CNRAs) listed in 31 TAC §501.3 are found reasonably close to the areas discussed in the Environmental Impact Statement (EIS). A short description of each CNRA near the project and of methods to minimize or avoid potential impacts is provided below.

Waters of the Open Gulf of Mexico

New work and future dredged maintenance material generated from portions of the FHCIP will be placed in two ODMDSs. An ODMDS site analysis describing the evaluated alternatives has been prepared for the proposed new ocean disposal site designations, and is included in the EIS as Appendix B. In total, the area within the existing new work ODMDS footprint will be disturbed during construction, and the footprint of the existing maintenance ODMDS will be disturbed intermittently for the life of the project, as it has since designation in 1990. The overall footprint of these offshore PAs will be minimized by mounding the dredged material vertically to the maximum extent practical. These offshore PAs are dispersive by nature and will likely revert to the in situ topography prior to the next maintenance dredged material disposal sequence.

Waters Under Tidal Influence

The entire project is located in a region that experiences tidal influence. For the proposed FHCIP, dredging and placement activities represent a minimal impact because the release of suspended solids is minimized by using upland confined PAs and compliance with the required State §401 Certification.

Submerged Lands

The LPP Alternative project footprint occurs in areas characterized as submerged lands. Dredging and placement activities represent a minimal impact because the release of suspended solids is minimized by using upland confined PAs. The ODMDSs are located in submerged lands, but these offshore PAs are dispersive by nature, have been used previously, and will likely revert to the in situ topography prior to their next dredged material disposal.

Coastal Wetlands

Although coastal wetlands occur within the study area, no coastal wetlands would be directly affected by the LPP Alternative. Hydrosalinity changes associated with the LPP Alternative may indirectly affect project area coastal wetlands in a minor way.

Submerged Aquatic Vegetation

This navigation project is located near areas characterized as being devoid of expanses of seagrasses. There will be no direct adverse impacts to seagrass beds as a result from the LPP Alternative.

Tidal Sand and Mud Flats

The LPP entirely avoids tidal sand or mud flats. There are tidal sand/mud flats along the North Jetty Channel shoreline, near the U.S. Coast Guard Station, but they will not be impacted (EIS Section 4.10.2.2.1).

Oyster Reefs

There are no oyster reefs identified within the LPP Alternative footprint.

Hard Substrate Reefs

There are no naturally occurring hard substrate formations in the vicinity of the project. The closest serpulid worm reefs within Texas waters are located much farther south in the Laguna Madre and Baffin Bay.

Coastal Barriers

The coastal barrier downdrift of the project area primarily consists of National Refuge areas, which are undeveloped with marshes in the backshore and with narrow beaches and overwash terrace on the foreshore. Dredging and dredged material placement operations are not expected to have any adverse impacts to the coastal barriers.

Coastal Shore Areas

These resource areas function as buffers, protecting upland habitats from erosion and storm damage and adjacent marshes and waterways from water quality degradation. Deepening and widening the channel may slightly increase the potential for storm damage or water quality degradation.

Gulf Beaches

The USACE Engineer and Research Development Center (ERDC) conducted a study to determine potential impacts from the FHCIP to longshore sediment transport rates on adjacent shorelines in the project area (ERDC, 2007). Results show that erosional dynamics along project area shorelines would be slightly altered due to the project. All impacts are considered negligible, and specific conclusions of the study include:

- The primary conclusion from this analysis is that if deepening of the Freeport Entrance Channel is implemented, the wave-induced sediment transport impacts on the adjacent shorelines will be so slight as to not be noticeable and will be dwarfed by the interannual variability in shoreline position.
- The model indicates that minor impacts will not extend farther than 3 to 4 miles (5 to 6 kilometers [km]) to either side of the Freeport jetties.

Critical Dune Areas

The Gulf beaches of the study area include dune systems. Since the dredged material is not destined to be placed directly or indirectly onto the beaches, adverse impacts to the dune complexes are not expected to occur as a result of dredging and dredged material placement operations.

Special Hazard Areas

Special hazard areas are areas designated by the Administrator of the Federal Insurance Administration under the National Flood Insurance Act as having special flood, mudslide, and/or flood-related erosion hazards. The project area is covered under the Flood Insurance Studies for Brazoria County, Texas. The land along the channel within the area studied is predominantly located in or adjacent to the 100-year floodplain. Project dredging and placement activities do not affect these low-lying areas because dredging is within and adjacent to the existing channel and placement is within contained upland sites and ODMDSs.

Critical Erosion Areas

These areas are those Gulf and bay shorelines that are undergoing erosion and are designated by the Commissioner of the General Land Office under Texas Natural Resources Code, §33.601(b). Although no critical erosion areas are affected by the LPP Alternative, channel changes associated with the LPP Alternative may indirectly affect nearby critical erosion areas by potentially altering the hydrological regime.

Coastal Historic Areas

Research demonstrated that PAs 8 and 9 have the potential to harbor intact historic and prehistoric period cultural deposits. Additional investigation of PAs 8 and 9 identified a potential Civil War site on PA 9. A draft programmatic agreement (Appendix E to the EIS) among the USACE, the State Historic Preservation Officer (SHPO), and Port Freeport to guide implementation of the proposed undertaking makes stipulations to take into account the effects of the undertaking on historic properties and satisfy the USACE Section 106 responsibilities for all individual aspects for the undertaking.

Three anomalies/sonar targets resembling submerged watercraft were discovered during a nautical remote-sensing survey conducted in February 2006 for the Freeport Harbor Navigation Channel Improvement Project (Borgens et al., 2007). Additional analysis of the anomalies concluded that they do not represent historic shipwrecks and require no further investigation or coordination. In response to the USACE letter dated January 22, 2010 (Appendix A-3 to the EIS), the SHPO concurred with this finding on February 1, 2010.

As with the impacts to the terrestrial PAs, the impacts to the three nautical anomalies/sonar targets that were identified during the remote-sensing survey will be addressed as per the conditions of the programmatic agreement (Appendix E to the EIS).

Coastal Preserves

This natural resource includes State Parks and National Wildlife Refuges (NWR). There are several preserves within the vicinity of the coastal shoreline and include the Brazoria NWR, Bryan Beach State Park, and San Bernard NWR. No coastal preserves would be affected by the LPP Alternative.

COMPLIANCE WITH GOALS AND POLICIES

The following goals and policies of the Texas Coastal Management Program (TCMP) were reviewed for compliance.

- §501.15 – Policy for Major Actions

- §501.25 – Dredging and Dredged Material Disposal and Placement

§501.15 – Policy for Major Actions

(a) *For purposes of this section, "major action" means an individual agency or subdivision action listed in §505.11 of this title (relating to Actions and Rules Subject to the Coastal Management Program), §506.12 of this title (relating to Federal Actions Subject to the Coastal Management Program), or §505.60 of this title (relating to Local Government Actions Subject to the Coastal Management Program), relating to an activity for which a Federal environmental impact statement under the National Environmental Policy Act, 42 United States Code Annotated, §4321, et seq. is required.*

(b) *Prior to taking a major action, the agencies and subdivisions having jurisdiction over the activity shall meet and coordinate their major actions relating to the activity. The agencies and subdivisions shall, to the greatest extent practicable, consider the cumulative and secondary adverse effects, as described in the Federal environmental impact assessment process, of each major action relating to the activity.*

(c) *No agency or subdivision shall take a major action that is inconsistent with the goals and policies of this chapter. In addition, an agency or subdivision shall avoid and otherwise minimize the cumulative adverse effects to coastal natural resource areas of each of its major actions relating to the activity.*

<u>Compliance</u>: This project involves action subject to §506.12 and constitutes a major action. Therefore, a Federal EIS is required under the National Environmental Policy Act, 42 USC, §4321, et seq. A review of potential beneficial uses (BUs) of dredged material for the proposed Widening Project, which included an interagency panel review, did not identify any cost-effective BUs in the project area. This was based on the characteristics of the dredged material, cost to transport the material, impacts associated with placement and manipulation of the material, and impacts to existing resources. Thus, no BU is proposed for the FHCIP. The purpose of this appendix to the EIS (which considers cumulative and secondary adverse effects of the project) is to demonstrate that the LPP Alternative is consistent with the TCMP. All project planning has made efforts to avoid and otherwise minimize the cumulative adverse effects to coastal natural resource areas relating to the activity.

§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.*

Compliance: Dredged material will be placed in three upland confined PAs and two ODMDSs. Placement within the ODMDSs would result in placement of dredged material within submerged lands, but these offshore PAs are dispersive by nature, have been previously used, and will likely revert to the in situ topography prior to the next dredged material disposal. With the exception of submerged lands, which would be temporarily impacted, all critical areas, shore areas, and Gulf beaches are avoided.

(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.

Compliance: Samples have been taken from both maintenance and virgin sediments in the project area (sections 4.2 and 4.3 and Appendix B of this EIS) and subjected to elutriate preparation and suspended particulate bioassays. No Texas Water Quality Standards or U.S. Environmental Protection Agency Water Quality Criteria were exceeded, and nothing in the results of the bioassays indicates any cause for concern. For all PAs, adequate dilution and dispersion occurs so that applicable surface water standards are not violated (EIS Section 4.2 and Appendix B).

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

Compliance: The LPP Alternative Dredged Material PAs avoids adverse effects on critical 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;

Compliance: Several alternatives were analyzed including a No Action Alternative, a NED Plan Alternative, and the LPP Alternative. Development of the LPP Alternative and

associated Dredged Material PAs resulted in an avoidance of detrimental impacts to coastal natural resources such as estuarine wetlands, oyster reefs, etc., to reduce impacts.

(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, including upland placement to the extent practicable, utilization of existing PAs, and minimum channel size to meet the project needs have been taken to minimize adverse affects on these resources. See Section 2.5 of the EIS for a discussion of all PAs that were evaluated and associated minimization of adverse effects.

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

<u>Compliance:</u> Critical areas are avoided and degradation of such areas is not anticipated as a result of the LPP Alternative.

(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> Dredging and placement is not precluded by paragraph (3), as noted above.

(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, and associated Dredged Material PA, have been minimized as described under "Compliance" for paragraph (1) of this subsection. See Section 2.5 of the EIS for a discussion of all PAs that were evaluated and associated minimization of adverse effects.

(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.*

Compliance: PAs have been selected to minimize impacts by using existing upland confined PAs or existing and previously authorized ODMDSs, wherever practical. Changes in water circulation and salinity should have minimal impacts to fisheries. Discharges will be confined with reinforced levees, where applicable. Only proper material will be used for certain substrates and uses. No impoundment or draining of critical areas will occur. No new channels are required to access existing or proposed PAs (upland and ODMDS).

(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 LPP Alternative have been tested for a variety of chemical parameters, and there appears to be no cause for concern relative to placing these sediments in the Gulf or upland confined PAs (Section 4.3 and Appendix B of 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> Discharges will be confined with reinforced levees where applicable. Only proper material will be used for certain substrates and uses. Additionally, the timing of discharge would be planned in a manner to reduce or avoid adverse impacts from unusually high water flows, wind, wave, and tidal actions.

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

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

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

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

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

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

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

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

Compliance: All of the sites minimize or avoid adverse dispersal effects to the greatest extent practicable. At ODMDSs, studies indicate adequate dispersion and dilution would occur during discharge. Sequenced discharge points will be used to disperse material across the ODMDSs. There are no sediments of concern.

(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.*

Compliance: Where applicable, all sites in this project meet this requirement. Contracts will be written to ensure compliance with all standards. ODMDSs are accessed by vessel and all upland sites can be accessed by land-based equipment without damaging critical areas.

(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.*

Compliance: **Proper coordination with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS), under the requirements of the Endangered Species Act, was implemented, and no impacts to endangered species or their habitats are anticipated, except for potential impacts to sea turtles during hopper dredging. Impacts to sea turtles, a primary wildlife concern, will be avoided or minimized via: (1) hopper dredging will be limited to the cooler months, when possible, when sea turtle activity and abundance is lowest; (2) dredges will employ trawls to safely remove sea turtles before being adversely affected by dredge equipment; and (3) qualified turtle observers will be used to document any turtles that become entrained by the hopper dredge dragheads, and all information will be submitted accordingly to USFWS and NMFS. A Habitat Evaluation Procedure (HEP) was implemented to mitigate habitats directly affected by the two new PAs, 8 and 9. Permanent impacts would be mitigated, and invasive species, such as tallow trees, will be removed. Lastly, the LPP Alternative would have minor, temporary impacts to wildlife in the area due to noise and physical disturbance during dredging and placement operations.**

(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> Temporary and minor adverse effects to fisheries may result from altering or removing productive fishing grounds and interfering with fishing activity near or in the ODMDSs and within the project area during construction and maintenance. Additionally, existing PAs were used to avoid additional impacts to resources. New PAs were located in a manner that did not impact valuable aquatic areas or recreational use areas.

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

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

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

(C) *with the least practicable risk that increased vessel traffic could result in navigation hazards, spills, or other forms of contamination that 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 LPP Alternative constitutes new work dredging to the existing ship channel for increased vessel safety (i.e., to minimize navigation hazards, spills, or other forms of contamination that could adversely affect CNRAs). The LPP Alternative will not impact any CNRAs (except submerged lands at the ODMDSs, which are expected to return to ambient bathymetry since the ODMDSs are dispersive sites).

(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> All new upland PAs (PAs 8 and 9) were reviewed by the HEP, and no further environmental review was recommended for the existing, actively used PA 1. PAs 8 and 9 would impact 39 acres of wetlands and 21 acres of forest. Avoidance and minimization was employed during project planning. The HEP identified a site to compensate for both wetland and forest impacts. Details regarding the Dredged Material PAs can be found in the EIS, Section 2.4, and the HEP analysis, including mitigation, can be found in Appendix H of the EIS.

(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> New work and future maintenance dredged material to be generated by the LPP Alternative consist of 72 percent clay. This substrate is not conducive for the BU that is most important for this area (i.e., beach nourishment, which requires high sand content). Also, some BU alternatives that may have been feasible (given substrate composition) were considered early in the project planning process but eliminated through alternatives analyses. Section 3.5 of the EIS provides more detail regarding sediment quality analyses.

(1) If the costs of the BU 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 BU 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 BU 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 BU site to the dredge site; and

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

(3) Examples of the BU 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 BUs are not available; and

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

Compliance: Numerous BUs were considered during project planning. BUs of dredged material are discussed in the EIS, Section 2.4 and Section 3.5 (Sediment Quality); however, new work dredged material to be generated by the LPP Alternative consist of 72 percent clay. This substrate is not conducive for the BU that is most important for this area (i.e., beach nourishment, which requires high sand content). Also, some BU alternatives that may have been feasible (given substrate composition) were considered early in the project planning process but eliminated through alternatives analyses.

(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> New work and future maintenance dredged material whose sediment characteristics preclude being used beneficially will be placed in either the ODMDSs or upland confined PAs.

(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>: PAs are designed to prevent impacts to adjoining private lands. All property rights and boundaries associated with submerged lands will be observed.

(g) Emergency dredging shall be allowed without a prior consistency determination as required in the applicable consistency rule when:

(1) there is an unacceptable hazard to life or navigation;

(2) there is an immediate threat of significant loss of property; or

(3) an immediate and unforeseen significant economic hardship is likely if corrective action is not taken within a time period less than the normal time needed under standard procedures. The council secretary shall be notified at least 24 hours prior to commencement of any emergency dredging operation by the agency or entity responding to the emergency. The notice shall include a statement demonstrating the need for emergency action. Prior to initiation of the dredging operations the project sponsor or permit-issuing agency shall, if possible, make all reasonable efforts to meet with council's designated representatives to ensure consideration of and consistency with applicable policies in this subchapter. Compliance with all applicable policies in this subchapter shall be required at the earliest possible date. The permit-issuing agency and the applicant shall submit a consistency determination within 60 days after the emergency operation is complete.

<u>Compliance</u>: The project would comply with *section (g)* in the event that emergency dredging is necessary.

(h) *There will be no mining of sand, shell, marl, gravel, or mudshell for project purposes. Dredged new work and maintenance material will be placed within ODMDSs, which are located within submerged lands, and shall be prohibited unless there is an affirmative showing of no significant impact on erosion within the coastal zone and no significant adverse effect on coastal water quality or terrestrial and aquatic wildlife habitat within any CNRA.*

<u>Compliance</u>: Placement within the ODMDSs would result in placement of dredged material within submerged lands, but these offshore PAs are dispersive by nature, have been previously used, and will likely revert to the in situ topography prior to the next dredged material disposal. With the exception of submerged lands, which would be temporarily impacted, all CNRAs are avoided.

(i) *The GLO and the SLB shall comply with the policies in this section when approving oil, gas, and other mineral lease plans of operation and granting surface leases, easements, and permits and adopting rules under the Texas Natural Resources Code, Chapters 32, 33, and 51 - 53, and Texas Water Code, Chapter 61, for dredging and dredged material disposal and placement. TxDOT shall comply with the policies in this subchapter when adopting rules and taking actions as local sponsor of the Gulf Intracoastal Waterway under Texas Transportation Code, Chapter 51. The TCEQ and the RRC shall comply with the policies in this section when issuing certifications and adopting rules under Texas Water Code, Chapter 26, and the Texas Natural Resources Code, Chapter 91, governing certification of compliance with surface water quality standards for Federal actions and permits authorizing dredging or the discharge or placement of dredged material. The TPWD shall comply with the policies in this section when adopting rules at Chapter 57 of this title (relating to Fisheries) governing dredging and dredged material disposal and placement. The TPWD shall comply with the policies in subsection (h) of this section when adopting rules and issuing permits under Texas Parks and Wildlife Code, Chapter 86, governing the mining of sand, shell, marl, gravel, and mudshell.*

<u>Compliance</u>: This project does not pertain to oil, gas, and other mineral lease plans of operation and granting surface leases, easements, and permits; *section (i)* is not applicable.

REFERENCES

Borgens, Amy, Sara Hoskins, Jenna Enright, and Robert L. Gearhart II. 2007. Remote-sensing survey of proposed channel modifications for historic properties, Freeport Harbor Navigation Channel Improvement Project, Freeport Harbor, Brazoria County, Texas. Prepared for the U.S. Army Corps of Engineers, Galveston District. Document No. 060218. PBS&J, Austin.

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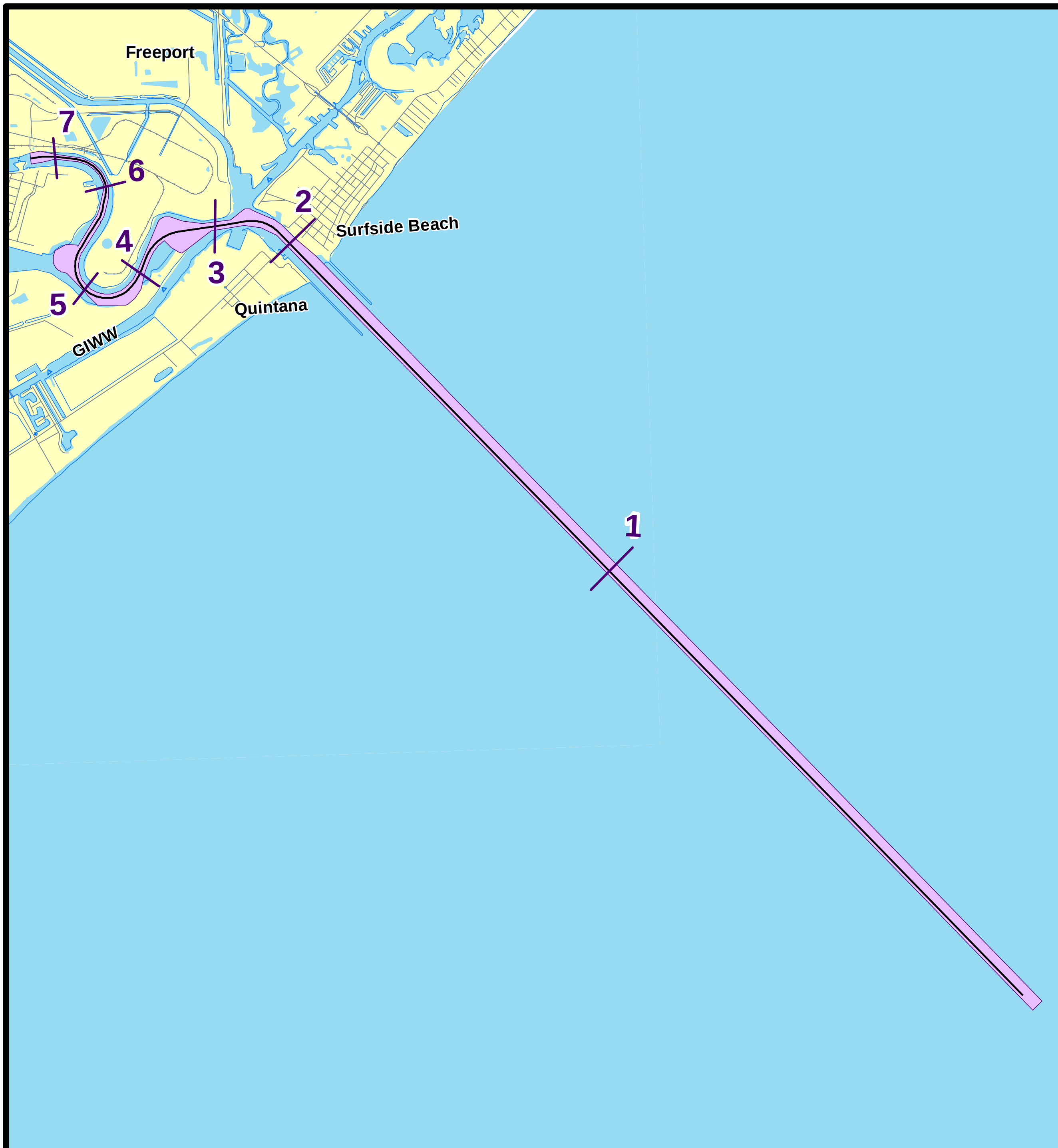
Appendix K

Cross Sections for 45-Foot Project, NED, LPP, and Jetty Stability



Legend

- Representative of Channel Stations
- Channel Centerline
- Proposed Channel Alignment

N
W E
S

0 3,600 7,200 14,400 Feet

Figure K
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Cross-Section Locations

Prepared for: USACE	
Job No.: 044190100	Scale: 1inch equals 7,000 feet
Prepared by: A. Christiansen	Date: 3/19/2008

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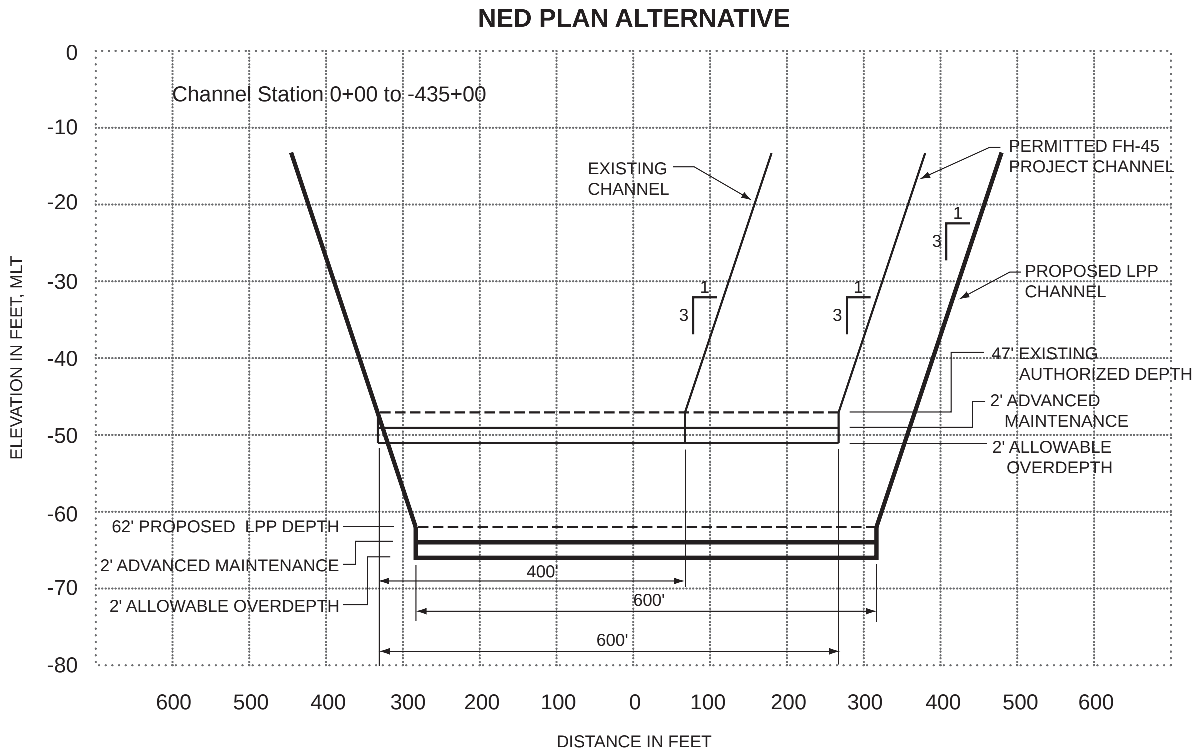

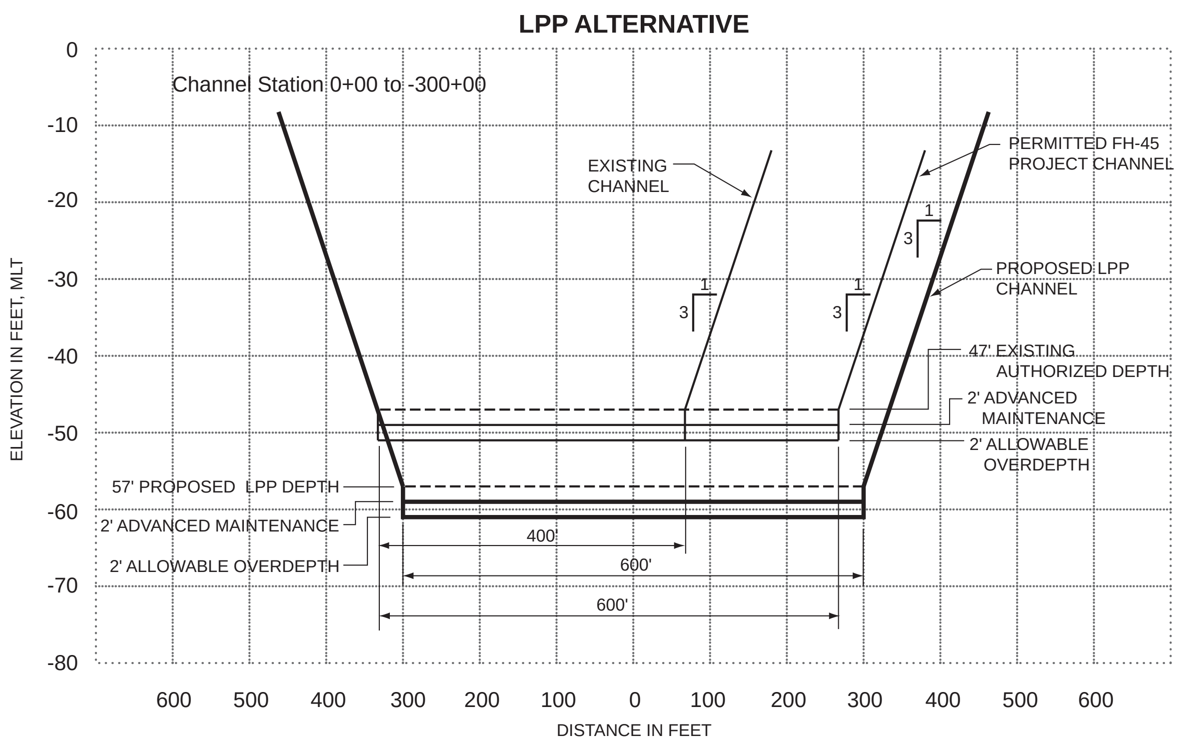

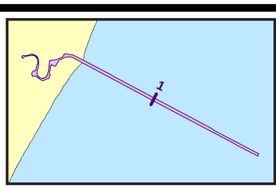

Outer Bar Channel

Figure K-1
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Alternatives
Channel Dimensions Cross Section 1

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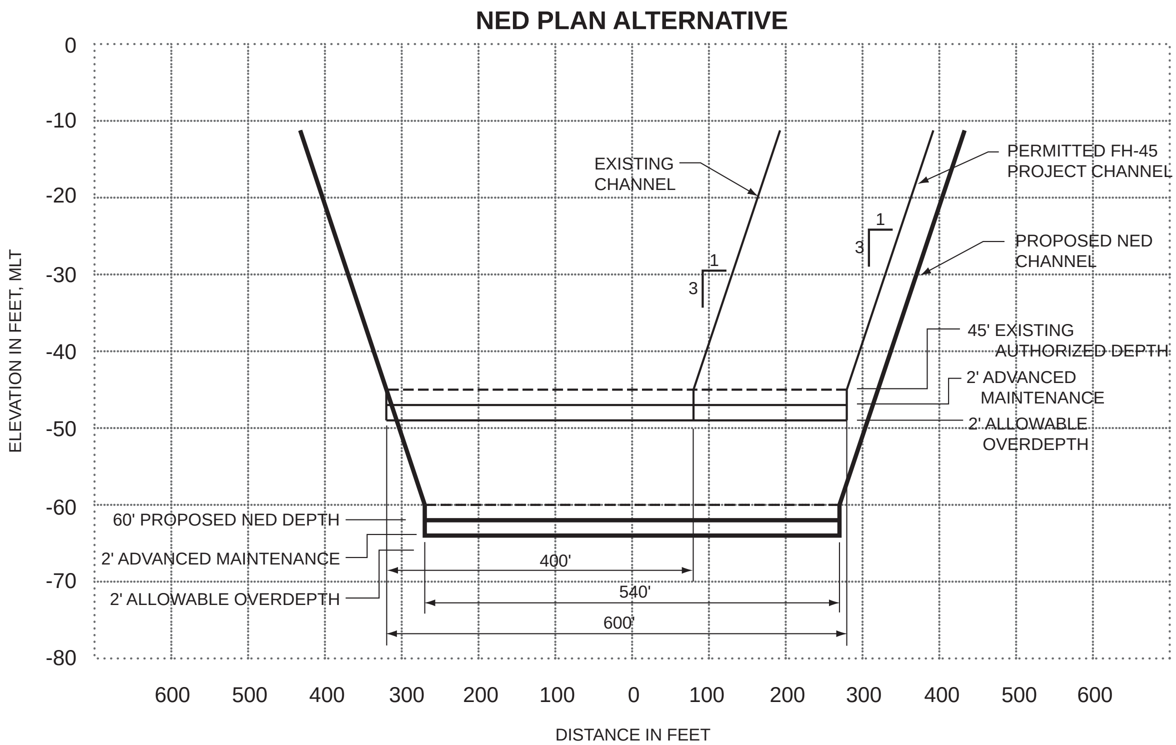

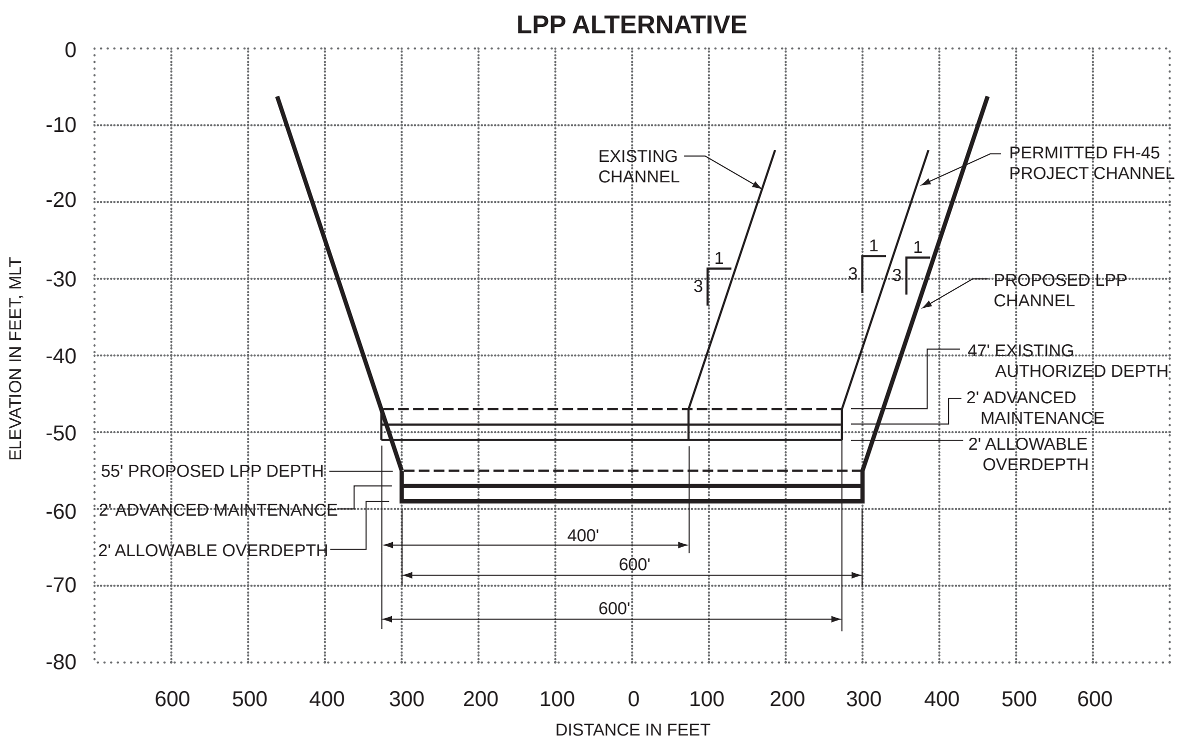

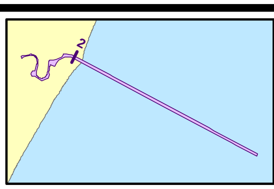

Jetty Channel

Channel Station 0+00 to 71+52

Figure K-2
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Alternatives
Channel Dimensions Cross Section 2

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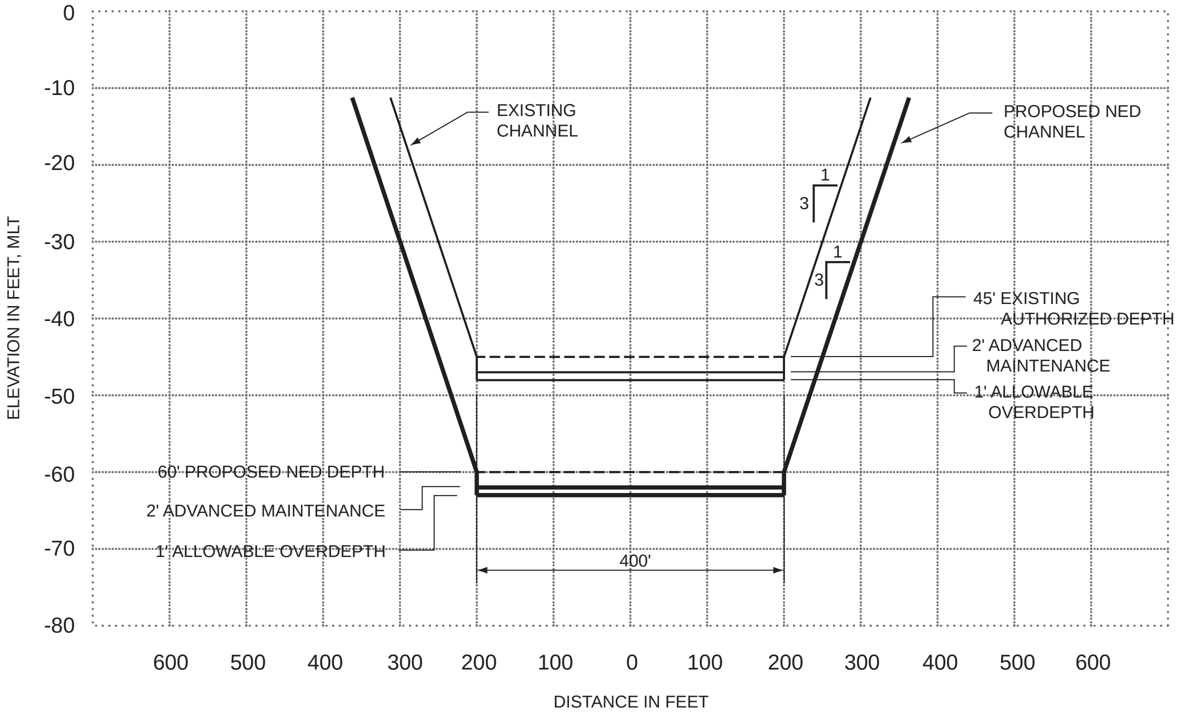
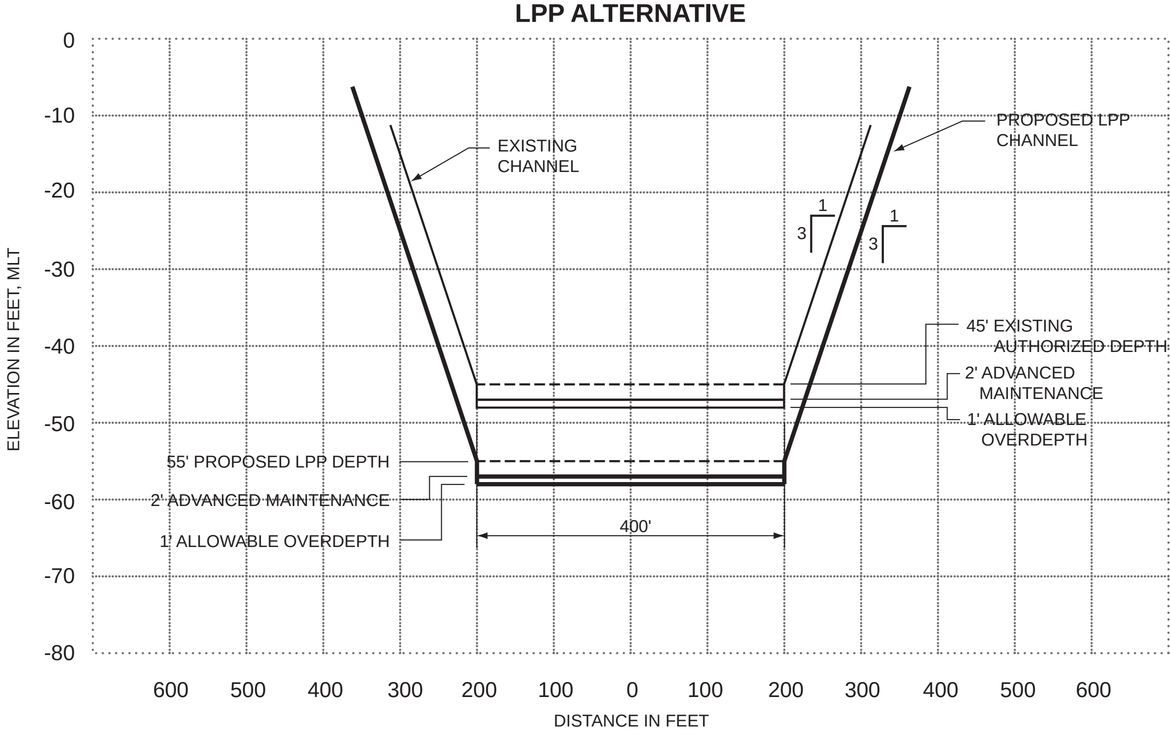
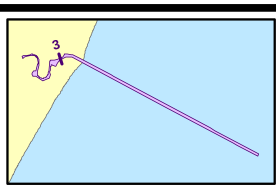
NED PLAN ALTERNATIVE



LPP ALTERNATIVE





Channel to Brazosport Turning Basin

Channel Station 78+52 to 101+00

Figure K-3
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Alternatives
Channel Dimensions Cross Section 3

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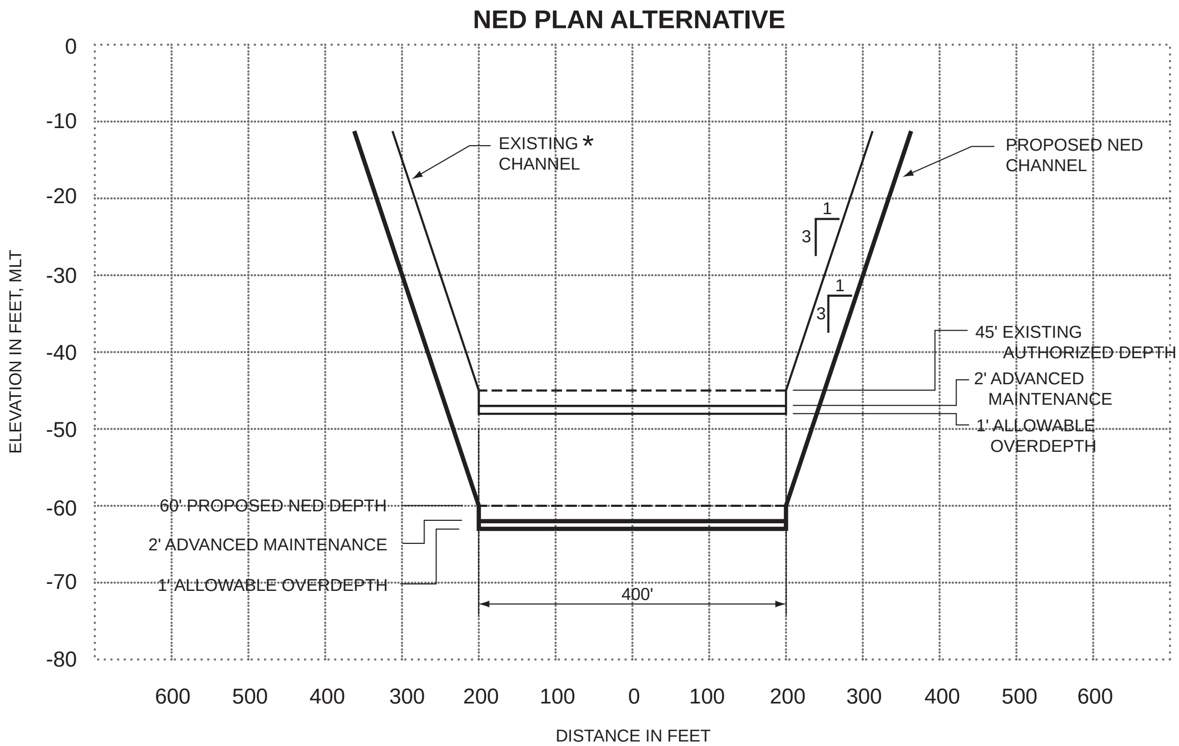

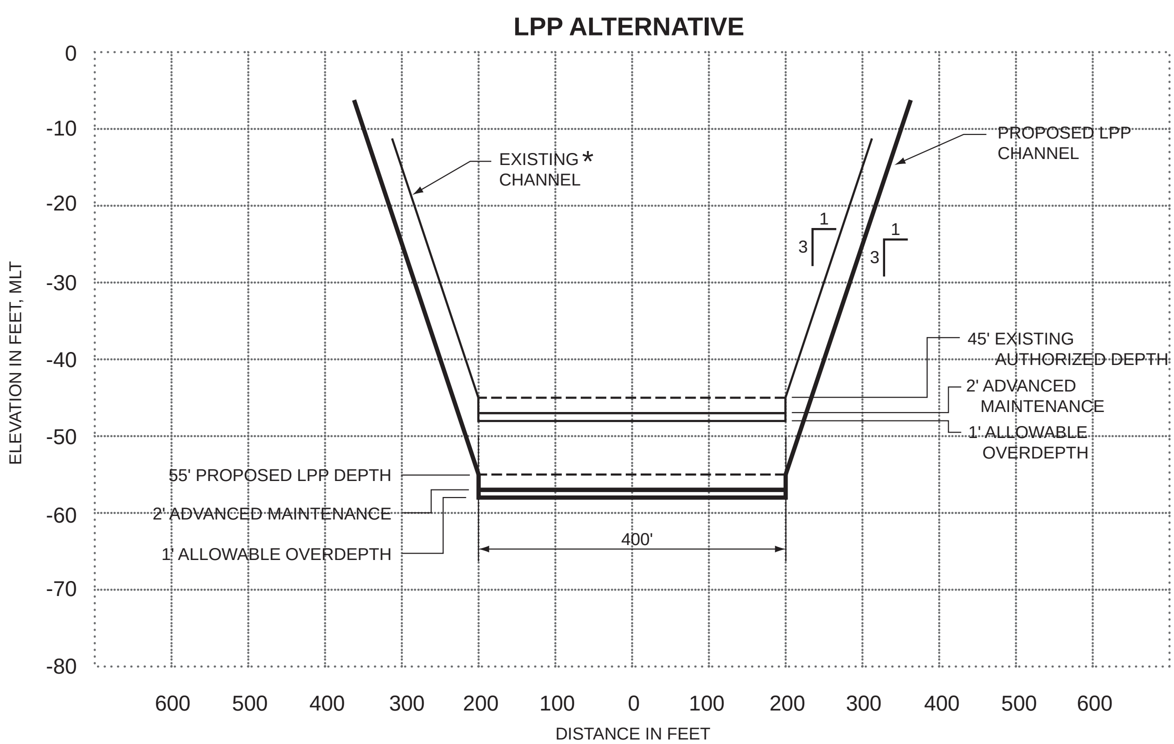

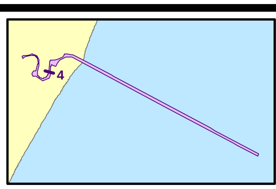

Channel to Upper Turning Basin
Lower Reach

Channel Station 115+00 to 132+66

***Existing Bottom Widths vary between 300ft and 600ft. Channel Improvement would not modify width.**

Figure K-4
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Alternatives
Channel Dimensions Cross Section 4

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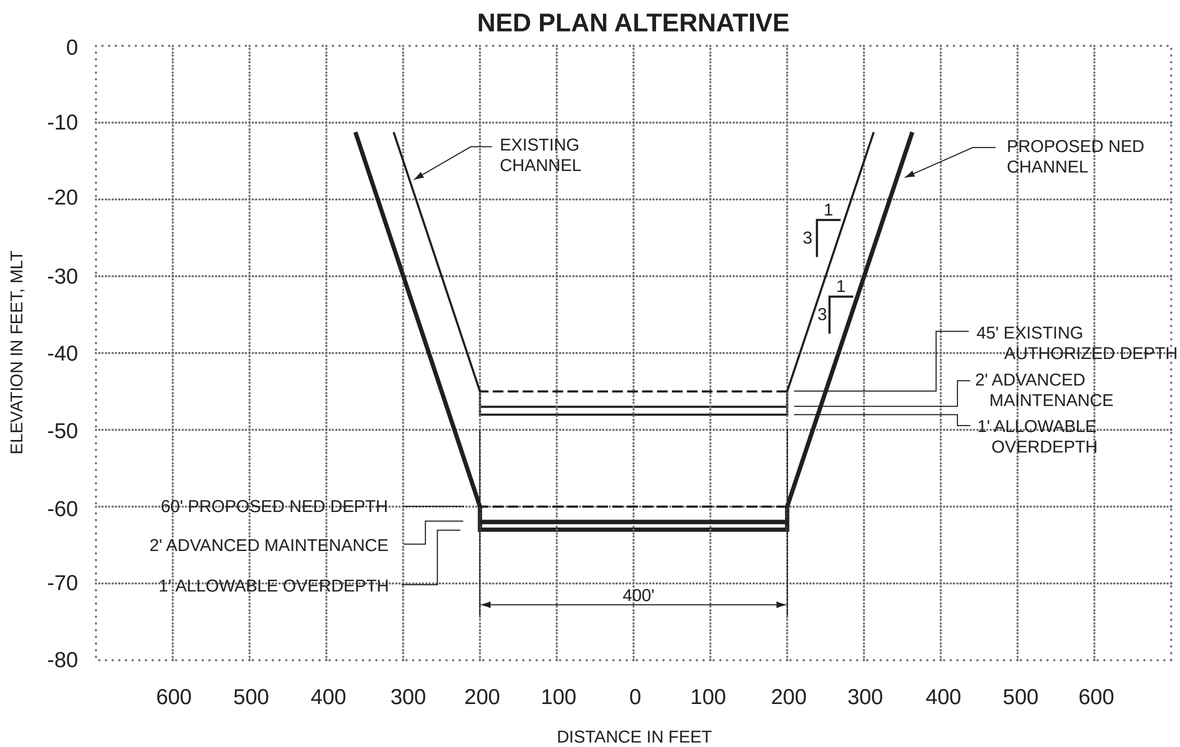
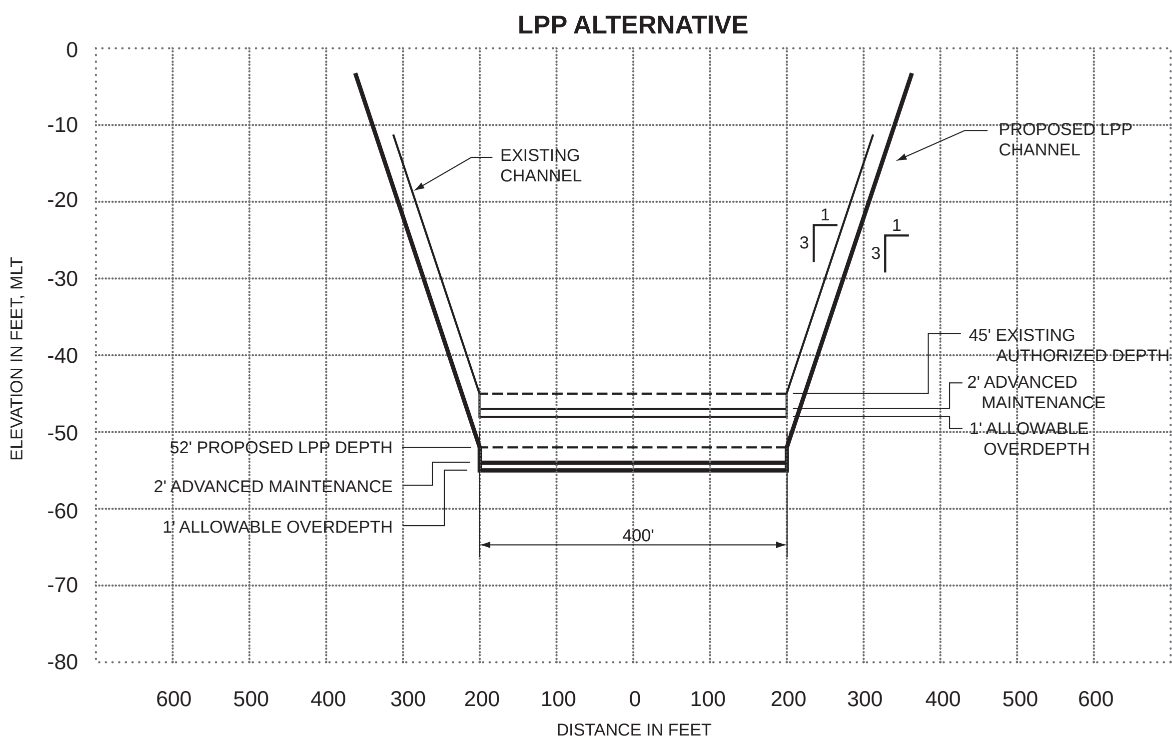
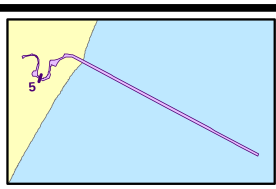




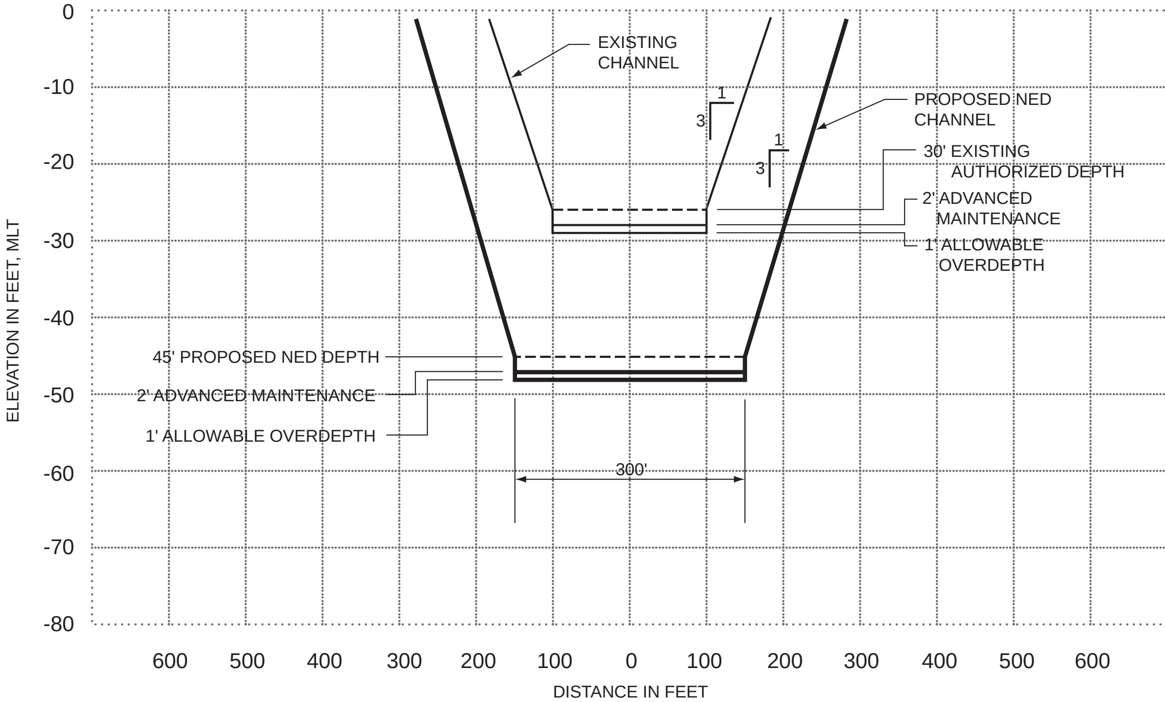


Channel to Upper Turning Basin
Upper Reach

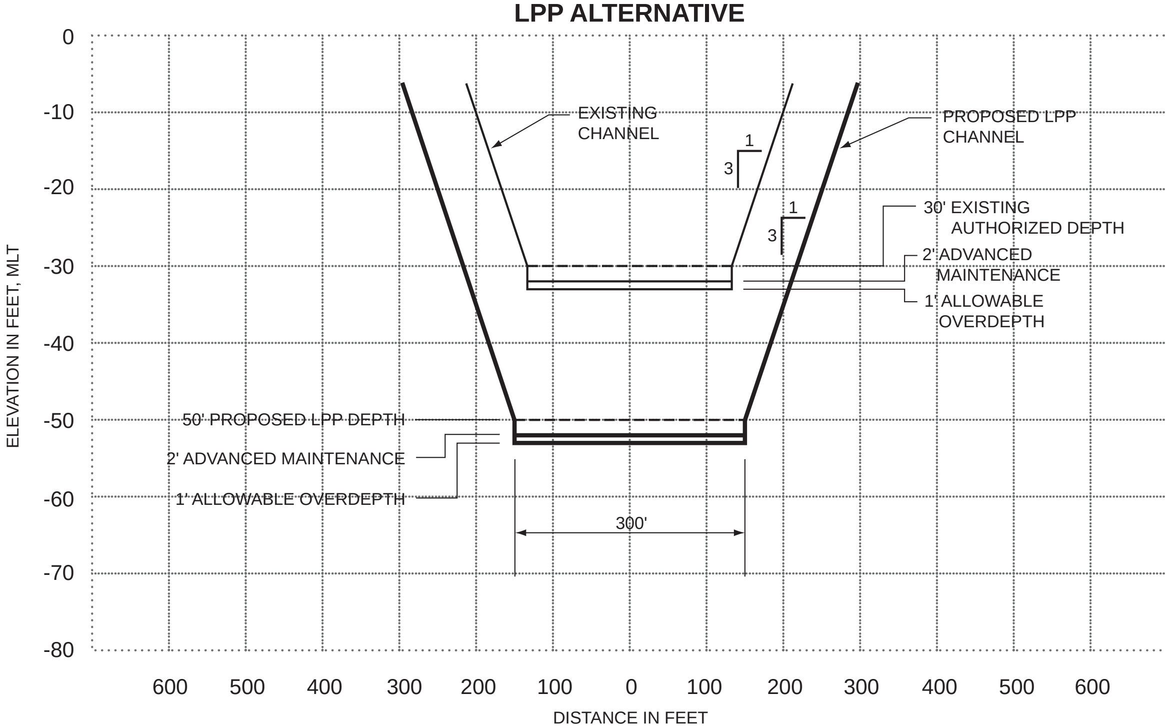
Channel Station 132+66 to 174+00

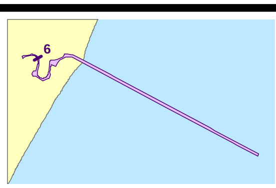
Figure K-5
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Alternatives
Channel Dimensions Cross Section 5

NED PLAN ALTERNATIVE



LPP ALTERNATIVE





Stauffer Channel
Lower Reach

Channel Station 186+00 to 222+00

Figure K-6
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Alternatives
Channel Dimensions Cross Section 6

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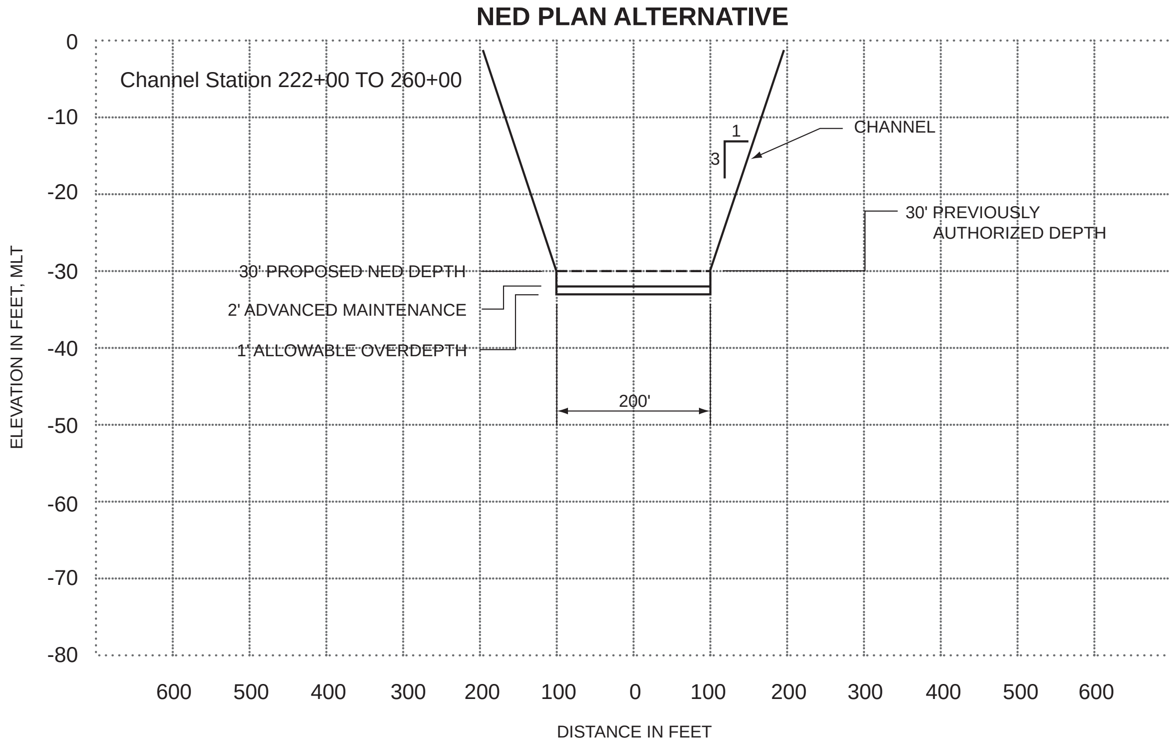

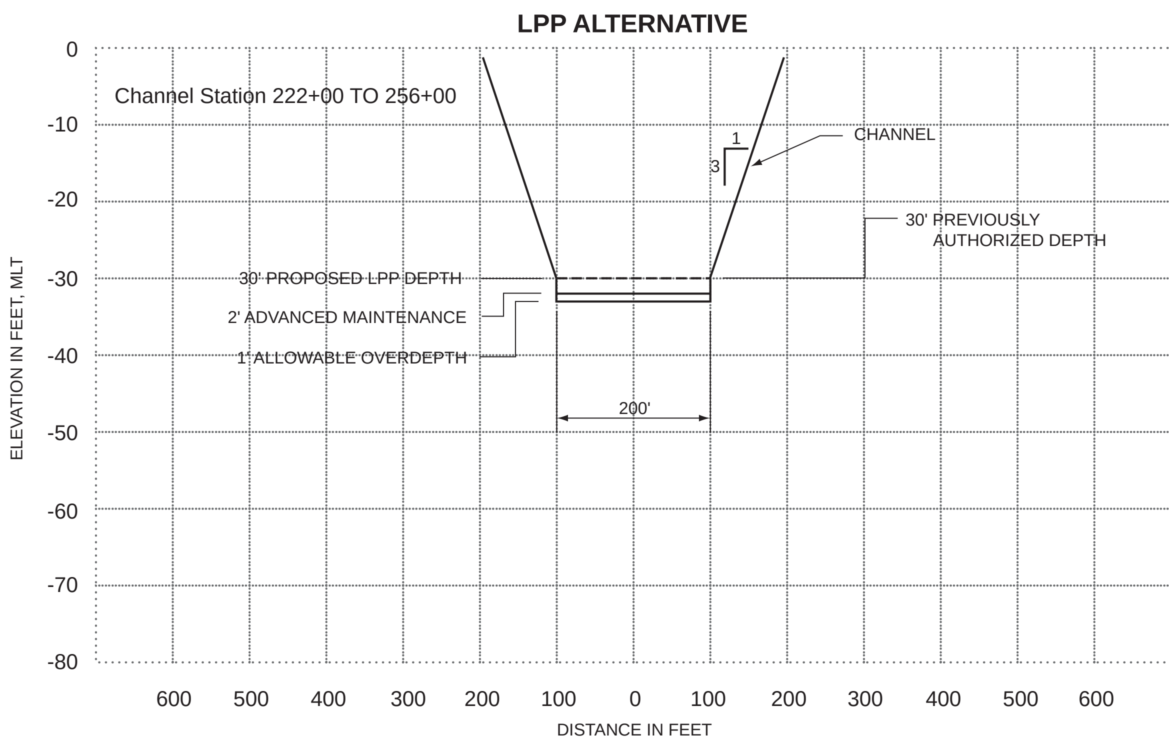

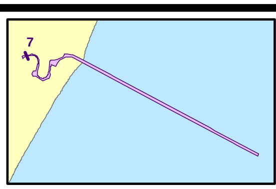

Stauffer Channel Upper Reach

Figure K-7
Freeport Harbor Channel Improvement Project
Existing, NED, and LPP Channel Alternatives
Channel Dimensions Cross Section 7

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Appendix L

Relative Sea Level Rise

APPENDIX L
RELATIVE SEA LEVEL RISE FOR FREEPORT, TEXAS: ADDRESSING THE MOST RECENT CORPS GUIDANCE

INTRODUCTION

New U.S. Army Corps of Engineers (USACE) guidance (Engineering Circular [EC] 1165-2-211, July 2009) specifies the following procedures for incorporating relative sea level rise (RSLR) into the project impacts.

Evaluate alternatives using “low,” “intermediate,” and “high” rates of future sea level change:

- Use the historic rate of local mean sea level change as the “low” rate. (The guidance further states that historic rates of sea level rise are best determined by local tide records.)
- Estimate the “intermediate” rate of local mean sea level change using the modified National Research Council (NRC) Curve I. Consider both the most recent Intergovernmental Panel on Climate Change (IPCC) projections and the NRC projections and add those to the local rate of vertical land movement.
- Estimate the “high” rate of local mean sea level change using the modified NRC Curve III. Consider both the most recent IPCC projections and the NRC projections and add those to the local rate of vertical land movement.

The Modified NRC curves are based on the curves published by the NRC in 1987 with modifications of the coefficients suggested in the IPCC 4th Assessment Report (AR4) (IPCC, 2007).

The Modified NRC equation is given below:

$$\eta(t)=(0.0017+M)t+bt^2 \qquad (1)$$

Where

$\eta(t)$	=	the relative sea level rise for year t (meters)
t	=	the elapsed time since the baseline year of 1986 (years)
M	=	the local rate of subsidence (+) or uplift (–) (meters/year)
b	=	the rate of acceleration of eustatic sea level rise (meters/year^2)

The values of b are chosen such that the sea level due to eustatic rise at year 2100 is equal to 0.5, 1.0, and 1.5 meters, respectively. These values are given in Table 1.

Table 1
Values of the Rate of Acceleration of Eustatic Sea Level Rise for Each of the Modified NRC Curves

NRC Curve	b (meters/year^2)
NRC I	2.35611E-05
NRC II	6.20345E-05
NRC III	1.0051 E-04

This document addresses this new guidance for the Freeport Harbor, Texas, system.

Historic RSLR

The recent historic rate of local RSLR rise can be obtained from local tide records with reasonably high confidence. This rate can be extracted from National Oceanic and Atmospheric Administration (NOAA) tide gage data at Freeport. It is equal to 4.35 ± 1.12 millimeters (mm)/year (0.0143 ± 0.003 feet/year) with a 95 percent confidence interval (NOAA, 2008). If we assume a historic eustatic rate equal to the globally averaged rate given for the Modified NRC curves (= 1.7 mm/year (0.0056 foot/year)), this results in an estimated observed subsidence rate of 4.35 – 1.7 = 2.65 mm/year (0.0087 foot/year).

To date, there is no scientific consensus on what the local subsidence rate should be for future projections. The relative influence of historic anthropogenic activities, such as oil extraction and groundwater withdrawal, are difficult to quantify. If these activities have contributed significantly to recent observations of subsidence, then the cessation of these activities may result in a rapid deceleration of subsidence rates, returning them to the long-term average rates.

Since the cessation of most of these anthropogenic activities occurred in the Freeport vicinity within the last 20 to 30 years, there is not yet sufficient tide gage data to determine whether or not the local rate of subsidence has decelerated.

Several studies of basal peat layers have been conducted in the Texas and Louisiana coastal region to determine estimates of the long-term average rates of subsidence. These rates are generally on the order to 0.5 mm/year (0.0016 foot/year) (Törnqvist et al., 2006). This rate is significantly lower than the observed tide gage rates. Therefore, if historic anthropogenic activities are largely responsible for the accelerated rates observed in the tide records, then one would expect the projected rates to decelerate rapidly over the next several decades.

New RSLR Analysis as per the Updated USACE Guidance

According to the most recent guidance, the subsidence rate should be chosen based on the tidal record analysis. However, the regional scientific debate concerning the validity of these tidal records with respect to projection of future subsidence rates indicates that the basal peat rates should also be considered.

Figure 1 gives the computed sea level rise based on the new guidance for the low (historic) rate, the intermediate (Modified NRC Curve I) rate, and the high (Modified NRC Curve III) rate. The computed sea level rise given here assumed a 50-year project life, and gives the predicted rise for the years 2012–2062. The rates are given for subsidence values that correspond to both the observed tidal gage values (rapid subsidence) and the observed basal peat values (moderate subsidence).

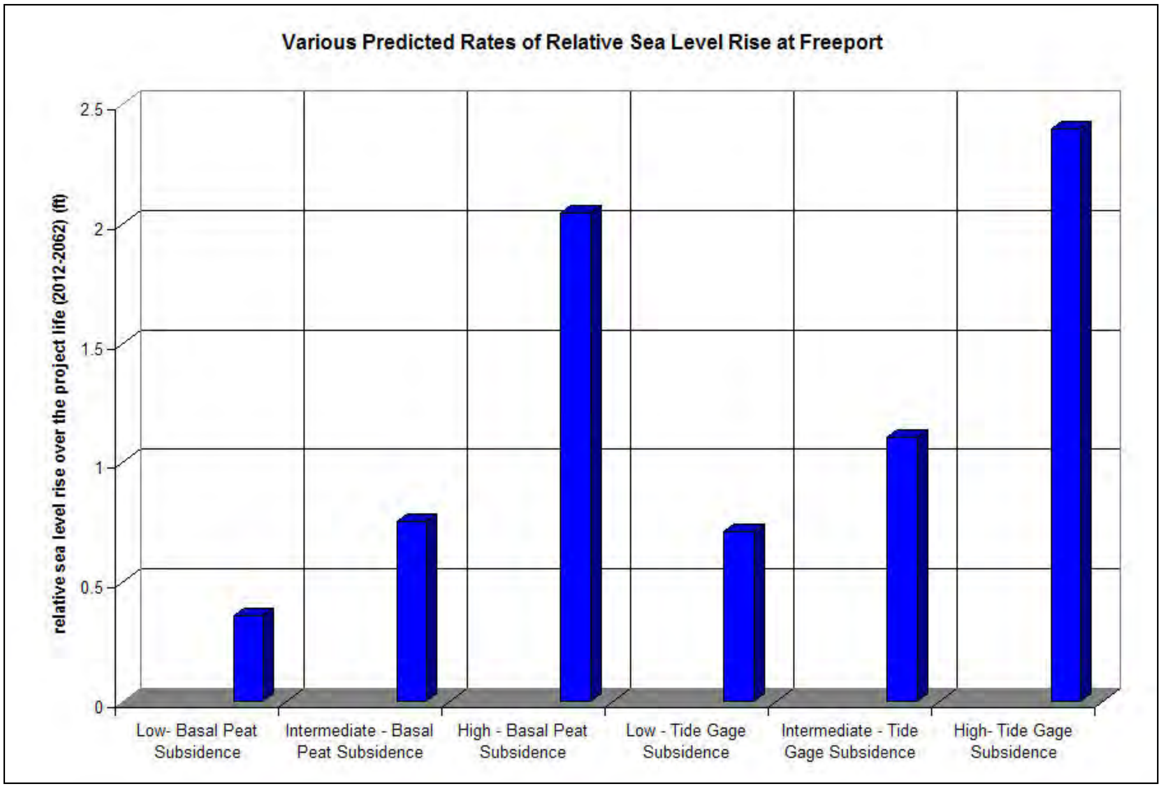

Figure 1: Various Predicted Rates of Relative Sea Level Rise for 2012–2062.

These values are given in Table 2.

Table 2
Estimates of Future Relative Sea Level Rise (2012–2062)

Subsidence Rate	Low (foot [cm*])	Intermediate (foot [cm])	High (foot [cm])
Basal Peat (0.0016 foot/year or 0.5 mm/year)	0.36 (11.0)	0.76 (23.2)	2.04 (62.2)
Tide gage (0.0087 foot/year or 2.65 mm/year)	0.71 (21.6)	1.11 (33.8)	2.40 (73.2)

*cm = centimeters

Project-related RSLR Impacts in the Freeport Harbor

The potential for RSLR impacts in the Freeport Harbor project area include impacts on wetlands and other sensitive low-lying areas due to higher water levels, impacts on vessel traffic due to changes in current velocities in the area, and impacts on surge levels.

Numerical model experiments performed for this project show that the changes from the Base, or existing, conditions to the Locally Preferred Plan (LPP) and National Economic Development Plan (NED) (both also referred to as the Plan conditions) include changes in the velocities in the harbor, the tides in the harbor, and the surge values. The depth-averaged velocities in the harbor show, for both plans, a decrease in peak ebb and flood velocities of from 0.0 to 0.18 foot/second (sec) (5.4 centimeters [cm]/sec), the decrease becoming less as one moves up into the harbor. Tidal differences include advancement of the flood and ebb tides by approximately 30 minutes in this diurnal system and an increase in the mean tide range of about 0.3 percent, or 0.01 foot (0.2 cm). The two plans give tidal results that are essentially identical. The surge values for the plans are about 0.16 foot (5 cm) higher with the plans than without them. These differences in tidal velocities, tidal timing and tide range, and surge are the result of physical changes to the system in the plans. The plan changes are of two types. One change involves an increase in the area of the harbor through the removal of parts of the southwest peninsula separating the harbor from the GIWW; the other change is the deepening and widening of the channels.

Both types of changes tend to increase the coupling of the harbor to the Gulf. The excavation of portions of the southwest peninsula will increase the tidal prism of the harbor by about 0.05 percent. This increased tidal prism results in more water moving into and out of the system during each tidal cycle. Since more water is entering and leaving the system during each tidal cycle, peak velocities are expected to increase as a result. Deepening and widening of the Jetty Channel and the inner basin also result in a stronger coupling between the Gulf and the harbor. This deepening and widening of the harbor results in increases in the volume of the harbor of from 5.8 percent (Plan 5) to 6.4 percent (Plan 4). The increased cross-sectional area for the water to flow into the system will result in decreased peak velocities. Detailed numerical modeling shows that the net effect of these competing processes is to lower the peak velocities, up to 0.18 foot/sec (5.4 cm/sec), in the harbor, as one would expect from the relative size of the effects.

With the projected RSLR, the system is, in effect, deepened from 0.36 foot (11.0 cm) to 2.4 feet (73.2 cm) further, depending on the RSLR and subsidence scenario. This additional “deepening” will result in further, though slight, decreases in peak velocities by further increasing the cross section of the channel.

The increased coupling also affects the tide. The advancement of the timing of the tide means that, with the deeper and wider channel, the tide can move into and out of the harbor more easily, and thus, the timing of the tide will change. Deepening of this type generally also causes an increase in the tide range inside a waterway; the range of the driving Gulf tide is diminished less as it experiences relatively less friction, due to the deeper water, as it travels up into the system. In this case, however, the system in its existing condition is already well coupled to the Gulf, as evidenced by the similarity of the tides in the jetties to those in the harbor. And, given the lack of resonant behavior in the short channel (about 3 miles [5 kilometers] from the jetties to the end of the deepened portion of the channel), only small increases in the tide range, predicted to be about 0.3 percent, or 0.01 foot (0.2 cm) for a mean tide of 1.64 feet (50 cm), can be expected with further deepening and widening. Again, with the projected RSLR for this system, no additional increase in tidal range is expected since the incremental change, due to RSLR, decreases the relative differences between the Base and Plan conditions.

The increased coupling due to the project also affects the surge, increasing the surge levels by about 0.16 foot (5 cm) locally. The percent differences of water level in the system between the with-plan and without-plan cases for RSLR of 0.36 foot (11.0 cm) to 2.4 feet (73.2 cm) will be smaller than without RSLR. The differences in surge height are thus expected to be less as well. Additionally, the effects of increased surge due to the project are local, and, given the general inundation of the greater Freeport area during a significant surge, the additional water elevation due to the project, with or without RSLR, is expected to be small.

Given the above discussion, impacts on wetlands in the Freeport Harbor are thus expected to be negligible for two reasons. First, there are no tidal wetlands in the system to be impacted. Second, changes in tidal range are expected to be small and difficult to measure, being in the millimeter range. Since the Freeport Harbor is a highly developed industrial area with no tidal wetlands, water level changes due to RSLR will have an effect on the harbor similar to that of a deepening. As seen in the modeling and an examination of the tide data, the harbor is already, at current depths and cross sections, closely coupled to the Gulf so that any further increases in depth will result in very small increases in tide range. Thus, RSLR is expected to result in an insignificant difference between the existing channel conditions and the plans.

Impacts on navigation are also expected to be negligible, with currents likely decreasing, with RSLR, even further from the decreases expected with the project. RSLR, being in this case essentially a deepening, means that an even larger effective cross-sectional area will be available for the flooding and ebbing tides, meaning that the peak velocities will decrease further. Hence, RSLR is expected to cause an insignificant difference between the existing channel and the plans.

Finally, impact differences on the surge levels due to the project, with and without RSLR, are expected to be very small and local.

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Appendix M

Field Survey for the Presence of Nesting Colonial Waterbirds

APPENDIX M
FIELD SURVEY FOR THE PRESENCE OF NESTING COLONIAL WATERBIRDS
FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT

A field survey was conducted by Galveston District personnel on June 18, 2010, at the inner portion of the Freeport Harbor Channel Improvement Project area, to assess the potential presence of nesting colonial waterbirds at Rookeries 610-101 and 610-102. U.S. Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department resource agency personnel were not able to participate in the field survey. According to the USFWS Texas Colonial Waterbird Census, these sites have been absent of any nesting activity for at least the last 10 years of surveys. The field survey did not reveal any nesting activity at either of these sites.

Rookery 610-101 is located at Bryan Beach State Park, near the intersection of the Freeport Harbor Channel system and the Gulf Intracoastal Waterway. This site consists of intertidal wetland areas dominated by smooth cordgrass (*Spartina alterniflora*), marsh-hay cordgrass (*Spartina patens*), leafy three-square (*Scirpus robustus*), needlerush (*Juncus roemerianus*), saltgrass (*Distichlis spicata*), bushy sea ox-eye daisy (*Borrichia frutescens*), saltwort (*Batis maritima*), annual glasswort (*Salicornia bigelovii*), perennial glasswort (*Salicornia virginica*), high tide bush (*Iva frutescens*), and gulf cordgrass (*Spartina spartinae*). While clapper rails and great egrets were observed feeding in the area, no nests or nesting birds were found.

Rookery 610-102 is located at Bryan Beach Spoil, which is an inactive upland placement area along the south side of the Freeport Channel system, situated on the southwest portion of the Teppco Peninsula. This site is dominated by black willow (*Salix nigra*), Chinese tallow (*Sapium sebiferum*), Brazilian vervain (*Verbena brasiliensis*), southern dewberry (*Rubus trivialis*), eastern baccharis (*Baccharis halimifolia*), giant ragweed (*Ambrosia trifida*), seaside goldenrod (*Solidago sempervirens*), sunflower (*Helianthus* sp.), johnsongrass (*Sorghum halopense*), and bermudagrass (*Cynodon dactylon*). No birds were observed in the area feeding, and no nests were found.

The field survey confirmed that Rookeries 610-101 and 610-102 are presently inactive, based on the absence of nests and nesting birds. Therefore, dredging activities at present would not affect these rookeries.

Appendix N

Greenhouse Gas Emissions and Climate Change

Document No. 110063
Job No. 441901

Greenhouse Gas Emissions and Climate Change for the Proposed Freeport Harbor Channel Improvement Project Brazoria County, Texas

Prepared for:

U.S. Army Corps of Engineers
Galveston District
P.O. Box 1229
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Prepared by:

PBS&J
6504 Bridge Point Parkway
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Austin, Texas 78730

April 2011

Contents

Tables

1.0 INTRODUCTION

This section describes the Greenhouse Gas Emissions and their related impacts on climate change for the Freeport Harbor Channel Improvement Project (FHCIP) Alternatives. Air emissions from the Project will result from the operation of dredges, tugboats, and land-side construction equipment powered by internal combustion engines that produce exhaust emissions. Emissions from this equipment will result in an increase in Greenhouse Gas (GHG) emissions that could contribute to global climate change. To date, specific thresholds to evaluate adverse impacts pertaining to GHG emissions have not been established by local decision-making agencies, the State, or the Federal government. The Council on Environmental Quality (CEQ) has published "Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions," February 10, 2010. The Draft Guidance suggests that the impacts of projects directly emitting GHGs in excess of 25,000 metric tons or more of carbon dioxide (CO_2)-equivalent (CO_2e) GHG emissions on an annual basis be considered in a qualitative and quantitative manner. However, the guidance stresses that, given the nature of GHGs and their persistence in the atmosphere, climate change impacts should be considered on a cumulative level. For consistency, this section presents a project-level analysis of GHG emissions.

1.1 QUANTIFICATION OF GHG EMISSIONS

An inventory of GHGs was prepared for project-related activities for both the National Economic Development (NED) and Locally Preferred Plan (LPP) alternatives based on the schedule and other assumptions as developed for each alternative. 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, NED Alternative Emissions Summary, and Appendix B, LPP Alternative Emissions Summary, of this document.

GHG emissions were estimated for emissions of CO_2, methane (CH_4), and nitrous oxides (N_2O), which are GHGs that may result from the combustion of fuel. The emission sources for each project alternative will consist of marine and land-based mobile sources that will be utilized as scheduled for the duration of the project. It is assumed that the marine emission sources will include two types of dredges, hydraulic and hopper, as well as support equipment such as tugboats, survey boats, and trawlers. The land-based emission sources will include both off-road equipment 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.

1.1.1 Methods Used for Estimation of Air Contaminant Emissions

GHG emissions were estimated for each piece of equipment. The emissions were then categorized and totaled and broken out on an annual basis for each year for which dredging is projected to occur.

The basis for emissions included the following:

- Preliminary project description and other information, as provided for each alternative.

- Emissions from marine vessels in support of the dredging activities were estimated for the project duration. 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 x 0.746 kilowatt per Engine Horsepower x Engine Load Factor x Emission Factor (grams per horsepower-hour) ÷ 453.59 grams per pounds ÷ 2,000 pounds per ton

  Load factors and emission factors for the different marine equipment were determined based on the U.S. Environmental Protection Agency (EPA) report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data," February 2000 and information from the "California Climate Action Registry, General Reporting Protocol," January 2009. Emission amounts (tons per year) for each of the pollutants were then calculated based on the following formula:

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

  Emissions of CO_2, CH_4, and N_2O were converted to metric tons, assuming 1 ton is equal to 0.907 metric ton:

  Emission Amount (metric tons/year) = Emission Amount (tons/year) x 0.0907 metric ton per ton

- The EPA, NONROAD emission factor model, was used to predict CO_2 emissions resulting from land-side, off-road construction equipment used for construction and placement in upland PAs with inputs for assumed equipment usage developed for this alternative. 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.

- Mobile on-road emissions associated with employee vehicles were emission factors estimated from data provided in Climate Action Registry (California Climate Action Registry, 2009).

1.1.2 Dredging Activities

Air emissions directly related with the dredging equipment including 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.

For the NED Alternative, it was assumed that the FHCIP would include the use of the dredge equipment as follows:

- Hopper Dredge – A hopper dredge would be used to dredge 17,957,000 cubic yards (CY) of material for placement at Ocean Dredged Material Disposal Sites (ODMDSs).

- Cutterhead – A 30-inch hydraulic cutterhead would be used for pumping and onshore placement of 5,211,000 CY of material into new upland placement areas (PAs).

For the LPP Alternative, it was assumed that the widening and deepening project would include the use of the dredge equipment as follows.

- Hopper Dredge – A hopper dredge would be used to dredge 12,733,000 CY of material for placement at ODMDSs.

- Cutterhead – A 24-inch hydraulic cutterhead would be used for pumping and onshore placement of 4,619,000 CY of material into new upland PAs.

When not dredging, air contaminant emissions were also estimated from dredging vessels when sailing as oceangoing vessels, e.g., during periods of mobilization to the dredging site or during transport and placement of the dredged material.

1.1.3 Land-side Dredged Material Placement – Nonroad Equipment

It is anticipated that land-side dredged material placement activities would occur primarily only in support of the mechanical dredging activities and would include working and compacting of the dredged material onshore within a localized area of placement using nonroad construction equipment.

1.1.4 On-Road Mobile – Employee Commuter Vehicles

Mobile source emissions associated with the project construction would be generated from employee commuter vehicles to and from the work-site. 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 EPA's mobile-source emissions model, MOBILE6.2, based on vehicle information and other input options specific to Brazoria County as previously provided by the Texas Commission on Environmental Quality's (TCEQ) Air Quality Planning and Implementation Division.

1.1.5 SUMMARY OF GHG EMISSIONS

The estimated annual GHG emissions as CO_2e for the NED Plan Alternative are summarized in Table 1 for each year of the anticipated construction activities.

TABLE 1
NED PLAN ALTERNATIVE – SUMMARY OF GHG EMISSIONS
(metric tons per year as CO_2e)

Activity	2011	2012	2013	2014	2015	2016
Dredging Activities	6,175	51,832	57,073	48,099	33,716	18,504
Land-side Dredged Material Placement	0	698	9	865	731	122
Employee Commuter Vehicles	58	1,252	931	1,248	663	244
Totals	6,233	53,782	58,013	50,212	35,111	18,870

The estimated annual GHG emissions for the LPP Plan Alternative are summarized in Table 2 for each year of the anticipated construction activities.

TABLE 2
LPP ALTERNATIVE – SUMMARY OF GHG EMISSIONS
(metric tons per year as CO_2e)

Activity	2011	2012	2013	2014	2015
Dredging Activities	5,833	45,694	52,306	43,051	13,355
Land-side Dredged Material Placement	0	2,008	2,677	1,421	7
Employee Commuter Vehicles	41	2,104	906	1,081	0
Totals	5,875	49,805	55,890	45,554	13,362

Based on the emissions summary shown in Table 1 and Table 2, total CO_2e would be less for the LPP versus the NED alternative.

2.0 MITIGATION

Measures that may be used to reduce GHG emissions from the proposed action would consider the equipment used for the project over the expected life of the project and the feasibility and practicality of such measures. Alternatives considered for their ability to reduce or mitigate GHG emissions are those that may provide for enhanced energy efficiency, lower GHG-emitting technology, and renewable energy, as appropriate for the dredging and construction equipment to be used.

2.1 DREDGING MITIGATION OPTIONS

- Design of the dredging operation and schedule so as to reduce overall fuel use
- Repowering/refitting with cleaner diesel engines
- Selection of newer dredges with more-efficient engines, if possible.

2.2 LAND-SIDE CONSTRUCTION MITIGATION OPTIONS

- Use of Biodiesel Fuel - Biodiesel can be used directly in the unmodified diesel engines of some construction equipment, trucks, and other heavy vehicles; resultant emissions are considerably cleaner than conventional diesel and it is a greenhouse-neutral fuel. Biodiesel would provide a 7 percent reduction in CO_2 emissions compared to diesel fuel.
- Conversion to compressed natural gas (CNG) or liquid propane gas (LPG) – CNG would provide a 40 percent reduction in CO_2 emissions compared to gasoline, and LPG would provide about a 34 percent reduction.
- Repowering / refitting with cleaner diesel engines
- Selection of newer dredges with more-efficient engines, if possible.

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3.0 GHG EMISSIONS CONTRIBUTION TO CLIMATE CHANGE

As shown above, the proposed project would increase GHG emissions with the LPP Alternative producing less total CO_2e than the NED alternative. However, it would be unlikely that GHGs emitted under the NED or LED alternatives would cause an individually discernible impact on global climate change. GHG emissions accumulate in the atmosphere because of their relatively long lifespan. Consequently, their impact on climate change is independent of the point of emission. Because GHGs accumulate in the atmosphere and affect climate change on a global scale, it is not reasonable to predict the impact on climate change based on a project-level evaluation; this analysis is more reasonably done on a regional or global scale.

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4.0 REFERENCES:

California Climate Action Registry. 2009. "California Climate Action Registry, General Reporting Protocol," January 2009.

Council on Environmental Quality. 2010. "Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions," February 10, 2010.

Environmental Protection Agency (EPA). 2000. "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data," EPA 420-R-00-002, February 2000.

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———. 2006. "Approval and Promulgation of Air Quality Implementation Plans; Texas; Revisions to the Ozone Attainment Plan for the Houston/Galveston/Brazoria Nonattainment Area," September 6, 2006. Federal Register, Volume 71, No. 172, Page 52670.

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Appendix A

NED Alternative Emissions Summary

APPENDIX A

List of Tables
Freeport Harbor Channel Improvement Project
NED Alternative

Table A-1. Annual Project Emissions Summary
Freeport Harbor Channel Improvement Project
NED Alternative

	(tons per year)			(metric tons per year)			Total CO_2e (metric tons per year)
Year 2011	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	6,730	1	0	6,105	1	0	6,175
Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0
Employee Vehicles	62.965	0.005	0.003	57.121	0.004	0.002	58
Subtotal	**6,793**	**1**	**0**	**6,162**	**1**	**0**	**6,233**
Year 2012	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	56,492	7	2	51,249	6	1	51,832
Construction Equipment	762.64	0.06	0.02	691.85	0.05	0.02	698
Employee Vehicles	1,359.81	0.10	0.06	1,233.60	0.09	0.05	1,252
Subtotal	**58,614**	**7**	**2**	**53,174**	**7**	**2**	**53,782**
Year 2013	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	62,205	8	2	56,432	7	2	57,073
Construction Equipment	0.06	0.07	0.03	0.05	0.07	0.02	9
Employee Vehicles	1,011.31	0.07	0.04	917.45	0.07	0.04	931
Subtotal	**63,217**	**8**	**2**	**57,349**	**7**	**2**	**58,013**
Year 2014	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	52,425	7	1	47,559	6	1	48,099
Construction Equipment	944.10	0.07	0.02	856.47	0.06	0.02	865
Employee Vehicles	1,356.03	0.10	0.06	1,230.17	0.09	0.05	1,248
Subtotal	**54,725**	**7**	**2**	**49,645**	**6**	**1**	**50,212**
Year 2015	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	36,748	5	1	33,338	4	1	33,716
Construction Equipment	798.60	0.06	0.02	724.48	0.05	0.02	731
Employee Vehicles	720.57	0.05	0.03	653.69	0.05	0.03	663
Subtotal	**38,268**	**5**	**1**	**34,716**	**4**	**1**	**35,111**
Year 2016	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	20,168	3	1	18,296	2	1	18,504
Construction Equipment	133.10	0.01	0.00	120.75	0.01	0.00	122
Employee Vehicles	264.78	0.02	0.01	240.20	0.02	0.01	244
Subtotal	**20,566**	**3**	**1**	**18,657**	**2**	**1**	**18,870**
TOTAL (ALL YEARS)	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	234,768	30	7	212,978	27	6	215,399
Construction Equipment	2,638.50	0.27	0.09	2,393.61	0.24	0.08	2,425
Employee Vehicles	4,775.47	0.35	0.21	4,332.23	0.31	0.19	4,397
	242,182	**30**	**7**	**219,704**	**27**	**6**	**222,221**

Table B-1. Dredging Contract Schedule - Days per Year
Freeport Harbor Channel Improvement Project
NED

Contract No.	Reach	Dredging Duration Months	Dredging Duration Days	Contract Start	Contract Finish	Year 1 2011 days	Year 2 2012 days	Year 3 2013 days	Year 4 2014 days	Year 5 2015 days	Year 6 2016 days
1	New Extention and Part of Outer Bar	35.3	1,059	10/1/2011	9/30/2014	65	261	261	195		
2	Outer Bar and Jetty Channel	41.4	1,242	6/1/2012	11/30/2016		152	261	261	261	239
3	Lower TB, PA1, & Seaway Removel	2	60	4/1/2012	6/1/2012		45				
4	Real Estate	6	180	10/1/2011	3/31/2012	65	65				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	14.5	435	4/1/2012	8/31/2014		196	261	173		
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	3.4	102	9/1/2014	2/28/2016				88	261	41
7	Stauffer Channel	4.4	132	3/1/2016	7/30/2016					109	
8	Mitigation	6	180	4/1/2015	9/30/2015					131	
					TOTAL	130	719	783	717	762	280

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
NED Alternative

Type	Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 1: New Extension & Part of Entrance				
DredgingNew Extent (Duration =	**12.3**	**Quantity =**	**2,670,000**	**CY**
Generic Large Hopper	Dredging	6150	14000	
	Idle	2116		
Survey Boat	Dredging	1230	2000	
	Idle	423		
Trawlers - 2	Dredging	8610	1200	
	Idle	2962		
Dredging Part of Outer Bar (Duration =	**23**	**Quantity =**	**5,550,000**	**CY**
Generic Large Hopper	Dredging	11500	14000	
	Idle	3956		
Survey Boat	Dredging	2300	2000	
	Idle	791		
Trawlers - 2	Dredging	16100	1200	
	Idle	5538		
Total	**35.3**	**61,676**		
CONTRACT 2: Outer Bar and Jetty Ch				
Dredging Outer Bar (Duration =	**23**	**Quantity =**	**5,550,000**	**CY**
Generic Large Hopper	Dredging	11500	14000	
	Idle	3956		
Survey Boat	Dredging	2300	2000	
	Idle	791		
Trawlers - 2	Dredging	16100	1200	
	Idle	5538		
Dredging Jetty Ch (Duration =	**18.4**	**Quantity =**	**4,187,000**	**CY**
Generic Large Hopper	Dredging	9200	14000	
	Idle	3165		
Survey Boat	Dredging	1840	2000	
	Idle	633		
Trawlers - 2	Dredging	12880	1200	
	Idle	4432		
Total	**41.4**	**72,335**		

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
NED Alternative

Type	Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 3: Lower TB, PA 1 Work & Seaway Removal				
Dredging Lower TB (Duration =	**2**	**Quantity =**	**318,000**	**CY**
30" Dredge	Dredging	1000	9000	
	Idle	450	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	2400	1500	
Spill Barge	Dredging	200	165	
Crewboat	Construction	200	400	
Total	**2**	**4,250**		
CONTRACT 5: Ch to Brz thr Brzpt TB & PA 8				
Dredging Cycle (Duration =	**14.5**	**Quantity =**	**2,316,000**	**CY**
30" Dredge	Dredging	7250	9000	
	Idle	3262.5	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	17400	1500	
Spill Barge	Dredging	1450	165	
Crewboat	Construction	1450	400	
Total	**14.5**	**30,813**		
CONTRACT 6: Ch to UTB thr UTB & PA 9				
Dredging Cycle (Duration =	3.4	**Quantity =**	**1,037,000**	**CY**
30" Dredge	Dredging	1700	9000	
	Idle	765	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	4080	1500	
Spill Barge	Dredging	340	165	
Crewboat	Construction	340	400	
Total	3.4	**7,225**		
CONTRACT 7: Stauffer Ch				
Dredging Cycle (Duration =	**4.4**	**Quantity =**	**1,540,000**	**CY**
30" Dredge	Dredging	2200	9000	
	Idle	990	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	5280	1500	
Spill Barge	Dredging	440	165	
Crewboat	Construction	440	400	
Total	**4.4**	**9,350**		

Table B-3. Dredging Contract Allocation by Year
Freeport Harbor Channel Improvement Project
NED Alternative

Contract No.	Reach	Dredging Duration Days	Year 1 **2011** percent	Year 2 **2012** percent	Year 3 **2013** percent	Year 4 **2014** percent	Year 5 **2015** percent
1	New Extention and Part of Outer Bar	1,059	8%	33%	33%	25%	
2	Outer Bar and Jetty Channel	1,242		13%	22%	22%	22%
3	Lower TB, PA1, & Seaway Removel	60		100%			
4	Real Estate	180	50%	50%			
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	435		31%	41%	27%	
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	102				23%	67%
7	Stauffer Channel	132					100%
8	Mitigation	180					100%

Table B-4. Dredge Equipment Operating Hours
Freeport Harbor Channel Improvement Project
NED Alternative

Contract No.	Reach	Dredge: Dredge Type	Dredge: Total Dredging	Dredge: Propelling	Dredge: Pumping	Dredge: Power Generating	Dredge: Idling	Survey Boat: Propelling	Survey Boat: Idling	Trawler: Propelling	Trawler: Idling	Floating Booster: Pumping	Tug: Propelling	Spill Barge: Main Engine	Crew Boat: Propelling
1	New Extension	Generic Large Hopper	6,150	3,998	2,153	6,150	2,116	1,230	423	8,610	2,962				
	Part of Outer Bar	Generic Large Hopper	11,500	7,475	4,025	11,500	3,956	2,300	791	16,100	5,538				
2	Outer Bar	Generic Large Hopper	11,500	7,475	4,025	11,500	3,956	2,300	791	16,100	5,538				
	Jetty Channel	Generic Large Hopper	9,200	5,980	3,220	9,200	3,165	1,840	633	12,880	4,432				
3	Lower TB	30" Dredge	1,000				450						2,400	200	200
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	7,250				3,263						17,400	1,450	1,450
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,700				765						4,080	340	340
7	Stauffer Channel	30" Dredge	2,200				990						5,280	440	440
8	Mitigation														

Table B-5. Typical Hopper Dredging Cycle
Freeport Harbor Channel Improvement Project
NEDAlternative

Contract No.	Reach	Dredging Cycle				
		Dredge Type	Total Dredging Hours	Propelling	Pumping	Power Generating
1	New Extension	Generic Large Hopper	6,150	65%	35%	100%
	Part of Outer Bar	Generic Large Hopper	11,500	65%	35%	100%
2	Outer Bar	Generic Large Hopper	11,500	65%	35%	100%
	Jetty Channel	Generic Large Hopper	9,200	65%	35%	100%

Table B-6. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
NED Alternative

Contract No.	Location/Disposal Site	Horsepower (hp)														
		Dredge Type	Engine Type					Survey Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
			Total	Propulsion	Pump	Generator	Generator at Idling	Main Engine	Idling	Main Engine	Idling	Pumping	Propulsion	Main Engine	Propulsion
1	New Extension	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Part of Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
2	Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Jetty Channel	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
3	Lower TB	30" Dredge	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
4	Real Estate						3,000						500	165	400
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9,000				3,000						500	165	400
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	9,000				3,000						500	165	400
7	Stauffer Channel	30" Dredge	9,000				3,000						500	165	400
8	Mitigation						3,000						500	165	400

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
NED Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	511.19	332.27	178.92	511.19	175.88	102.24	35.16	715.66	246.20				
	Part of Outer Bar	Generic Large Hopper	955.88	621.32	334.56	955.88	328.82	191.18	65.75	1,338.24	460.32				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL		1,467.07	953.60	513.48	1,467.07	504.71	293.41	100.91	2,053.90	706.52				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	2,052.62	1,334.20	718.42	2,052.62	706.24	410.52	141.18	2,873.67	988.60				
	Part of Outer Bar	Generic Large Hopper	3,838.24	2,494.85	1,343.38	3,838.24	1,320.35	767.65	264.00	5,373.53	1,848.36				
2	Outer Bar	Generic Large Hopper	1,488.93	967.80	521.12	1,488.93	512.19	297.79	102.41	2,084.50	717.02				
	Jetty Channel	Generic Large Hopper	1,191.14	774.24	416.90	1,191.14	409.78	238.23	81.96	1,667.60	573.82				
3	Lower TB	30" Dredge	1,000.00				450.00						2,400.00	200.00	200.00
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2,255.56				1,015.00						5,413.33	451.11	451.11
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		11,826.48	5,571.10	2,899.82	8,570.92	4,413.56	1,714.18	589.55	11,999.29	4,127.79		7,813.33	651.11	651.11
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	2,052.62	1,334.20	718.42	2,052.62	706.24	410.52	141.18	2,873.67	988.60				
	Part of Outer Bar	Generic Large Hopper	3,838.24	2,494.85	1,343.38	3,838.24	1,320.35	767.65	264.00	5,373.53	1,848.36				
2	Outer Bar	Generic Large Hopper	2,556.64	1,661.82	894.83	2,556.64	879.49	511.33	175.85	3,579.30	1,231.19				
	Jetty Channel	Generic Large Hopper	2,045.32	1,329.45	715.86	2,045.32	703.63	409.06	140.73	2,863.44	985.31				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	3,003.57				1,351.61						7,208.57	600.71	600.71
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		13,496.39	6,820.33	3,672.49	10,492.82	4,951.31	2,098.66	721.76	14,689.94	5,053.46		7,208.57	600.71	600.71

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
NED Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper	1,533.57	996.82	536.75	1,533.57	527.65	306.71	105.48	2,146.99	738.61				
	Part of Outer Bar	Generic Large Hopper	2,867.65	1,863.97	1,003.68	2,867.65	986.47	573.53	197.24	4,014.71	1,380.96				
2	Outer Bar	Generic Large Hopper	2,556.64	1,661.82	894.83	2,556.64	879.49	511.33	175.85	3,579.30	1,231.19				
	Jetty Channel	Generic Large Hopper	2,045.32	1,329.45	715.86	2,045.32	703.63	409.06	140.73	2,863.44	985.31				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,990.87				695.89						4,778.10	398.17	398.17
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	383.59				172.62						920.62	76.72	76.72
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		11,377.64	5,852.06	3,151.11	9,003.17	4,165.74	1,800.63	619.30	12,604.44	4,336.06		5,698.71	474.89	474.89
YEAR 2015															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	2,556.64	1,661.82	894.83	2,556.64	879.49	511.33	175.85	3,579.30	1,231.19				
	Jetty Channel	Generic Large Hopper	2,045.32	1,329.45	715.86	2,045.32	703.63	409.06	140.73	2,863.44	985.31				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,137.69				511.96						2,730.46	227.54	227.54
7	Stauffer Channel	30" Dredge	2,200.00				990.00						5,280.00	440.00	440.00
8	Mitigation														
	YEAR 2015 TOTAL		7,939.65	2,991.27	1,610.69	4,601.96	3,085.08	920.39	316.58	6,442.74	2,216.50		8,010.46	667.54	667.54
YEAR 2016															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	2,341.14	1,521.74	819.40	2,341.14	805.35	468.23	161.03	3,277.60	1,127.41				
	Jetty Channel	Generic Large Hopper	1,872.91	1,217.39	655.52	1,872.91	644.32	374.58	128.86	2,522.08	902.26				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	178.72				80.42						428.92	35.74	35.74
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2016 TOTAL		4,392.77	2,739.14	1,474.92	4,214.05	1,530.10	842.81	289.89	5,899.68	2,029.67		428.92	35.74	35.74

Table C-2. Marine Engine Emission Factors and Fuel Consumption Algorithms

(in g/kW-hr, for all marine engines)

Freeport Harbor Channel Improvement Project

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
CO2	1	648.6	44.1

Notes:

1.) All regressions but SO_2 are in the form of:

Emissions Rate (g/hp-hr) = $(a*(\text{Fractional Load})^{-x} + b) * 0.7457$

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 C-3. Marine Equipment Load Factors and Emission Factors
Freeport Harbor Channel Improvement Project

	Dredge					Crew Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
Operating Mode	Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
Load Factor	0.8	0.8	0.8	0.8	0.2	0.4	0.2	0.4	0.2	0.8	0.4	0.4	0.4
EF (Gram/hp-hr)													
CO_2	525	525	525	525	648	566	648	566	648	525	566	566	566
CH_4	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
N_2O	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015

<u>Notes:</u>

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:

- A.) The main engines on the dredges were assumed to operate at full power (e.g. 0.8 "cruise" load factor from Table 5-2 of EPA report) for all hours of operation.
- B.) The generators on the dredges were assumed to operate at 0.2 load factor during idling.
- C.) The main engines or propulsion engines on the support equipment 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.
- D.) The auxiliary engines, if any, on the support equipment were assumed to operate sparingly during idling 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 Data", February 2000.

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).

5.) CH_4 and N_2O emission factors were obtained from "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (ICF International 2009).

Table C-4. Marine Equipment CO2 Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

CO_2 (tpy)

YEAR 2011

Contract No.	Location/Disposal Site	Dredge	Dredge Dredging	Dredge Propelling	Dredge Pumping	Dredge Generating	Dredge Idling	Survey Boat Propelling	Survey Boat Idling	Trawler Propelling	Trawler Idling	Floating Pumping	Tug Propelling	Spill Barge Main Engine	Crew Boat Propelling
1	New Extension	Generic Large Hopper		1,383.87	248.39	473.12	50.26	51.02	10.05	107.14	21.11				
	Part of Outer Bar	Generic Large Hopper		2,587.72	464.46	884.69	93.96	95.40	18.79	200.34	39.46				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			3,971.59	712.85	1,357.81	144.22	146.42	28.83	307.48	60.57				

YEAR 2012

Contract No.	Location/Disposal Site	Dredge	Dredge Dredging	Dredge Propelling	Dredge Pumping	Dredge Generating	Dredge Idling	Survey Boat Propelling	Survey Boat Idling	Trawler Propelling	Trawler Idling	Floating Pumping	Tug Propelling	Spill Barge Main Engine	Crew Boat Propelling
1	New Extension	Generic Large Hopper		5,555.78	997.37	1,899.75	201.81	204.88	40.34	430.20	84.75				
	Part of Outer Bar	Generic Large Hopper		10,390.69	1,865.00	3,552.37	377.30	383.06	75.44	804.43	158.45				
2	Outer Bar	Generic Large Hopper		4,030.75	723.47	1,378.03	146.36	148.60	29.26	312.06	61.47				
	Jetty Channel	Generic Large Hopper		3,224.60	578.77	1,102.43	117.10	118.88	23.42	249.64	49.19				
3	Lower TB	30" Dredge	6,478.66				128.59								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9,394.05				435.06						675.33	18.57	45.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		15,872.71	23,202.80	4,164.61	7,932.58	1,406.22	855.40	168.47	1,796.33	353.86		675.33	18.57	45.02

YEAR 2013

Contract No.	Location/Disposal Site	Dredge	Dredge Dredging	Dredge Propelling	Dredge Pumping	Dredge Generating	Dredge Idling	Survey Boat Propelling	Survey Boat Idling	Trawler Propelling	Trawler Idling	Floating Pumping	Tug Propelling	Spill Barge Main Engine	Crew Boat Propelling
1	New Extension	Generic Large Hopper		5,556.76	997.37	1,899.75	201.81	204.86	40.34	430.20	84.75				
	Part of Outer Bar	Generic Large Hopper		10,390.69	1,865.00	3,552.37	377.30	383.06	75.44	804.43	158.45				
2	Outer Bar	Generic Large Hopper		6,921.23	1,242.27	2,366.23	251.32	255.16	50.25	535.83	105.55				
	Jetty Channel	Generic Large Hopper		5,536.98	993.82	1,892.98	201.07	204.13	40.21	428.67	84.47				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	12,509.43				579.34						899.29	24.73	59.95
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		12,509.43	28,405.66	5,098.45	9,711.34	1,610.83	1,047.21	206.25	2,199.13	433.21		899.29	24.73	59.95

Table C-4. Marine Equipment CO2 Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

CO_2 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		4,151.60	745.16	1,419.35	150.78	153.05	30.14	321.41	63.32				
	Part of Outer Bar	Generic Large Hopper		7,763.16	1,393.39	2,654.07	281.89	286.20	56.36	601.01	118.38				
2	Outer Bar	Generic Large Hopper		6,921.23	1,242.27	2,366.23	251.32	255.16	50.25	535.83	105.55				
	Jetty Channel	Generic Large Hopper		5,536.98	993.82	1,892.98	201.07	204.13	40.21	428.67	84.47				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	8,291.69				384.01						596.08	16.39	39.74
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,597.59				73.99						114.85	3.16	7.66
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		9,889.28	24,372.97	4,374.64	8,332.64	1,343.05	898.54	176.97	1,886.93	371.72		710.93	19.55	47.40
YEAR 2015															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		6,921.23	1,242.27	2,366.23	251.32	255.16	50.25	535.83	105.55				
	Jetty Channel	Generic Large Hopper		5,536.98	993.82	1,892.98	201.07	204.13	40.21	428.67	84.47				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	4,738.32				219.44						340.63	9.37	22.71
7	Stauffer Channel	30" Dredge	9,162.67				424.35						658.69	18.11	43.91
8	Mitigation														
	YEAR 2015 TOTAL		13,900.99	12,458.21	2,236.09	4,259.22	1,096.17	459.29	90.46	964.50	190.01		999.33	27.48	66.62

Table C-5. Marine Equipment CH_4 Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

CH_4 (tpy)

YEAR 2011

Contract No.	Location/Disposal Site	Dredge	Dredge Dredging	Dredge Propelling	Dredge Pumping	Dredge Generating	Dredge Idling	Survey Boat Propelling	Survey Boat Idling	Trawler Propelling	Trawler Idling	Floating Pumping	Tug Propelling	Spill Barge Main Engine	Crew Boat Propelling
1	New Extension	Generic Large Hopper		0.1771	0.0318	0.0605	0.0052	0.0061	0.0010	0.0127	0.0022				
	Part of Outer Bar	Generic Large Hopper		0.3311	0.0594	0.1132	0.0097	0.0113	0.0019	0.0238	0.0041				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			0.5081	0.0912	0.1737	0.0149	0.0174	0.0030	0.0365	0.0063				

YEAR 2012

Contract No.	Location/Disposal Site	Dredge	Dredge Dredging	Dredge Propelling	Dredge Pumping	Dredge Generating	Dredge Idling	Survey Boat Propelling	Survey Boat Idling	Trawler Propelling	Trawler Idling	Floating Pumping	Tug Propelling	Spill Barge Main Engine	Crew Boat Propelling
1	New Extension	Generic Large Hopper		0.7109	0.1276	0.2431	0.0209	0.0243	0.0042	0.0510	0.0088				
	Part of Outer Bar	Generic Large Hopper		1.3294	0.2386	0.4545	0.0391	0.0454	0.0078	0.0954	0.0164				
2	Outer Bar	Generic Large Hopper		0.5157	0.0926	0.1763	0.0152	0.0176	0.0030	0.0370	0.0064				
	Jetty Channel	Generic Large Hopper		0.4126	0.0740	0.1410	0.0121	0.0141	0.0024	0.0296	0.0051				
3	Lower TB	30" Dredge	0.8289				0.0133								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.2019				0.0451						0.0801	0.0022	0.0053
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		2.0308	2.9686	0.5328	1.0149	0.1457	0.1015	0.0175	0.2131	0.0367		0.0801	0.0022	0.0053

YEAR 2013

Contract No.	Location/Disposal Site	Dredge	Dredge Dredging	Dredge Propelling	Dredge Pumping	Dredge Generating	Dredge Idling	Survey Boat Propelling	Survey Boat Idling	Trawler Propelling	Trawler Idling	Floating Pumping	Tug Propelling	Spill Barge Main Engine	Crew Boat Propelling
1	New Extension	Generic Large Hopper		0.7109	0.1276	0.2431	0.0209	0.0243	0.0042	0.0510	0.0088				
	Part of Outer Bar	Generic Large Hopper		1.3294	0.2386	0.4545	0.0391	0.0454	0.0078	0.0954	0.0164				
2	Outer Bar	Generic Large Hopper		0.8855	0.1589	0.3027	0.0260	0.0303	0.0052	0.0636	0.0109				
	Jetty Channel	Generic Large Hopper		0.7084	0.1272	0.2422	0.0208	0.0242	0.0042	0.0509	0.0088				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.6005				0.0600						0.1067	0.0029	0.0071
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		1.6005	3.6343	0.6523	1.2425	0.1669	0.1242	0.0214	0.2609	0.0449		0.1067	0.0029	0.0071

Table C-5. Marine Equipment CH_4 Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

CH_4 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.5312	0.0953	0.1816	0.0156	0.0182	0.0031	0.0381	0.0066				
	Part of Outer Bar	Generic Large Hopper		0.9932	0.1783	0.3396	0.0292	0.0340	0.0058	0.0713	0.0123				
2	Outer Bar	Generic Large Hopper		0.8855	0.1589	0.3027	0.0260	0.0303	0.0052	0.0636	0.0109				
	Jetty Channel	Generic Large Hopper		0.7084	0.1272	0.2422	0.0208	0.0242	0.0042	0.0509	0.0088				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.0609				0.0398						0.0707	0.0019	0.0047
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.2044				0.0077						0.0136	0.0004	0.0009
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		1.2653	3.1183	0.5597	1.0661	0.1391	0.1066	0.0183	0.2239	0.0385		0.0844	0.0023	0.0056
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.8855	0.1589	0.3027	0.0260	0.0303	0.0052	0.0636	0.0109				
	Jetty Channel	Generic Large Hopper		0.7084	0.1272	0.2422	0.0208	0.0242	0.0042	0.0509	0.0088				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.6062				0.0227						0.0404	0.0011	0.0027
7	Stauffer Channel	30" Dredge	1.1723				0.0440						0.0782	0.0021	0.0052
8	Mitigation														
	YEAR 2015 TOTAL		1.7785	1.5939	0.2861	0.5449	0.1136	0.0545	0.0094	0.1144	0.0197		0.1186	0.0033	0.0079

Table C-6. Marine Equipment N_2O Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

N_2O (tpy)

YEAR 2011

Contract No.	Location/Disposal Site	Dredge	Dredge: Dredging	Dredge: Propelling	Dredge: Pumping	Dredge: Generating	Dredge: Idling	Survey Boat: Propelling	Survey Boat: Idling	Trawler: Propelling	Trawler: Idling	Floating: Pumping	Tug: Propelling	Split Barge: Main Engine	Crew Boat: Propelling
1	New Extension	Generic Large Hopper		0.0393	0.0071	0.0135	0.0012	0.0013	0.0002	0.0028	0.0005				
	Part of Outer Bar	Generic Large Hopper		0.0736	0.0132	0.0252	0.0022	0.0025	0.0004	0.0053	0.0009				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			0.1129	0.0203	0.0386	0.0033	0.0039	0.0007	0.0081	0.0014				

YEAR 2012

Contract No.	Location/Disposal Site	Dredge	Dredge: Dredging	Dredge: Propelling	Dredge: Pumping	Dredge: Generating	Dredge: Idling	Survey Boat: Propelling	Survey Boat: Idling	Trawler: Propelling	Trawler: Idling	Floating: Pumping	Tug: Propelling	Split Barge: Main Engine	Crew Boat: Propelling
1	New Extension	Generic Large Hopper		0.1580	0.0284	0.0540	0.0046	0.0054	0.0009	0.0113	0.0020				
	Part of Outer Bar	Generic Large Hopper		0.2954	0.0530	0.1010	0.0087	0.0101	0.0017	0.0212	0.0036				
2	Outer Bar	Generic Large Hopper		0.1146	0.0206	0.0392	0.0034	0.0039	0.0007	0.0082	0.0014				
	Jetty Channel	Generic Large Hopper		0.0917	0.0165	0.0313	0.0027	0.0031	0.0005	0.0066	0.0011				
3	Lower TB	30" Dredge	0.1842				0.0030								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.2671				0.0100						0.0178	0.0005	0.0012
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		0.4513	0.6597	0.1184	0.2255	0.0324	0.0226	0.0039	0.0474	0.0081		0.0178	0.0005	0.0012

YEAR 2013

Contract No.	Location/Disposal Site	Dredge	Dredge: Dredging	Dredge: Propelling	Dredge: Pumping	Dredge: Generating	Dredge: Idling	Survey Boat: Propelling	Survey Boat: Idling	Trawler: Propelling	Trawler: Idling	Floating: Pumping	Tug: Propelling	Split Barge: Main Engine	Crew Boat: Propelling
1	New Extension	Generic Large Hopper		0.1580	0.0284	0.0540	0.0046	0.0054	0.0009	0.0113	0.0020				
	Part of Outer Bar	Generic Large Hopper		0.2954	0.0530	0.1010	0.0087	0.0101	0.0017	0.0212	0.0036				
2	Outer Bar	Generic Large Hopper		0.1958	0.0353	0.0673	0.0058	0.0067	0.0012	0.0141	0.0024				
	Jetty Channel	Generic Large Hopper		0.1574	0.0283	0.0538	0.0046	0.0054	0.0009	0.0113	0.0019				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.3557				0.0133						0.0237	0.0007	0.0016
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		0.3557	0.8076	0.1450	0.2761	0.0371	0.0276	0.0047	0.0580	0.0100		0.0237	0.0007	0.0016

Table C-6. Marine Equipment N_2O Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

N_2O (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		0.1180	0.0212	0.0404	0.0035	0.0040	0.0007	0.0085	0.0015				
	Part of Outer Bar	Generic Large Hopper		0.2207	0.0396	0.0755	0.0065	0.0075	0.0013	0.0158	0.0027				
2	Outer Bar	Generic Large Hopper		0.1968	0.0353	0.0673	0.0058	0.0067	0.0012	0.0141	0.0024				
	Jetty Channel	Generic Large Hopper		0.1574	0.0283	0.0538	0.0046	0.0054	0.0009	0.0113	0.0019				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.2357				0.0088						0.0157	0.0004	0.0010
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.0454				0.0017						0.0030	0.0001	0.0002
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		0.2812	0.6930	0.1244	0.2369	0.0309	0.0237	0.0041	0.0498	0.0086		0.0187	0.0005	0.0012
YEAR 2015															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.1968	0.0353	0.0673	0.0058	0.0067	0.0012	0.0141	0.0024				
	Jetty Channel	Generic Large Hopper		0.1574	0.0283	0.0538	0.0046	0.0054	0.0009	0.0113	0.0019				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.1347				0.0051						0.0090	0.0002	0.0006
7	Stauffer Channel	30" Dredge	0.2605				0.0098						0.0174	0.0005	0.0012
8	Mitigation														
	YEAR 2015 TOTAL		0.3952	0.3542	0.0636	0.1211	0.0252	0.0121	0.0021	0.0254	0.0044		0.0263	0.0007	0.0018

Table C-7. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

YEAR 2011

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	2,344.9	0.3	0.1
	Part of Outer Bar	Generic Large Hopper	4,384.8	0.6	0.1
2	Outer Bar	Generic Large Hopper			
	Jetty Channel	Generic Large Hopper			
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge			
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge			
7	Stauffer Channel	30" Dredge			
8	Mitigation				
	YEAR 2011 TOTAL		6,729.8	0.9	0.2

YEAR 2012

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	9,415.8	1.2	0.3
	Part of Outer Bar	Generic Large Hopper	17,606.7	2.2	0.5
2	Outer Bar	Generic Large Hopper	6,830.0	0.9	0.2
	Jetty Channel	Generic Large Hopper	5,464.0	0.7	0.2
3	Lower TB	30" Dredge	6,607.2	0.8	0.2
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	10,568.0	1.3	0.3
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge			
7	Stauffer Channel	30" Dredge			
8	Mitigation				
	YEAR 2012 TOTAL		56,491.9	7.1	1.6

YEAR 2013

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	9,415.8	1.2	0.3
	Part of Outer Bar	Generic Large Hopper	17,606.7	2.2	0.5
2	Outer Bar	Generic Large Hopper	11,727.8	1.5	0.3
	Jetty Channel	Generic Large Hopper	9,382.3	1.2	0.3
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	14,072.7	1.8	0.4
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge			
7	Stauffer Channel	30" Dredge			
8	Mitigation				
	YEAR 2013 TOTAL		62,205.5	7.9	1.7

YEAR 2014

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	7,034.8	0.9	0.2
	Part of Outer Bar	Generic Large Hopper	13,154.5	1.7	0.4
2	Outer Bar	Generic Large Hopper	11,727.8	1.5	0.3
	Jetty Channel	Generic Large Hopper	9,382.3	1.2	0.3
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9,327.9	1.2	0.3
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,797.2	0.2	0.1
7	Stauffer Channel	30" Dredge			
8	Mitigation				
	YEAR 2014 TOTAL		52,424.6	6.6	1.5

Table C-7. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

YEAR 2015

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper			
	Part of Outer Bar	Generic Large Hopper			
2	Outer Bar	Generic Large Hopper	11,727.8	1.5	0.3
	Jetty Channel	Generic Large Hopper	9,382.3	1.2	0.3
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge			
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	5,330.5	0.7	0.1
7	Stauffer Channel	30" Dredge	10,307.7	1.3	0.3
8	Mitigation				
		YEAR 2015 TOTAL	**36,748.4**	**4.6**	**1.0**

YEAR 2016

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper			
	Part of Outer Bar	Generic Large Hopper			
2	Outer Bar	Generic Large Hopper	10,739.3	1.4	0.3
	Jetty Channel	Generic Large Hopper	8,591.5	1.1	0.2
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge			
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	837.4	0.1	0.0
7	Stauffer Channel	30" Dredge			
8	Mitigation				
		YEAR 2016 TOTAL	**20,168.1**	**2.6**	**0.6**

TOTAL

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	28,211.4	3.6	0.8
	Part of Outer Bar	Generic Large Hopper	52,752.8	6.7	1.5
2	Outer Bar	Generic Large Hopper	52,752.8	6.7	1.5
	Jetty Channel	Generic Large Hopper	42,202.5	5.3	1.2
3	Lower TB	30" Dredge	6,607.2	0.8	0.2
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	33,968.7	4.3	1.0
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	7,965.1	1.0	0.2
7	Stauffer Channel	30" Dredge	10,307.7	1.3	0.3
8	Mitigation				
		PROJECT TOTAL	**234,768.2**	**29.7**	**6.6**

Table C-8. Annual Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

	CO2	CH4	N2O
Year 2011	6,730	0.9	0.2
Year 2012	56,492	7.1	1.6
Year 2013	62,205	7.9	1.7
Year 2014	52,425	6.6	1.5
Year 2015	36,748	4.6	1.0
Year 2016	20,168	2.6	0.6

Table D-1. Construction Equipment Emission Factors
Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Description	Fuel Type1	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr) CO_2	CH_4[2]	N_2O[2]
Contract 5: Ch to Brz thr Brzpt TB & PA 8							
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	536.005004	0.0390782	0.01373018
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	Truck Trailer	--	0	0%	0	0	0
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	535.797263	0.03906305	0.01372486
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	535.745354	0.03905927	0.01372353
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%	685.997007	0.04983406	0.01713046
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	173	43%	787.85182	0.05743944	0.02018143
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	536.039676	0.03908073	0.01373107
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	623.402943	0.04545007	0.01596894
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	535.743439	0.03905913	0.01372348
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	535.855141	0.03906727	0.01372634
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	535.903786	0.03907082	0.01372758
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	135	59%	535.903786	0.03907082	0.01372758
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	250	59%	536.005004	0.0390782	0.01373018
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	536.137913	0.03908789	0.01373358
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	536.266791	0.03909728	0.01373688
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	530.17646	0.03865326	0.01358087
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 56,000 GVW TRUCK)	Highway Truck	Diesel	310	59%	536.266791	0.03909728	0.01373688
Contract 6: Ch to UTB thr UTB & PA 9							
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	536.005004	0.0390782	0.01373018
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	Truck Trailer	--	0	0%		0	0

Table D-1. Construction Equipment Emission Factors
Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Description	Fuel Type1	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr)		
					CO_2	CH_4[2]	N_2O[2]
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	535.797263	0.03906305	0.01372486
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	535.745354	0.03905927	0.01372353
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%		0	0
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	250	43%	530.173	0.03865301	0.01358079
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	236	59%	536.039676	0.03908073	0.01373107
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	623.402943	0.04545007	0.01596894
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	535.743439	0.03905913	0.01372348
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	535.855141	0.03906727	0.01372634
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	535.903786	0.03907082	0.01372758
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	535.743439	0.03905913	0.01372348
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	535.855141	0.03906727	0.01372634
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	535.903786	0.03907082	0.01372758
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	536.137913	0.03908789	0.01373358
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	536.266791	0.03909728	0.01373688
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	Highway Truck	Diesel	205	59%	536.137913	0.03908789	0.01373358
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	530.17646	0.03865326	0.01358087
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	Crawler Dozers/Tractor	Diesel	80	59%	594.912667	0.04337294	0.01523914
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)		--	0	0%		0	0
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358

1. Emission Factors as provided by the EPA's NONROAD Model.
2. NONROAD does not provide emission factors for CH_4 and N_2O. Emission factors for these air contaminants were determined by ratio of emission factors provided for diesel fuel in the Climate Action Registry (California Climate Action Registry, 2009)

Table D-2. Load Factors For Equipment Using Diesel or Gasoline

SCC Code	Equipment	Load Factor[1] Diesel	Gasoline
22xx003010	Aerial Lifts	21%	46%
22xx005015	Agricultural Tractor	59%	62%
22xx006015	Air Compressors	43%	56%
22xx001030	All Terrain Vehicles	42%	100%
22xx002033	Bore/Drill Rigs	43%	79%
22xx002042	Cement & Motar Mixers	43%	59%
22xx004066	Chippers/Stump Grinders	43%	78%
22xx002039	Concrete/Industrial Saws	59%	78%
22xx002045	Cranes	43%	47%
22xx002066	Crawler Dozers/Tractor	59%	80%
22xx002054	Crushing/Procesing Equipment	43%	85%
22xx002078	Dumpers/Tenders	21%	41%
22xx002036	Excavators	59%	53%
22xx007015	Fellers/Bunchers/Skidders	59%	70%
22xx003020	Forklifts	59%	30%
22xx006020	Gas Compressors	43%	85%
22xx006005	Generator Sets	43%	68%
22xx002048	Graders	59%	64%
22xx005050	Hydro Power Units	43%	56%
22xx004056	Lawn and Garden Tractor	43%	44%
22xx002051	Off-Highway Truck	59%	80%
22xx002075	Off-Highway Tractor	59%	70%
22xx004056	Other Agricultural Equipment	59%	55%
22xx002081	Other Construction Equipment	59%	48%
22xx003040	Other General Industrial	43%	54%
22xx003050	Other Material Handling	21%	53%
22xx002003	Pavers	59%	66%
22xx002021	Paving Equipment	59%	59%
22xx002009	Plate Compactors	43%	55%
22xx006030	Pressure Washer	43%	85%
22xx006010	Pumps	43%	69%
22xx003060	Refrigeration/AC	43%	46%
22xx002015	Rollers	59%	62%
22xx002057	Rough Terrain Forklifts	59%	63%
22xx002063	Rubber Tire Dozer	59%	75%
22xx002060	Rubber Tire Loader	59%	71%
22xx002018	Scrapers	59%	70%
22xx002072	Skid Steer Loader	21%	58%
22xx001060	Specialty Vehicle/Carts	21%	58%
22xx002024	Surfacing Equipment	59%	49%
22xx003030	Sweepers/Scrubbers	43%	71%
22xx002006	Tampers/Rammers	43%	55%
22xx003070	Terminal Tractors	59%	78%
22xx005040	Tillers > 6 hp	59%	71%
22xx004026	Timmer/Edger/Brush Cutter	43%	91%
22xx002066	Tractor/Loader/Backhoe	21%	48%
22xx002030	Trenchers	59%	66%
22xx006025	Welders	21%	68%

1. 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-005b, December 2002

Table D-3. Emissions Summary

Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	CO_2 Emissions (tons per year)					CH_4 Emissions (tons per year)					N_2O Emissions (tons per year)				
				2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
CONTRACT 5: Ch to Brz thr Brzpt TB & PA 8			23															
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3 14 CY BKT	1	24	23	0.9821	1.3095	0.8730			0.0001	0.0001	0.0001			0.0000	0.0000	0.0000		
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	1	24	23	-	-	-			-	-	-			-	-	-		
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	23	0.7532	1.0042	0.6695			0.0001	0.0001	0.0000			0.0000	0.0000	0.0000		
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,136	23	35.6497	47.5329	31.6886			0.0026	0.0035	0.0023			0.0009	0.0012	0.0008		
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	183	23	11.8210	15.7613	10.5076			0.0009	0.0011	0.0008			0.0003	0.0004	0.0003		
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,651	23	317.3852	423.1802	282.1201			0.0231	0.0309	0.0206			0.0081	0.0108	0.0072		
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	183	23	0.2534	0.3379	0.2253			0.0000	0.0000	0.0000			0.0000	0.0000	0.0000		
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	1	24	23	0.6087	0.8090	0.5393			0.0000	0.0001	0.0000			0.0000	0.0000	0.0000		
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1 2 M3) BUCKET, 23 3' (7.1 M) MAX DIGGING DEPTH	1	24	23	0.7792	1.0390	0.6926			0.0001	0.0001	0.0001			0.0000	0.0000	0.0000		
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	314	23	2.3051	3.0734	2.0489			0.0002	0.0002	0.0001			0.0001	0.0001	0.0001		
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	366	23	5.8382	7.9177	5.2784			0.0004	0.0006	0.0004			0.0002	0.0002	0.0001		
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	366	23	9.9823	13.3098	8.8732			0.0007	0.0010	0.0008			0.0003	0.0003	0.0002		
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	183	23	2.4958	3.3277	2.2185			0.0002	0.0002	0.0002			0.0001	0.0001	0.0001		
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	1	64	23	1.1783	1.5711	1.0474			0.0001	0.0001	0.0001			0.0000	0.0000	0.0000		
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	1	4,014	23	136.8861	182.5148	121.6766			0.0100	0.0133	0.0089			0.0035	0.0047	0.0031		
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	1	24	23	0.7532	1.0042	0.6695			0.0001	0.0001	0.0000			0.0000	0.0000	0.0000		
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	10	23	0.2865	0.3820	0.2547			0.0000	0.0000	0.0000			0.0000	0.0000	0.0000		
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	85	23	2.6675	3.5568	2.3711			0.0002	0.0003	0.0002			0.0001	0.0001	0.0001		
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	10	23	0.4231	0.5641	0.3761			0.0000	0.0000	0.0000			0.0000	0.0000	0.0000		
MAP C65MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	1	6,651	23	228.9102	305.2136	203.4757			0.0167	0.0223	0.0148			0.0059	0.0078	0.0052		
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 56,000 GVW TRUCK)	1	61	23	2.5807	3.4410	2.2940			0.0002	0.0003	0.0002			0.0001	0.0001	0.0001		
Contract 6: Ch to UTB thr UTB & PA 9			16															
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	1	24	16			0.6275	1.8824	0.3137			0.0000	0.0001	0.0000			0.0000	0.0000	0.0000
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	1	24	16			-	-	-			-	-	-			-	-	-
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	16			0.4812	1.4436	0.2406			0.0000	0.0001	0.0000			0.0000	0.0000	0.0000
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,173	16			23.5180	70.5541	11.7590			0.0017	0.0051	0.0009			0.0006	0.0018	0.0003
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	191	16			7.8825	23.6474	3.9412			0.0006	0.0017	0.0003			0.0002	0.0006	0.0001
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,868	16			209.3897	628.1691	104.6948			0.0153	0.0458	0.0076			0.0054	0.0161	0.0027
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	191	16			-	-	-			-	-	-			-	-	-
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	1	24	16			0.3770	1.1309	0.1885			0.0000	0.0001	0.0000			0.0000	0.0000	0.0000
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1 2 M3) BUCKET, 23 3' (7.1 M) MAX DIGGING DEPTH	1	24	16			0.4978	1.4935	0.2489			0.0000	0.0001	0.0000			0.0000	0.0000	0.0000
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	381	16			1.7869	5.3607	0.8935			0.0001	0.0004	0.0001			0.0000	0.0001	0.0000

Table D-3. Emissions Summary

Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	CO_2 Emissions (tons per year)					CH_4 Emissions (tons per year)					N_2O Emissions (tons per year)				
				2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	383	16			3.9701	11.9103	1.9850			0.0003	0.0009	0.0001			0.0001	0.0003	0.0001
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	383	16			6.6738	20.0215	3.3369			0.0005	0.0015	0.0002			0.0002	0.0005	0.0001
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	191	16			1.6643	4.9928	0.8321			0.0001	0.0004	0.0001			0.0000	0.0001	0.0000
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	45	16			0.4665	1.3994	0.2332			0.0000	0.0001	0.0000			0.0000	0.0000	0.0000
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	45	16			0.7841	2.3524	0.3921			0.0001	0.0002	0.0000			0.0000	0.0001	0.0000
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	25	16			0.2178	0.6535	0.1089			0.0000	0.0000	0.0000			0.0000	0.0000	0.0000
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	73	16			1.3363	4.0090	0.6682			0.0001	0.0003	0.0000			0.0000	0.0001	0.0000
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	73	16			1.9732	5.9195	0.9866			0.0001	0.0004	0.0001			0.0001	0.0002	0.0000
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	1	120	16			2.1444	6.4333	1.0722			0.0002	0.0005	0.0001			0.0001	0.0002	0.0000
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	1	45	16			0.9895	2.9685	0.4948			0.0001	0.0002	0.0000			0.0000	0.0001	0.0000
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	1	80	16			0.6191	1.8572	0.3095			0.0000	0.0001	0.0000			0.0000	0.0000	0.0000
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)	1	40	16			-	-	-			-	-	-			-	-	-
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	1	40	16			0.8020	2.4059	0.4010			0.0001	0.0002	0.0000			0.0000	0.0001	0.0000
			TOTALS	**762.64**	**1,016.85**	**944.10**	**798.60**	**133.10**	**0.06**	**0.07**	**0.07**	**0.06**	**0.01**	**0.02**	**0.03**	**0.02**	**0.02**	**0.00**

Table D-4. Total Estimated Project Emissions by Year of Construction Activity
Freeport Harbor Channel Improvement Project
NED Alternative
(tons per year)

	2012	2013	2014	2015	2016
CO2	762.64	0.06	944.10	798.60	133.10
CH4	0.06	0.07	0.07	0.06	0.01
N2O	0.02	0.03	0.02	0.02	0.003

Table E-1. Crew Size per Equipment
Freeport Harbor Channel Improvement Project
NED Alternative

	Hopper Dredge		Cutterhead Dredge		
	Hopper Dredge Crew	Shore Crew	Cutterhead Dredge Crew	Shore Crew	Other Construction Equipment
Employees	22	8	46	6	6

Table E-2. Emission Factors for Employee Vehicles
Freeport Harbor Channel Improvement Project

County	Type of Vehicle	Category[1]	Emisson Factor (g/mile)[2]		
			CO2	CH4	N2O
Brazoria	Cars	LDGV	202.3547	0.0147	0.0079
	Pickups	LDGT1	216.1203	0.0157	0.0101

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 estimated from emissions data provided in Climate Action Registry (California Climate Action Registry, 2009).

Table E-3. Summary of Employee Vehicles Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

Project Year	Type of Vehicle	EPA Category	Daily Vehicles (/day)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (tpy) CO2	CH4	N2O
2011	Cars	LDGV	21	50.0	130	136,500	30.4469	0.0022	0.0012
	Pickups	LDGT1	21	50.0	130	136,500	32.5181	0.0024	0.0015
2011 Total Mobile Emission							**62.965**	**0.005**	**0.003**
2012	Cars	LDGV	82	50.0	719	2,947,900	657.5412	0.0478	0.0257
	Pickups	LDGT1	82	50.0	719	2,947,900	702.2719	0.0510	0.0328
2012 Total Mobile Emission							**1,359.813**	**0.099**	**0.058**
2013	Cars	LDGV	56	50.0	783	2,192,400	489.0238	0.0355	0.0191
	Pickups	LDGT1	56	50.0	783	2,192,400	522.2908	0.0379	0.0244
2013 Total Mobile Emission							**1,011.315**	**0.073**	**0.044**
2014	Cars	LDGV	82	50.0	717	2,939,700	655.7122	0.0476	0.0256
	Pickups	LDGT1	82	50.0	717	2,939,700	700.3184	0.0509	0.0327
2014 Total Mobile Emission							**1,356.031**	**0.099**	**0.058**
2015	Cars	LDGV	41	50.0	762	1,562,100	348.4328	0.0253	0.0136
	Pickups	LDGT1	41	50.0	762	1,562,100	372.1357	0.0270	0.0174
2015 Total Mobile Emission							**720.569**	**0.052**	**0.031**
2016	Cars	LDGV	41	50.0	280	574,000	128.0331	0.0093	0.0050
	Pickups	LDGT1	41	50.0	280	574,000	136.7428	0.0099	0.0064
2016 Total Mobile Emission							**264.776**	**0.019**	**0.011**

Notes:
1. Total VMT is assumed to be 50 miles/day round trip.
2. Annual travel = Daily vehicles * Total VMT * Travel days/yr.
3. Annual emissions = Emission factor * Annual travel * 1lb/453.6 grams * 1ton/2000lb

Table E-4. Annual Employee Vehicle Emissions
Freeport Harbor Channel Improvement Project
NED Alternative
(tons per year)

Year	CO2	CH4	N2O
Year 2011	62.965	0.005	0.003
Year 2012	1359.81	0.10	0.06
Year 2013	1011.31	0.07	0.04
Year 2014	1356.03	0.10	0.06
Year 2015	720.57	0.05	0.03
Year 2016	264.78	0.02	0.01

Table F-1. NED Alternative - Additional Maintenance Dredging - Assumptions for Marine Equipment Engines
Freeport Harbor Channel Improvement Project
Additional 1,580,000 cy/yr Maintenance Dredging

Activity	Equipment Type	Quantity	Total Installed Power (hp)	Engine Type	Engine Fuel Type	Engine Load Factor	Engine Horsepower (hp)	Hours of Operation per Day (hrs/day)	Daily Engine Usage (%)	Total Days of Operation (days)	Total Engine Hours of Operation (hrs)
Additional 1,580,000 cy/yr Maintenance Dredging	Hopper Dredge	1	14,000	Propulsion - Oceangoing	Diesel	0.8	9,000	20	65%	40	514
				Propulsion - Dredging	Diesel	0.8	9,000	20	35%	40	277
				Dredge Pump(s)	Diesel	0.8	3,000	20	35%	40	277
				Auxiliary - Oceangoing	Diesel	0.8	2,000	20	65%	40	514
				Auxiliary - Idling	Diesel	0.8	2,000	20	35%	40	277
	Survey Boat	1	2,000	Propulsion	Diesel	0.4	2,000	20	100%	8	158
				Auxiliary	Diesel	0.2	2,000	20	100%	8	158
	Shrimp Boat (Turtle Trawl)	2	600	Propulsion	Diesel	0.4	600	24	100%	28	1,330
				Auxiliary	Diesel	0.2	600	24	100%	28	1,330
Total Engine Hours											4,832

Notes:
1. Days of operation are determined assuming 40,000 CY/day production rate for a hopper dredge removing unconsolidated, predominantly silty dredged material.

Table F-2. NED Alternative - Additional Mainenance Dredging - Marine Equipment Hours of Operation
Freeport Harbor Channel Improvement Project
Additional 1,580,000 cy/yr Maintenance Dredging

			Dredge								
			Generic Large Hopper Dredge					Crew/Survey Boat (Runabout)		Shrimp Boats (Total of Two)	
Contract No.	Additional Volume/Disposal Site	Dredge	Propulsion Ocean Going	Propulsion Dredging	Dredge Pump(s)	Auxillary Oceangoing	Auxiliary Idling	Propulsion	Secondary	Propulsion	Secondary
Additional Maintenance Dredging	1,580,000 CY of Additional Maintenance Material to ODMS	Hopper	514	277	277	514	277	158	158	1,330	1,330

Table F-3. NED Alternative - Additional Maintenance Dredging - Marine Equipment Estimated Emissions
Freeport Harbor Channel Improvement Project
Additional 1,580,000 cy/yr Maintenance Dredging
(Tons per Year)

Phase No.	Pollutant	Dredge	Dredge									**Total Emissions Per Year**
			Generic Large Hopper Dredge					Crew/Survey Boat		Shrimp Boat		
			Propulsion Oceangoing	Propulsion - Dredging	Dredge Pump(s)	Auxiliary - Oceangoing	Auxillary - Dredging	Propulsion	Auxiliary	Propulsion	Auxiliary	
Additional 1,580,000 cy/yr Maintenance Dredging	CO2	Hopper	2,138.6839	1,151.5990	383.8663	475.2631	316.0498	78.8449	45.1500	199.0485	113.9837	**4,902**
	CH4	Hopper	0.2736	0.1473	0.0491	0.0608	0.0327	0.0094	0.0047	0.0236	0.0118	**0.613**
	N2O	Hopper	0.0608	0.0327	0.0109	0.0135	0.0073	0.0021	0.0010	0.0052	0.0026	**0.136**

Appendix B

LPP Alternative Emissions Summary

APPENDIX B

List of Tables
Freeport Harbor Channel Improvement Project
LPP Alternative

Table A-1. Annual Project Emissions Summary
Freeport Harbor Channel Improvement Project
LPP Alternative

	(tons per year)			(metric tons per year)			Total CO_2e (metric tons per year)
Year 2011	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	6,358	0.80	0.18	5,768	0.73	0.16	5,833
Construction Equipment	0	0.00	0.00	0.00	0.00	0.00	0
Employee Vehicles	45	0.00	0.00	40.801	0.00	0.00	41
Subtotal	**6,403**	**0.81**	**0.18**	**5,809**	**0.73**	**0.16**	**5,875**
Year 2012	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	49,802	6.30	1.40	45,180	5.72	1.27	45,694
Construction Equipment	2,193	0.16	0.06	1,989.08	0.15	0.05	2,008
Employee Vehicles	2,285	0.17	0.10	2,073.17	0.15	0.09	2,104
Subtotal	**54,280**	**6.63**	**1.55**	**49,242**	**6.01**	**1.41**	**49,805**
Year 2013	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	57,010	7.21	1.60	51,719	6.54	1.45	52,306
Construction Equipment	2,923	0.21	0.07	2,652.10	0.19	0.07	2,677
Employee Vehicles	984	0.07	0.04	892.84	0.06	0.04	906
Subtotal	**60,918**	**7.49**	**1.72**	**55,264**	**6.80**	**1.56**	**55,890**
Year 2014	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	46,923	5.93	1.32	42,567	5.38	1.20	43,051
Construction Equipment	1,552	0.11	0.04	1,407.99	0.10	0.04	1,421
Employee Vehicles	1,174	0.09	0.05	1,065.42	0.08	0.05	1,081
Subtotal	**49,649**	**6.13**	**1.41**	**45,041**	**5.56**	**1.28**	**45,554**
Year 2015	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
Dredge & Support Equipment	14,556	1.84	0.41	13,205	1.67	0.37	13,355
Construction Equipment	0	0.06	0.02	0.00	0.05	0.02	7
Employee Vehicles	0	0.00	0.00	0.00	0.00	0.00	0
Subtotal	**363**	**0.03**	**0.02**	**13,205**	**1.72**	**0.39**	**13,362**
	CO_2	CH_4	N_20	CO_2	CH_4	N_20	CO2e
TOTAL (ALL YEARS)							
Dredge & Support Equipment	174,649	22.08	4.91	158,439	20.03	4.45	160,240
Construction Equipment	6,668	0.54	0.19	6,049	0.49	0.17	6,113
Employee Vehicles	4,489	0.33	0.19	4,072	0.30	0.18	4,133
TOTAL (ALL YEARS)	**185,806**	**22.95**	**5.29**	**168,560**	**20.82**	**4.80**	**170,486**

Table B-1. Dredging Contract Schedule - Days per Year
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Dredging Duration Months	Dredging Duration Days	Contract Start	Contract Finish	Year 1 2011 days	Year 2 2012 days	Year 3 2013 days	Year 4 2014 days	Year 5 2015 days	Year 6 2016 days
1	New Extention and Part of Outer Bar	23.2	696	10/1/2011	10/31/2013	65	261	218			
2	Outer Bar and Jetty Channel	33.2	996	6/1/2012	3/31/2015		152	261	261	64	
3	Lower TB, PA1, & Seaway Removel	1	30	4/1/2012	5/31/2012		44				
4	Real Estate	6	180	10/1/2011	3/31/2012	65	65				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	8	240	4/1/2012	11/30/2014		196	261	238		
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	4	120	12/1/2013	9/30/2014			22	195		
7	Stauffer Channel	6	180	10/1/2014	4/30/2015				66	86	
8	Mitigation	6	180	4/1/2015	9/30/2015					131	
					TOTAL	130	718	762	760	281	0

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
LPP Alternative

Type	Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 1: New Extension & Part of Entrance				
DredgingNew Extent (Duration =	**6**	**Quantity =**	**795,000**	**CY**
Generic Large Hopper	Dredging	3000	14000	
	Idle	1032		
Survey Boat	Dredging	600	2000	
	Idle	206		
Trawlers - 2	Dredging	4200	1200	
	Idle	1444		
Dredging Part of Outer Bar (Duration =	**17.2**	**Quantity =**	**4,145,000**	**CY**
Generic Large Hopper	Dredging	8600	14000	
	Idle	2958		
Survey Boat	Dredging	1720	2000	
	Idle	592		
Trawlers - 2	Dredging	12040	1200	
	Idle	4142		
Total	**23.2**	**40,534**		
CONTRACT 2: Outer Bar and Jetty Ch				
Dredging Outer Bar (Duration =	**17.2**	**Quantity =**	**4,145,000**	**CY**
Generic Large Hopper	Dredging	8600	14000	
	Idle	2958		
Survey Boat	Dredging	1720	2000	
	Idle	592		
Trawlers - 2	Dredging	12040	1200	
	Idle	4142		
Dredging Jetty Ch (Duration =	**16**	**Quantity =**	**3,648,000**	**CY**
Generic Large Hopper	Dredging	8000	14000	
	Idle	2752		
Survey Boat	Dredging	1600	2000	
	Idle	550		
Trawlers - 2	Dredging	11200	1200	
	Idle	3852		
Total	**33.2**	**58,006**		

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
LPP Alternative

Type	Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 3: Lower TB, PA 1 Work & Seaway Removal				
Dredging Lower TB (Duration =	**1**	**Quantity =**	**208,000**	**CY**
30" Dredge	Dredging	500	9000	
	Idle	225	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	1200	1500	
Spill Barge	Dredging	100	165	
Crewboat	Construction	100	400	
Total	**1**	**2,125**		
CONTRACT 5: Ch to Brz thr Brzpt TB & PA 8				
Dredging Cycle (Duration =	**8**	**Quantity =**	**1,716,000**	**CY**
30" Dredge	Dredging	4000	9000	
	Idle	1800	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	9600	1500	
Spill Barge	Dredging	800	165	
Crewboat	Construction	800	400	
Total	**8**	**17,000**		
CONTRACT 6: Ch to UTB thr UTB & PA 9				
Dredging Cycle (Duration =	**4**	**Quantity =**	**881,000**	**CY**
30" Dredge	Dredging	2000	9000	
	Idle	900	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	4800	1500	
Spill Barge	Dredging	400	165	
Crewboat	Construction	400	400	
Total	**4**	**8,500**		
CONTRACT 7: Stauffer Ch				
Dredging Cycle (Duration =	**6**	**Quantity =**	**1,814,000**	**CY**
30" Dredge	Dredging	3000	9000	
	Idle	1350	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	7200	1500	
Spill Barge	Dredging	600	165	
Crewboat	Construction	600	400	
Total	**6**	**12,750**		

Table B-3. Dredging Contract Allocation by Year
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Dredging Duration Days	Year 1 **2011** percent	Year 2 **2012** percent	Year 3 **2013** percent	Year 4 **2014** percent	Year 5 **2015** percent
1	New Extention and Part of Outer Bar	696	12%	48%	40%		
2	Outer Bar and Jetty Channel	996		21%	35%	35%	9%
3	Lower TB, PA1, & Seaway Removel	30		100%			
4	Real Estate	180	50%	50%			
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	240		28%	38%	34%	
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	120			18%	90%	
7	Stauffer Channel	180				37%	57%
8	Mitigation	180					100%

Table B-4. Dredge Equipment Operating Hours
Freeport Harbor Channel Improvement Project
LPP Alternative

		Operating Hours														
		Dredge						Survey Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
Contract No.	**Reach**	Dredge Type	Total Dredging	Propelling	Pumping	Power Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
1	New Extension	Generic Large Hopper	3,000	1,950	1,050	3,000	1,032	600	206	4,200	1,444				
	Part of Outer Bar	Generic Large Hopper	8,600	5,590	3,010	8,600	2,958	1,720	592	12,040	4,142				
2	Outer Bar	Generic Large Hopper	8,600	5,590	3,010	8,600	2,958	1,720	592	12,040	4,142				
	Jetty Channel	Generic Large Hopper	8,000	5,200	2,800	8,000	2,752	1,600	550	11,200	3,852				
3	Lower TB	30" Dredge	500				225						1,200	100	100
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	4,000				1,800						9,600	800	800
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2,000				900						4,800	400	400
7	Stauffer Channel	30" Dredge	3,000				1,350						7,200	600	600
8	Mitigation														

Table B-5. Typical Hopper Dredging Cycle
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Dredging Cycle				
		Dredge Type	Total Dredging Hours	Propelling	Pumping	Power Generating
1	New Extension	Generic Large Hopper	3,000	65%	35%	100%
	Part of Outer Bar	Generic Large Hopper	8,600	65%	35%	100%
2	Outer Bar	Generic Large Hopper	8,600	65%	35%	100%
	Jetty Channel	Generic Large Hopper	8,000	65%	35%	100%

Table B-6. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Location/Disposal Site	Dredge Type	Engine Type: Total	Engine Type: Propulsion	Engine Type: Pump	Engine Type: Generator	Engine Type: Generator at Idling	Survey Boat: Main Engine	Survey Boat: Idling	Trawler: Main Engine	Trawler: Idling	Floating Booster: Pumping	Tug: Propulsion	Spill Barge: Main Engine	Crew Boat: Propulsion
		Horsepower (hp)													
1	New Extension	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Part of Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
2	Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Jetty Channel	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
3	Lower TB	30" Dredge	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
4	Real Estate						3,000						500	165	400
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9,000				3,000						500	165	400
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	9,000				3,000						500	165	400
7	Stauffer Channel	30" Dredge	9,000				3,000						500	165	400
8	Mitigation						3,000						500	165	400

Table B-7. Construction Equipment Operating Hours
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Dredge Type	Operating Hours
			Misc Construction Equipment
1	New Extension	Generic Large Hopper	
	Part of Outer Bar	Generic Large Hopper	
2	Outer Bar	Generic Large Hopper	
	Jetty Channel	Generic Large Hopper	
3	Lower TB	30" Dredge	750
4	Real Estate		
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	6,000
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	3,000
7	Stauffer Channel	30" Dredge	4,500
8	Mitigation		131

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
LPP Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper	358.46	233.00	125.46	358.46	123.31	71.69	24.61	501.84	172.54				
	Part of Outer Bar	Generic Large Hopper	1,027.57	667.92	359.65	1,027.57	353.44	205.51	70.74	1,438.60	494.91				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011	TOTAL	1,386.03	900.92	485.11	1,386.03	476.75	277.21	95.36	1,940.44	667.44				
YEAR 2012															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper	1,439.34	935.57	503.77	1,439.34	495.13	287.87	98.83	2,015.07	692.80				
	Part of Outer Bar	Generic Large Hopper	4,126.10	2,681.97	1,444.14	4,126.10	1,419.19	825.22	284.03	5,776.54	1,987.25				
2	Outer Bar	Generic Large Hopper	1,771.27	1,151.33	619.95	1,771.27	609.24	354.25	121.93	2,479.78	853.09				
	Jetty Channel	Generic Large Hopper	1,647.70	1,071.00	576.69	1,647.70	566.81	329.54	113.28	2,306.78	793.37				
3	Lower TB	30" Dredge	500.00				225.00						1,200.00	100.00	100.00
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,128.06				507.63						2,707.34	225.61	225.61
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012	TOTAL	10,512.47	5,839.87	3,144.54	8,984.41	3,822.99	1,796.88	618.07	12,578.18	4,326.51		3,907.34	325.61	325.61
YEAR 2013															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper	1,202.21	781.43	420.77	1,202.21	413.56	240.44	82.55	1,683.09	578.66				
	Part of Outer Bar	Generic Large Hopper	3,446.32	2,240.11	1,206.21	3,446.32	1,185.38	689.26	237.24	4,824.85	1,659.85				
2	Outer Bar	Generic Large Hopper	3,041.46	1,976.95	1,064.51	3,041.46	1,046.12	608.29	209.37	4,258.05	1,454.85				
	Jetty Channel	Generic Large Hopper	2,829.27	1,839.02	990.24	2,829.27	973.27	565.85	194.51	3,960.98	1,362.29				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,502.16				675.97						3,605.18	300.43	300.43
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	366.67				165.00						880.00	73.33	73.33
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013	TOTAL	12,388.09	6,837.62	3,681.74	10,619.26	4,459.30	2,103.85	723.66	14,726.97	5,066.65		4,485.18	373.76	373.76

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
LPP Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	3,041.46	1,976.95	1,064.51	3,041.46	1,046.12	608.29	209.37	4,258.05	1,464.85				
	Jetty Channel	Generic Large Hopper	2,829.27	1,839.02	990.24	2,829.27	973.27	565.85	194.51	3,960.98	1,362.29				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,359.78				616.40						3,287.48	273.96	273.96
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,797.24				808.76						4,313.36	359.45	359.45
7	Stauffer Channel	30" Dredge	1,100.00				495.00						2,640.00	220.00	220.00
8	Mitigation														
	YEAR 2014 TOTAL		10,137.76	3,815.98	2,054.76	5,870.73	3,939.56	1,174.15	403.88	8,219.02	2,827.15		10,240.85	853.40	853.40
YEAR 2015															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	745.80	484.77	261.03	745.80	256.52	149.16	51.34	1,044.12	359.20				
	Jetty Channel	Generic Large Hopper	693.77	450.95	242.82	693.77	238.66	138.75	47.70	971.27	334.05				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	1,697.37				763.82						4,073.68	339.47	339.47
8	Mitigation														
	YEAR 2015 TOTAL		3,136.93	935.72	503.85	1,439.57	1,258.99	287.91	99.04	2,015.39	693.25		4,073.68	339.47	339.47

Table C-2. Marine Engine Emission Factors and Fuel Consumption Algorithms

(in g/kW-hr, for all marine engines)

Freeport Harbor Channel Improvement Project

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
CO2	1	648.6	44.1

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 C-3. Marine Equipment Load Factors and Emission Factors
Freeport Harbor Channel Improvement Project

	Dredge					Crew Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
Operating Mode	Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
Load Factor	0.8	0.8	0.8	0.8	0.2	0.4	0.2	0.4	0.2	0.8	0.4	0.4	0.4
EF (Gram/hp-hr)													
CO_2	525	525	525	525	648	566	648	566	648	525	566	566	566
CH_4	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
N_2O	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015

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:

A.) The main engines on the dredges were assumed to operate at full power (e.g. 0.8 "cruise" load factor from Table 5-2 of EPA report) for all hours of operation.

B.) The generators on the dredges were assumed to operate at 0.2 load factor during idling.

C.) The main engines or propulsion engines on the support equipment 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.

D.) The auxiliary engines, if any, on the support equipment were assumed to operate sparingly during idling 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 Data", February 2000.

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).

5.) CH_4 and N_2O emission factors were obtained from "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (ICF International 2009).

Table C-4. Marine Equipment CO_2 Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

CO_2 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		970.39	174.17	331.76	35.24	35.77	7.03	75.13	14.79				
	Part of Outer Bar	Generic Large Hopper		2,781.80	499.30	951.04	101.00	102.55	20.21	215.36	42.43				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**3,752.19**	**673.47**	**1,282.80**	**136.23**	**138.33**	**27.25**	**290.49**	**57.22**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		3,896.51	699.37	1,332.14	141.49	143.65	28.24	301.66	59.39				
	Part of Outer Bar	Generic Large Hopper		11,169.99	2,004.87	3,818.80	405.54	411.79	81.16	864.77	170.36				
2	Outer Bar	Generic Large Hopper		4,795.11	860.66	1,639.35	174.09	176.78	34.84	371.23	73.13				
	Jetty Channel	Generic Large Hopper		4,460.57	800.61	1,524.98	161.97	164.44	32.37	345.33	68.01				
3	Lower TB	30" Dredge	3,239.33				64.29								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	4,698.19				217.58						337.75	9.29	22.52
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**7,937.52**	**24,322.18**	**4,365.52**	**8,316.27**	**1,164.97**	**896.66**	**176.62**	**1,882.99**	**370.90**		**337.75**	**9.29**	**22.52**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		3,254.56	584.15	1,112.67	118.18	119.98	23.59	251.96	49.61				
	Part of Outer Bar	Generic Large Hopper		9,329.72	1,674.57	3,189.65	338.73	343.95	67.79	722.30	142.29				
2	Outer Bar	Generic Large Hopper		8,233.71	1,477.84	2,814.94	298.93	303.54	59.83	637.44	125.58				
	Jetty Channel	Generic Large Hopper		7,659.26	1,374.74	2,618.55	278.12	282.37	55.58	592.97	116.78				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	6,256.26				289.74						449.76	12.37	29.98
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,527.11				70.72						109.78	3.02	7.32
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**7,783.38**	**28,477.25**	**5,111.30**	**9,735.81**	**1,394.42**	**1,049.84**	**206.79**	**2,204.67**	**434.26**		**559.54**	**15.39**	**37.30**

Table C-4. Marine Equipment CO_2 Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

CO_2 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		8,233.71	1,477.84	2,814.94	298.93	303.54	59.83	637.44	125.58				
	Jetty Channel	Generic Large Hopper		7,659.26	1,374.74	2,618.55	278.12	282.37	55.58	592.97	116.78				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	5,704.95				264.21						410.12	11.28	27.34
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	7,485.22				345.66						538.10	14.80	35.87
7	Stauffer Channel	30" Dredge	4,581.34				212.17						329.35	9.06	21.96
8	Mitigation														
	YEAR 2014 TOTAL		17,771.50	15,892.97	2,852.58	5,433.49	1,400.09	585.91	115.41	1,230.41	242.36		1,277.57	35.13	85.17
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		2,018.99	362.38	690.25	73.30	74.43	14.67	156.31	30.79				
	Jetty Channel	Generic Large Hopper		1,878.13	337.10	642.10	68.20	69.24	13.63	145.40	28.64				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	7,069.29				327.40						508.20	13.98	33.88
8	Mitigation														
	YEAR 2015 TOTAL		7,069.29	3,897.13	699.48	1,332.35	468.90	143.67	28.30	301.71	59.43		508.20	13.98	33.88

Table C-5. Marine Equipment CH_4 Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

CH_4(tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		0.1242	0.0223	0.0424	0.0037	0.0042	0.0007	0.0089	0.0015				
	Part of Outer Bar	Generic Large Hopper		0.3559	0.0639	0.1217	0.0105	0.0122	0.0021	0.0256	0.0044				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			0.4801	0.0862	0.1641	0.0141	0.0164	0.0028	0.0345	0.0059				
YEAR 2012															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		0.4985	0.0895	0.1704	0.0147	0.0170	0.0029	0.0358	0.0062				
	Part of Outer Bar	Generic Large Hopper		1.4291	0.2565	0.4886	0.0420	0.0489	0.0084	0.1026	0.0176				
2	Outer Bar	Generic Large Hopper		0.6135	0.1101	0.2097	0.0180	0.0210	0.0036	0.0440	0.0076				
	Jetty Channel	Generic Large Hopper		0.5707	0.1024	0.1951	0.0168	0.0195	0.0034	0.0410	0.0070				
3	Lower TB	30" Dredge	0.4144				0.0067								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.6011				0.0225						0.0401	0.0011	0.0027
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		1.0155	3.1118	0.5585	1.0639	0.1207	0.1064	0.0183	0.2234	0.0384		0.0401	0.0011	0.0027
YEAR 2013															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		0.4164	0.0747	0.1424	0.0122	0.0142	0.0024	0.0299	0.0051				
	Part of Outer Bar	Generic Large Hopper		1.1937	0.2142	0.4081	0.0351	0.0408	0.0070	0.0857	0.0147				
2	Outer Bar	Generic Large Hopper		1.0534	0.1891	0.3602	0.0310	0.0360	0.0062	0.0756	0.0130				
	Jetty Channel	Generic Large Hopper		0.9799	0.1759	0.3350	0.0288	0.0335	0.0058	0.0704	0.0121				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.8004				0.0300						0.0534	0.0015	0.0036
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.1954				0.0073						0.0130	0.0004	0.0009
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		0.9958	3.6434	0.6540	1.2456	0.1445	0.1246	0.0214	0.2616	0.0450		0.0664	0.0018	0.0044

Table C-5. Marine Equipment CH_4 Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

CH_4(tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		1.0534	0.1891	0.3602	0.0310	0.0360	0.0062	0.0756	0.0130				
	Jetty Channel	Generic Large Hopper		0.9799	0.1759	0.3350	0.0288	0.0335	0.0058	0.0704	0.0121				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.7299				0.0274						0.0487	0.0013	0.0032
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.9577				0.0359						0.0638	0.0018	0.0043
7	Stauffer Channel	30" Dredge	0.5861				0.0220						0.0391	0.0011	0.0026
8	Mitigation														
	YEAR 2014 TOTAL		2.2737	2.0334	0.3650	0.6952	0.1450	0.0695	0.0120	0.1460	0.0251		0.1516	0.0042	0.0101
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.2583	0.0464	0.0883	0.0076	0.0088	0.0015	0.0185	0.0032				
	Jetty Channel	Generic Large Hopper		0.2403	0.0431	0.0822	0.0071	0.0082	0.0014	0.0173	0.0030				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	0.9045				0.0339						0.0603	0.0017	0.0040
8	Mitigation														
	YEAR 2015 TOTAL		0.9046	0.4986	0.0895	0.1705	0.0486	0.0170	0.0029	0.0368	0.0062		0.0603	0.0017	0.0040

Table C-6. Marine Equipment N_2O Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

N_2O (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		0.0276	0.0050	0.0094	0.0008	0.0009	0.0002	0.0020	0.0003				
	Part of Outer Bar	Generic Large Hopper		0.0791	0.0142	0.0270	0.0023	0.0027	0.0005	0.0057	0.0010				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			0.1067	0.0191	0.0366	0.0031	0.0036	0.0006	0.0077	0.0013				
YEAR 2012															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		0.1108	0.0199	0.0379	0.0033	0.0038	0.0007	0.0080	0.0014				
	Part of Outer Bar	Generic Large Hopper		0.3176	0.0570	0.1086	0.0093	0.0109	0.0019	0.0228	0.0039				
2	Outer Bar	Generic Large Hopper		0.1363	0.0245	0.0466	0.0040	0.0047	0.0008	0.0098	0.0017				
	Jetty Channel	Generic Large Hopper		0.1268	0.0228	0.0434	0.0037	0.0043	0.0007	0.0091	0.0016				
3	Lower TB	30" Dredge	0.0921				0.0015								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.1336				0.0050						0.0089	0.0002	0.0006
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		0.2257	0.6916	0.1241	0.2364	0.0268	0.0236	0.0041	0.0496	0.0086		0.0089	0.0002	0.0006
YEAR 2013															
Contract No.	Location/Disposal Site	Dredge													
1	New Extension	Generic Large Hopper		0.0925	0.0166	0.0316	0.0027	0.0032	0.0005	0.0066	0.0011				
	Part of Outer Bar	Generic Large Hopper		0.2653	0.0476	0.0907	0.0078	0.0091	0.0016	0.0190	0.0033				
2	Outer Bar	Generic Large Hopper		0.2341	0.0420	0.0800	0.0069	0.0080	0.0014	0.0168	0.0029				
	Jetty Channel	Generic Large Hopper		0.2178	0.0391	0.0744	0.0064	0.0074	0.0013	0.0156	0.0027				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.1779				0.0067						0.0119	0.0003	0.0008
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.0434				0.0016						0.0029	0.0001	0.0002
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		0.2213	0.8097	0.1453	0.2768	0.0321	0.0277	0.0048	0.0581	0.0100		0.0148	0.0004	0.0010

Table C-6. Marine Equipment N_2O Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

N_2O (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propeling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.2341	0.0420	0.0800	0.0069	0.0080	0.0014	0.0168	0.0029				
	Jetty Channel	Generic Large Hopper		0.2178	0.0391	0.0744	0.0064	0.0074	0.0013	0.0156	0.0027				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.1522				0.0061						0.0108	0.0003	0.0007
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.2128				0.0080						0.0142	0.0004	0.0009
7	Stauffer Channel	30" Dredge	0.1303				0.0049						0.0087	0.0002	0.0006
8	Mitigation														
	YEAR 2014 TOTAL		0.5063	0.4519	0.0811	0.1546	0.0322	0.0154	0.0027	0.0324	0.0056		0.0337	0.0009	0.0022
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.0574	0.0103	0.0196	0.0017	0.0020	0.0003	0.0041	0.0007				
	Jetty Channel	Generic Large Hopper		0.0534	0.0096	0.0183	0.0016	0.0018	0.0003	0.0038	0.0007				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	0.2010				0.0075						0.0134	0.0004	0.0009
8	Mitigation														
	YEAR 2015 TOTAL		0.2010	0.1108	0.0199	0.0379	0.0108	0.0038	0.0007	0.0080	0.0014		0.0134	0.0004	0.0009

Table C-7. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

YEAR 2011

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	1,644.3	0.2	0.0
	Part of Outer Bar	Generic Large Hopper	4,713.7	0.6	0.1
2	Outer Bar	Generic Large Hopper			
	Jetty Channel	Generic Large Hopper			
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge			
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge			
7	Stauffer Channel	30" Dredge			
8	Mitigation				
	YEAR 2011 TOTAL		**6,358.0**	**0.8**	**0.2**

YEAR 2012

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	6,602.5	0.8	0.2
	Part of Outer Bar	Generic Large Hopper	18,927.3	2.4	0.5
2	Outer Bar	Generic Large Hopper	8,125.2	1.0	0.2
	Jetty Channel	Generic Large Hopper	7,558.3	1.0	0.2
3	Lower TB	30" Dredge	3,303.6	0.4	0.1
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	5,285.3	0.7	0.1
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge			
7	Stauffer Channel	30" Dredge			
8	Mitigation				
	YEAR 2012 TOTAL		**49,802.2**	**6.3**	**1.4**

YEAR 2013

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	5,514.7	0.7	0.2
	Part of Outer Bar	Generic Large Hopper	15,809.0	2.0	0.4
2	Outer Bar	Generic Large Hopper	13,951.8	1.8	0.4
	Jetty Channel	Generic Large Hopper	12,978.4	1.6	0.4
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	7,038.1	0.9	0.2
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,718.0	0.2	0.0
7	Stauffer Channel	30" Dredge			
8	Mitigation				
	YEAR 2013 TOTAL		**57,010.0**	**7.2**	**1.6**

Table C-7. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

YEAR 2014

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper			
	Part of Outer Bar	Generic Large Hopper			
2	Outer Bar	Generic Large Hopper	13,951.8	1.8	0.4
	Jetty Channel	Generic Large Hopper	12,978.4	1.6	0.4
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	6,417.9	0.8	0.2
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	8,420.6	1.1	0.2
7	Stauffer Channel	30" Dredge	5,153.9	0.7	0.1
8	Mitigation				
		YEAR 2014 TOTAL	**46,922.6**	**5.9**	**1.3**

YEAR 2015

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper			
	Part of Outer Bar	Generic Large Hopper			
2	Outer Bar	Generic Large Hopper	3,421.1	0.4	0.1
	Jetty Channel	Generic Large Hopper	3,182.4	0.4	0.1
3	Lower TB	30" Dredge			
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge			
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge			
7	Stauffer Channel	30" Dredge	7,952.7	1.0	0.2
8	Mitigation				
		YEAR 2015 TOTAL	**14,556.3**	**1.8**	**0.4**

TOTAL

Contract No.	Location/Disposal Site	Dredge	CO2	CH4	N2O
1	New Extension	Generic Large Hopper	13,761.4	1.7	0.4
	Part of Outer Bar	Generic Large Hopper	39,450.0	5.0	1.1
2	Outer Bar	Generic Large Hopper	39,450.0	5.0	1.1
	Jetty Channel	Generic Large Hopper	36,697.5	4.6	1.0
3	Lower TB	30" Dredge	3,303.6	0.4	0.1
4	Real Estate				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	18,741.3	2.4	0.5
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	10,138.6	1.3	0.3
7	Stauffer Channel	30" Dredge	13,106.6	1.7	0.4
8	Mitigation				
		PROJECT TOTAL	**174,649.0**	**22.1**	**4.9**

Table C-8. Annual Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

	CO_2	CH_4	N_2O
Year 2011	6,358	0.80	0.18
Year 2012	49,802	6.30	1.40
Year 2013	57,010	7.21	1.60
Year 2014	46,923	5.93	1.32
Year 2015	14,556	1.84	0.41

Table D-1. Total Estimated Project Emissions by Year of Construction Activity

Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
LPP Alternative

Equipment Type	Description	Fuel Type1	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr) CO_2	CH_4[2]	N_2O[2]
Contract 5: Ch to Brz thr Brzpt TB & PA 8							
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	536.005004	0.0390782	0.01373018
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	Truck Trailer	--	0	0%	0	0	0
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	535.797263	0.03906305	0.01372486
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	535.745354	0.03905927	0.01372353
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%	685.997007	0.04983406	0.01713046
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	173	43%	787.85182	0.05743944	0.02018143
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	536.039676	0.03908073	0.01373107
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	623.402943	0.04545007	0.01596894
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	535.743439	0.03905913	0.01372348
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	535.855141	0.03906727	0.01372634
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	535.903786	0.03907082	0.01372758
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	135	59%	535.903788	0.03907082	0.01372756
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	250	59%	536.005004	0.0390782	0.01373018
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	536.137913	0.03908789	0.01373358
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	536.266791	0.03909728	0.01373688
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	530.17646	0.03865326	0.01358087
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 58,000 GVW TRUCK)	Highway Truck	Diesel	310	59%	536.266791	0.03909728	0.01373686
Contract 6: Ch to UTB thr UTB & PA 9							
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	536.005004	0.0390782	0.01373018
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	Truck Trailer	--	0	0%		0	0
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358

Table D-1. Total Estimated Project Emissions by Year of Construction Activity

Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
LPP Alternative

Equipment Type	Description	Fuel Type†	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr)		
					CO_2	CH_4[2]	N_2O[2]
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	535.797263	0.03908305	0.01372486
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	535.745354	0.03905927	0.01372353
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%		0	0
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	250	43%	530.173	0.03865301	0.01358079
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	536.039676	0.03908073	0.01373107
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	623.402943	0.04545007	0.01596894
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	535.743439	0.03905913	0.01372348
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	535.855141	0.03906727	0.01372634
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	535.903786	0.03907082	0.01372758
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	535.743439	0.03905913	0.01372348
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	535.855141	0.03906727	0.01372634
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	535.903786	0.03907082	0.01372758
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	536.137913	0.03908789	0.01373358
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	536.266791	0.03909728	0.01373688
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	Highway Truck	Diesel	205	59%	536.137913	0.03908789	0.01373358
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	530.17646	0.03865326	0.01358087
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	Crawler Dozers/Tractor	Diesel	80	59%	594.912667	0.04337294	0.01523914
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)		–	0	0%		0	0
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	536.137913	0.03908789	0.01373358

Table D-2. Total Estimated Project Emissions by Year of Construction Activity

SCC Code	Equipment	Load Factor[1] Diesel	Gasoline
22xx003010	Aerial Lifts	21%	46%
22xx005015	Agricultural Tractor	59%	62%
22xx006015	Air Compressors	43%	56%
22xx001030	All Terrain Vehicles	42%	100%
22xx002033	Bore/Drill Rigs	43%	79%
22xx002042	Cement & Motar Mixers	43%	59%
22xx004066	Chippers/Stump Grinders	43%	78%
22xx002039	Concrete/Industrial Saws	59%	78%
22xx002045	Cranes	43%	47%
22xx002066	Crawler Dozers/Tractor	59%	80%
22xx002054	Crushing/Procesing Equipment	43%	85%
22xx002078	Dumpers/Tenders	21%	41%
22xx002036	Excavators	59%	53%
22xx007015	Fellers/Bunchers/Skidders	59%	70%
22xx003020	Forklifts	59%	30%
22xx006020	Gas Compressors	43%	85%
22xx006005	Generator Sets	43%	68%
22xx002048	Graders	59%	64%
22xx005050	Hydro Power Units	43%	56%
22xx004056	Lawn and Garden Tractor	43%	44%
22xx002051	Off-Highway Truck	59%	80%
22xx002075	Off-Highway Tractor	59%	70%
22xx004056	Other Agricultural Equipment	59%	55%
22xx002081	Other Construction Equipment	59%	48%
22xx003040	Other General Industrial	43%	54%
22xx003050	Other Material Handling	21%	53%
22xx002003	Pavers	59%	66%
22xx002021	Paving Equipment	59%	59%
22xx002009	Plate Compactors	43%	55%
22xx006030	Pressure Washer	43%	85%
22xx006010	Pumps	43%	69%
22xx003060	Refrigeration/AC	43%	46%
22xx002015	Rollers	59%	62%
22xx002057	Rough Terrain Forklifts	59%	63%
22xx002063	Rubber Tire Dozer	59%	75%
22xx002060	Rubber Tire Loader	59%	71%
22xx002018	Scrapers	59%	70%
22xx002072	Skid Steer Loader	21%	58%
22xx001060	Specialty Vehicle/Carts	21%	58%
22xx002024	Surfacing Equipment	59%	49%
22xx003030	Sweepers/Scrubbers	43%	71%
22xx002006	Tampers/Rammers	43%	55%
22xx003070	Terminal Tractors	59%	78%
22xx005040	Tillers > 6 hp	59%	71%
22xx004026	Timmer/Edger/Brush Cutter	43%	91%
22xx002066	Tractor/Loader/Backhoe	21%	48%
22xx002030	Trenchers	59%	66%
22xx006025	Welders	21%	68%

1. 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-005b, December 2002

Table D-3. Total Estimated Project Emissions by Year of Construction Activity

Freeport Harbor Channel Improvement Project
LPP Alternative

Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	CO_2 Emissions (tons per year)			CH_4 Emissions (tons per year)			N_2O Emissions (tons per year)		
				2012	2013	2014	2012	2013	2014	2012	2013	2014
Contract 5: Ch to Brz thr Brzpt TB & PA 8			8									
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	1	24	8	2.8237	3.7649	0.6275	0.0002	0.0003	0.0000	0.0001	0.0001	0.0000
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	1	24	8	-	-	-	-	-	-	-	-	-
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	8	2.1653	2.8871	0.4812	0.0002	0.0002	0.0000	0.0001	0.0001	0.0000
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,136	8	102.4929	136.6572	22.7762	0.0075	0.0100	0.0017	0.0026	0.0035	0.0006
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	183	8	33.9854	45.3139	7.5523	0.0025	0.0033	0.0006	0.0009	0.0012	0.0002
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,651	8	912.4823	1,216.6431	202.7739	0.0665	0.0887	0.0148	0.0234	0.0312	0.0052
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	183	8	0.7286	0.9714	0.1619	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM,	1	24	8	1.7443	2.3258	0.3876	0.0001	0.0002	0.0000	0.0000	0.0001	0.0000
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	1	24	8	2.2402	2.9870	0.4978	0.0002	0.0002	0.0000	0.0001	0.0001	0.0000
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	314	8	6.6270	8.8361	1.4727	0.0005	0.0006	0.0001	0.0002	0.0002	0.0000
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	366	8	17.0725	22.7633	3.7939	0.0012	0.0017	0.0003	0.0004	0.0006	0.0001
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	366	8	28.6992	38.2656	6.3776	0.0021	0.0028	0.0005	0.0007	0.0010	0.0002
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	183	8	7.1754	9.5673	1.5945	0.0005	0.0007	0.0001	0.0002	0.0002	0.0000
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	1	64	8	3.3878	4.5170	0.7528	0.0002	0.0003	0.0001	0.0001	0.0001	0.0000
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL	1	4,014	8	393.5476	524.7302	87.4550	0.0287	0.0383	0.0064	0.0101	0.0134	0.0022
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	1	24	8	2.1653	2.8871	0.4812	0.0002	0.0002	0.0000	0.0001	0.0001	0.0000
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	10	8	0.8238	1.0984	0.1831	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	85	8	7.6689	10.2252	1.7042	0.0006	0.0007	0.0001	0.0002	0.0003	0.0000
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	10	8	1.2163	1.6218	0.2703	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80'	1	6,651	8	658.1167	877.4890	146.2482	0.0480	0.0640	0.0107	0.0169	0.0225	0.0037
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 56,000 GVW	1	61	8	7.4197	9.8929	1.6488	0.0005	0.0007	0.0001	0.0002	0.0003	0.0000
Contract 6: Ch to UTB thr UTB & PA 9			4									

Table D-3. Total Estimated Project Emissions by Year of Construction Activity

Freeport Harbor Channel Improvement Project
LPP Alternative

Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	CO_2 Emissions (tons per year)			CH_4 Emissions (tons per year)			N_2O Emissions (tons per year)		
				2012	2013	2014	2012	2013	2014	2012	2013	2014
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	1	24	4			2.5099			0.0002			0.0001
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	1	24	4			-			-			-
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	4			1.9247			0.0001			0.0000
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,173	4			94.0721			0.0059			0.0024
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	191	4			31.5299			0.0023			0.0008
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,868	4			837.5588			0.0611			0.0215
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	191	4			-			-			-
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM,	1	24	4			1.5078			0.0001			0.0000
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1	1	24	4			1.9913			0.0001			0.0001
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	381	4			7.1476			0.0005			0.0002
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	383	4			15.8804			0.0012			0.0004
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	383	4			26.6953			0.0019			0.0007
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	191	4			6.6570			0.0005			0.0002
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	45	4			1.8658			0.0001			0.0000
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	45	4			3.1365			0.0002			0.0001
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	25	4			0.8713			0.0001			0.0000
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	73	4			5.3454			0.0004			0.0001
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	73	4			7.8927			0.0006			0.0002
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2	1	120	4			8.5777			0.0006			0.0002
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80'	1	45	4			3.9580			0.0003			0.0001
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	1	80	4			2.4762			0.0002			0.0001
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)	1	40	4			-			-			-
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	1	40	4			3.2079			0.0002			0.0001
TOTALS				2,192.58	2,923.44	1,552.05	0.16	0.21	0.11	0.06	0.07	0.04

Table D-4. Total Estimated Project Emissions by Year of Construction Activity
Freeport Harbor Channel Improvement Project
LPP Alternative

	2012	2013	2014
CO_2	2192.58	2923.44	1552.05
CH_4	0.16	0.21	0.11
N_2O	0.06	0.07	0.04

Table E-1. Crew Size per Equipment
Freeport Harbor Channel Improvement Project
LPP Alternative

	Hopper Dredge		Cutterhead Dredge		
	Hopper Dredge Crew	Shore Crew	Cutterhead Dredge Crew	Shore Crew	Other Construction Equipment
Employees	22	8	46	6	6

Table E-2. Emission Factors for Employee Vehicles
Freeport Harbor Channel Improvement Project

County	Type of Vehicle	EPA Category[1]	Emisson Factor (g/mile)[2]		
			CO2	CH4	N2O
Brazoria	Cars	LDGV	202.3547	0.0147	0.0079
	Pickups	LDGT1	216.1203	0.0157	0.0101

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 estimated from emissions data provided in Climate Action Registry (California Climate Action Registry, 2009).

Table E-3. Summary of Employee Vehicles Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

Project Year	Type of Vehicle	EPA Category	Daily Vehicles (/day)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (tpy)		
							CO2	CH4	N2O
2011	Cars	LDGV	15	50.0	130	97,500	21.75	0.0016	0.0008
	Pickups	LDGT1	15	50.0	130	97,500	23.23	0.0017	0.0011
						2011 Total Mobile Emission	**44.97**	**0.0033**	**0.0019**
2012	Cars	LDGV	138	50.0	718	4,954,200	1,105.05	0.0803	0.0431
	Pickups	LDGT1	138	50.0	718	4,954,200	1,180.23	0.0857	0.0552
						2012 Total Mobile Emission	**2,285.28**	**0.1660**	**0.0983**
2013	Cars	LDGV	56	50.0	762	2,133,600	475.91	0.0346	0.0186
	Pickups	LDGT1	56	50.0	762	2,133,600	508.28	0.0369	0.0238
						2013 Total Mobile Emission	**984.19**	**0.0715**	**0.0423**
2014	Cars	LDGV	67	50.0	760	2,546,000	567.90	0.0413	0.0222
	Pickups	LDGT1	67	50.0	760	2,546,000	606.53	0.0441	0.0283
						2014 Total Mobile Emission	**1,174.42**	**0.0853**	**0.0505**
2015	Cars	LDGV	56	50.0	281	786,800	175.50	0.0127	0.0069
	Pickups	LDGT1	56	50.0	281	786,800	187.44	0.0136	0.0088
						2015 Total Mobile Emission	**362.94**	**0.0264**	**0.0156**

Notes:
1. Total VMT is assumed to be 50 miles/day round trip.
2. Annual travel = Daily vehicles * Total VMT * Travel days/yr.
3. Annual emissions = Emission factor * Annual travel * 1lb/453.6 grams * 1ton/2000lb

Table E-4. Annual Employee Vehicle Emissions
Freeport Harbor Channel Improvement Project
NED Alternative
(tons per year)

Year	CO2	CH4	N2O
Year 2011	44.975	0.003	0.002
Year 2012	2285.28	0.17	0.10
Year 2013	984.19	0.07	0.04
Year 2014	1174.42	0.09	0.05
Year 2015	362.94	0.03	0.02

Table F-1. LPP Alternative - Additional Maintenance Dredging - Assumptions for Marine Equipment Engines
Freeport Harbor Channel Improvement Project
Additional 1,280,000 cy/yr Maintenance Dredging

Activity	Equipment Type	Quantity	Total Installed Power (hp)	Engine Type	Engine Fuel Type	Engine Load Factor	Engine Horsepower (hp)	Hours of Operation per Day (hrs/day)	Daily Engine Usage (%)	Total Days of Operation (days)	Total Engine Hours of Operation (hrs)
Additional 1,280,000 cy/yr Maintenance Dredging	Hopper Dredge	1	14,000	Propulsion - Oceangoing	Diesel	0.8	9,000	20	65%	32	416
				Propulsion - Dredging	Diesel	0.8	9,000	20	35%	32	224
				Dredge Pump(s)	Diesel	0.8	3,000	20	35%	32	224
				Auxiliary - Oceangoing	Diesel	0.8	2,000	20	65%	32	416
				Auxiliary - Idling	Diesel	0.8	2,000	20	35%	32	224
	Survey Boat	1	2,000	Propulsion	Diesel	0.4	2,000	20	100%	6	128
				Auxiliary	Diesel	0.2	2,000	20	100%	6	128
	Shrimp Boat (Turtle Trawl)	2	600	Propulsion	Diesel	0.4	600	24	100%	22	1,075
				Auxiliary	Diesel	0.2	600	24	100%	22	1,075
Total Engine Hours											3,910

Notes:
1. Days of operation are determined assuming 40,000 CY/day production rate for a hopper dredge removing unconsolidated, predominantly silty dredged material.

Table F-2. LPP Alternative - Additional Mainenance Dredging - Marine Equipment Hours of Operation
Freeport Harbor Channel Improvement Project
Additional 1,280,000 cy/yr Maintenance Dredging

			Dredge								
			Generic Large Hopper Dredge					Crew/Survey Boat (Runabout)		Shrimp Boats (Total of Two)	
Contract No.	**Additional Volume/Disposal Site**	**Dredge**	Propulsion Ocean Going	Propulsion Dredging	Dredge Pump(s)	Auxillary Oceangoing	Auxiliary Idling	Propulsion	Secondary	Propulsion	Secondary
Additional Maintenance Dredging	1,280,000 CY of Additional Maintenance Material to ODMS	Hopper	416	224	224	416	224	128	128	1,075	1,075

Table F-3. LPP Alternative - Additional Maintenance Dredging - Marine Equipment Estimated Emissions
Freeport Harbor Channel Improvement Project
Additional 1,280,000 cy/yr Maintenance Dredging
(Tons per Year)

Phase No.	Pollutant	Dredge	Dredge									Total Emissions Per Year
			Generic Large Hopper Dredge					Crew/Survey Boat		Shrimp Boat		
			Propulsion Oceangoing	Propulsion - Dredging	Dredge Pump(s)	Auxiliary - Oceangoing	Auxillary - Dredging	Propulsion	Auxiliary	Propulsion	Auxiliary	
Additional 1,280,000 cy/yr Maintenance Dredging	CO_2	Hopper	1,732.60	932.94	310.98	385.02	64.01	63.87	36.58	160.96	92.17	**3,779.15**
	CH_4	Hopper	0.2217	0.1194	0.0398	0.0493	0.0066	0.0076	0.0038	0.0191	0.0095	**0.48**
	N_2O	Hopper	0.0493	0.0265	0.0088	0.0109	0.0015	0.0017	0.0008	0.0042	0.0021	**0.11**