Corpus Christi Liquefaction, LLC
Cheniere Corpus Christi Pipeline, L.P.

Corpus Christi Liquefaction Project

Resource Report 3 — Fisheries, Wildlife, and Vegetation

Docket Nos. CP12-___-000 and CP12-___-000

August 2012

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ACRONYMS AND ABBREVIATIONS

ATWS	additional temporary works space
CCBNEP	Corpus Christi Bay National Estuary Program
CCL Project	Corpus Christi Liquefaction Project
CFR	Code of Federal Regulations
cfu	colony forming unit
CCL	Corpus Christi Liquefaction, LLC
CCLNG	Corpus Christi LNG, L.P.
CCLNG Import Terminal	Corpus Christi LNG, L.P. import terminal
CCL Terminal	Corpus Christi Liquefaction Project Terminal
Corpus Christi Pipeline	Cheniere Corpus Christi Pipeline, L.P.
Commission	Federal Energy Regulatory Commission
DMPA	Dredged Material Placement Area
EFH	essential fish habitat
EPA	United States Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GMFMC	Gulf of Mexico Fishery Management Council
Gulf	Gulf of Mexico
HDD	horizontal directional drill
IMO	International Maritime Organization
lbs	pounds
LNG	liquefied natural gas
LNGC	liquefied natural gas carrier
m^3	cubic meter
MBTA	Migratory Bird Treaty Act
MMBtu	million British thermal units
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PCCA	Port of Corpus Christi Authority
Plan	FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan*
Pipeline	Corpus Christi Liquefaction Project Pipeline
ppt	parts per thousand
Procedures	FERC's *Wetland and Waterbody Construction and Mitigation Procedures*
Project	Corpus Christi Liquefaction Project
SAV	submerged aquatic vegetation
SPCC Plan	Spill Prevention, Control, and Countermeasures Plan
SWPPP	Stormwater Pollution Prevention Plan
TPWD	Texas Parks and Wildlife Department
TNHC	Texas Natural History Collection
TWS	temporary work space
µPa	1 micro Pascal
USACE	United States Army Corps of Engineers

USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VGP	Vessel General Permit

RESOURCE REPORT 3 – FISH, WILDLIFE, AND VEGETATION	
Filing Requirement	**Location in Environmental Report**
1. Classify the fishery type of each surface waterbody that would be crossed, including fisheries of special concern. (§380.12 (e) (1)).	Section 3.1.1; Section 3.1.2
2. Describe terrestrial and wetland wildlife and habitats that would be affected by the Project. (§ 380.12 (e) (2)).	Section 3.1.2; Section 3.1.4; Section 3.2.2; Section 3.2.3
3. Describe the major vegetative cover types that would be crossed and provide the acreage of each vegetative cover type that would be affected by construction. (§ 380.12 (e) (3)).	Section 3.1.5; Section 3.2.4
4. Describe the effects of construction and operation procedures on the fishery resources and proposed mitigation measures. (§ 380.12 (e) (4)).	Section 3.1.1.3; Section 3.1.1.4; Section 3.2.1.3
5. Evaluate the potential for short-term, long-term, and permanent impact on the wildlife resources and state-listed endangered or threatened species caused by construction and operation of the Project and proposed mitigation measures. (§ 380.12 (e) (4)).	Section 3.1.2.1; Section 3.1.2.2; Section 3.1.3.3; Section 3.1.3.4; Section 3.1.4; Section 3.1.6.1; Section 3.1.6.2; Section 3.2.2.2; Section 3.2.3; Section 3.2.5.2
6. Identify all federally listed or proposed endangered or threatened species that potentially occur in the vicinity of the Project and discuss results of consultations with other agencies. (§ 380.12 (e) (5)).	Section 3.1.6; Section 3.2.5.1; Appendices 3C, 3D, and 3E
7. Identify all federally listed essential fish habitat (EFH) that potentially occurs in the vicinity of the Project and the results of abbreviated consultations with NMFS, and any resulting EFH assessments. (§ 380.12 (e) (4 & 7)).	Section 3.1.1.1; Section 3.1.1.2; Appendix 3A
8. Describe any significant biological resources that would be affected. Describe impact and any mitigation proposed to avoid or minimize that impact. (§ 380.12 (e) (4 & 7)).	Section 3.1; Section 3.2.
9. Provide copies of correspondence from federal and state fish and wildlife agencies along with responses to their recommendations to avoid or limit impact on wildlife, fisheries, and vegetation.	Resource Report 1, Appendix 1B
10. Provide a list of significant wildlife habitats crossed by the project. Specify locations by milepost, and include length and width of crossing at each significant wildlife habitat.	Not Applicable (no significant wildlife habitats crossed)

3.0 FISHERIES, WILDLIFE, AND VEGETATION

Corpus Christi Liquefaction, LLC ("CCL") and Cheniere Corpus Christi Pipeline, L.P. ("Corpus Christi Pipeline") propose to construct and operate a natural gas liquefaction and export plant and import facilities with regasification capabilities ("CCL Terminal") and an associated 23-mile-long pipeline ("Pipeline") (collectively referred to as the "CCL Project" or "Project"), to be located at the previously authorized, but not constructed, liquefied natural gas ("LNG") import terminal site ("CCLNG Import Terminal") and pipeline route in San Patricio and Nueces Counties, Texas. The CCL Terminal has been designed to produce approximately 782 million MMBtu per year of LNG. In addition, the CCL Terminal includes approximately 400,000 MMBtu per day of LNG regasification capacity. The Project facilities will consist of:

Terminal Facilities:

- Liquefaction facilities;
- LNG storage;
- LNG vaporization and send out;
- Marine terminal and LNG transfer lines;
- Vapor handling system; and
- Utilities, infrastructure, and support systems.

Pipeline Facilities:

- 23-mile natural gas transmission pipeline;
- Two compressor stations; and
- Meter stations and appurtenant facilities.

A description of the Project facilities and construction, operation, and maintenance procedures is included in Resource Report 1. Resource Report 1 also describes the previous review and authorizations received on April 18, 2005 under Federal Energy Regulatory Commission ("FERC" or "Commission") Docket No. CP04-37-000 by Corpus Christi LNG, L.P. ("CCLNG")[1] for the CCLNG Import Terminal, and by Cheniere Corpus Christi Pipeline Company[2] in Docket Nos. CP04-44-000, CP04-45-000, and CP04-46-000 for the Pipeline.

Resource Report 3 provides a description of existing conditions and potential Project impacts on fisheries, wildlife and vegetation. Section 3.1 includes information on the CCL Terminal site and Section 3.2 includes information on the Pipeline. For the CCL Terminal site, Section 3.1.1 describes Fisheries, Section 3.1.2 describes Terrestrial Wildlife; Section 3.1.3 describes Marine Resources; Section 3.1.4 describes Migratory Birds; Section 3.1.5 describes Vegetation; and Section 3.1.6 describes Threatened and Endangered Species. For the Pipeline, Section 3.2.1 describes Fisheries; Section 3.2.2 describes

[1] Now Corpus Christi LNG, LLC.
[2] Now Corpus Christi Pipeline.

Wildlife; Section 3.2.3 describes Migratory Birds; Section 3.2.4 describes Vegetation; and Section 3.2.5 describes Threatened and Endangered Species.

3.1 CCL TERMINAL

3.1.1 Fisheries

The Gulf of Mexico ("Gulf") and its surrounding estuarine waters support a great diversity of fishery resources as nearshore Gulf fish communities typically consist of species found in both estuarine and offshore oceanic habitats. Tunnell et al. (1996) report the occurrence of 234 fish species within the Corpus Christi Bay National Estuary Program ("CCBNEP") study area, which includes the Aransas, Corpus Christi, and Upper Laguna Madre estuary systems. Within Corpus Christi Bay, the CCL Terminal site encompasses four aquatic/intertidal habitat types including open bay, seagrass, coastal marsh, and tidal flats. The following paragraphs provide a general description of the fishery resources likely to occur in each of these habitat types.

Open bay communities support a variety of benthic invertebrates, including, but not limited to, nematodes, harpacticoid copepods, gastrotrichs, clams, snails, polychaete worms, amphipods, and crabs. Epibenthos typically prefer protected areas such as seagrass beds and salt marshes; however, they also occur in the open bay communities. Penaeid shrimp, roughback shrimp (*Trachypenaeus similis*), mantis shrimp (*Squilla empusa*), and blue crabs (*Callinectes sapidus and C. similis*) are the most abundant epifauna in these areas (Murray and Jinnette 1976; Armstrong 1987). Other epifaunal crustaceans that occur in open bay habitats include *Gammarus mucronatus*, Xanthid crabs (i.e., mud crab (*Neopanope texana*) and hermit crab (*Pagurus annulipes*)), and grass shrimp (*Palaemonetes pugio*) (Tunnell et al. 1996; Armstrong 1987). The nektonic community (occupying the water column above the substrate) of open bays includes a variety of invertebrates and fishes. Common nektonic invertebrates include: zooplankton, a variety of cnidarians (jellyfish) and the bay squid (*Lolliguncula brevis*) (Britton and Morton 1989). Fish species common in open bay habitats include the Atlantic croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus),* bay anchovy (*Anchoa mitchilli*), hardhead catfish (*Arius felis*), pinfish (*Lagodon rhomboides*), sand seatrout (*Cynoscion arenarius*), star drum (*Stellifer lanceolatus*), spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), southern flounder (*Paralichthys lethostigma*), Gafftopsail catfish (*Bagre marinus*), and striped mullet (*Mugil cephalus*) (Murray and Jinette 1976; Bowman et al. 1976; Hildebrand and King 1979; Moore 1978; Armstrong 1987; Tunnell et al. 1996).

Seagrasses support a variety of invertebrates, including various annelids, polychaetes, crustaceans, gastropods and bivalves. Seagrass habitats also are often populated by diverse and abundant fish faunas (Zieman and Zieman 1989) because the seagrass canopy provides shelter for juvenile fish (e.g., spotted seatrout and red drum, and for small permanent residents such as the tidewater silversides (*Menidia peninsulae*), rainwater killifish (*Lucania parva*), pinfish (*L. rhomboides*), bay anchovy (*A. mitchilli*), striped mullet, menhaden (*Brevoortia* spp.), silver perch (*Bairdiella chrysura*), dusky pipefish (*Syngnathus floridae*), and speckled worm eel (*Myrophis punctatus*) (Zimmerman 1969; Rickner 1975;

Chaney 1988; Gourley 1989; Tunnell et al. 1996). Seagrass beds also provide important feeding grounds for larger invertebrate and fish predators that are attracted to these areas in pursuit of the aforementioned prey species (Gulf of Mexico Fishery Management Council ("GMFMC") 1998). Such species include the hardhead catfish, spotted seatrout, red drum, southern flounder, spot (*Leistomus xanthurus*), and various sharks and rays (Zimmerman 1969; Rickner 1975; Chaney 1988; Gourley 1989; Tunnell et al. 1996).

During periods of inundation, coastal marshes provide habitat for a variety of filter-feeding molluscs, oligochaetes, polychaetes, nematodes, fiddler crabs (*Uca* spp.), mud crabs (*Rhithropanopeus* spp.), grass shrimp, penaeid shrimp, and amphipods (*Orchestia* spp.). The abundance of emergent and epiphytic vegetation found in coastal marshes supports a variety of grazing invertebrates, such as snails and various insects. Invertebrate predators, including crustacean larvae, adult copepods (Marshall and Orr 1960), odonates, coleopterans, dipterans, amphipods (Davis and Gray 1966), and blue crabs (Tunnell et al. 1996) also are common inhabitants of coastal marshes. Much like seagrass habitats, coastal marshes are an important nursery habitat for a variety of marine and estuarine fishes. In addition to these species, coastal marshes support several small, resident fish, including important forage species, such as killifishes, menhaden, the bay anchovy, striped mullet, and mosquito fish (*Gambusia affinis*). Moving into tidal marshes to feed on these forage fishes are a variety of larger predatory fishes, such as tarpon (*Megalops atlanticus*).

During periods of inundation, tidal flats are inhabited by a variety of benthic invertebrates, including polychaetes, gastropods, and crustaceans (i.e., blue crab and *Uca* spp.), that feed on the abundant microfauna found in these areas (Withers 1994). Small fish will move into these areas to feed on the above-mentioned invertebrates; common fish species include sheepshead minnow (*Cyprinodon variegatus*), Gulf killifish (*Fundulus grandis*), rough silversides (*Membras martinica*), and larval inshore lizard fish (*Synodus foetens*), southern flounder, red drum, and spotted sea trout (Harrington and Harrington 1972; Pfeifer and Wiegert 1981; Pulich et al. 1982).

3.1.1.1 Fishery Classification

The fish species known to occur in Corpus Christi Bay, most of which are temperate in biogeographic distribution with a few tropical species (Tunnell et al. 1996), can be classified as warmwater marine or estuarine. Table 3.1-1 provides a list of representative commercial and game fish species known to occur in Corpus Christi Bay.

TABLE 3.1-1

Representative Game and Commercial Fish Species Known to Occur in Corpus Christi Bay

Common Name	Scientific Name	Fishery Classification
Brown shrimp	*Farfantepenaeus aztecus*	Warmwater marine/estuarine
Pink shrimp	*Farfantepenaeus duorarum*	Warmwater marine/estuarine
White shrimp	*Litopenaeus setiferus*	Warmwater marine/estuarine
Red drum	*Sciaenops ocellatus*	Warmwater estuarine
Spanish mackerel	*Scomberomorus maculatus*	Warmwater marine
Atlantic croaker	*Micropogonias undulatus*	Warmwater marine/estuarine
Black drum	*Pogonias cromis*	Warmwater marine/estuarine
Gafftopsail catfish	*Barge marinus*	Warmwater marine/estuarine
Sand seatrout	*Cynoscion arenarius*	Warmwater estuarine
Sheepshead	*Archosargus probatocephalus*	Warmwater marine/estuarine
Southern flounder	*Paralichthys lethostigma*	Warmwater marine/estuarine
Spotted seatrout	*Cynoscion nebulosus*	Warmwater estuarine
Striped mullet	*Mugil cephalus*	Warmwater marine

3.1.1.2 Fisheries of Special Concern

Fish species of special concern that occur in the vicinity of the CCL Terminal site include state- and federally-listed threatened and endangered species, those with essential fish habitat ("EFH") designated in the Corpus Christi Bay estuary, and those of commercial and recreational value. Threatened and endangered fish species are discussed in Section 3.1.6. An overview of other species of concern is provided below.

Essential Fish Habitat

In the Magnuson-Stevens Act, Congress defined EFH as consisting of "waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (16 United States Code 1802(10)). Specific habitats include all estuarine water and substrate (mud, sand, shell and rock); all associated biological communities, such as sub-tidal vegetation (seagrasses and algae) and the adjacent inter-tidal vegetation (marshes and mangroves). EFH represents areas of high economic importance due to the dependence of recreational and commercial fisheries directly and indirectly associated with these areas.

The National Oceanic and Atmospheric Administration ("NOAA") Fisheries Habitat Conservation Essential Fish Habitat Mapper indicates that EFH is available for three shellfish species (juveniles and adults of brown, pink, and white shrimp) and five species of coastal pelagic finfish (juveniles and adults of gray snapper, red drum, and Spanish mackerel, king mackerel, and cobia), eight sharks (lemon, bull, finetooth, spinner, scalloped hammerhead, bonnethead, blacktip, and Atlantic sharpnose), and 14 species

of reef fish and snapper-grouper complex species within Corpus Christi Bay (NOAA Fisheries 2012a). These species are found in a wide range of salinities; therefore, localized changes in salinity at the CCL Terminal site are unlikely to adversely impact these species. Of these species, adult gray snapper and adult pink shrimp are completely absent from Corpus Christi Bay (E&E 2003).

A full EFH assessment was performed for this Project in August 2012. The assessment includes life history and relative abundance of all species where EFH is available within Corpus Christi Bay, potential impacts, and conservation measures to avoid and/or minimize impacts. The assessment also includes correspondence with NOAA Fisheries. The EFH assessment is included as Appendix 3A of this resource report.

Recreational and Commercial Fisheries

Of the fishing effort in Texas bays and passes from 1988 to 1998, the Corpus Christi Bay system received an average of 9.6 percent of the private-boat and 17.38 percent of the recreational boat fishing pressure per year (Green et al. 2002). The Corpus Christi Bay system also accounts for approximately 9 and 21 percent of the annual private and recreational boat landings, respectively (based on 10-year average, May 1988 – May 1998). The principle finfish species harvested by sport-boat anglers in the study are Atlantic croaker, black drum, gafftopsail catfish, red drum, sand seatrout, sheepshead (*Archosargus probatocephalus*), southern flounder, and spotted seatrout (Green et al. 2002).

In 2000, approximately 27 million pounds ("lbs") of seafood worth more than $42.5 million was harvested in Texas bay systems, of which Corpus Christi Bay accounted for approximately 738,782 lbs. valued at $1,043,829 (Auil-Marshalleck et al. 2002). The most important commercial finfish species currently reported from the study area are black drum, southern flounder, sheepshead, and striped mullet. Collectively, these species accounted for about 90 percent of the 237,792 lbs. of finfish harvested in Corpus Christi Bay in 2000, which had an ex-vessel value of $336,312 (Auil-Marshalleck et al. 2002).

Principal shellfish species harvested in the study area include brown shrimp, pink shrimp, white shrimp, blue crab, and eastern oyster (*Crassostrea virginica*), of which brown shrimp is the most common species (Auil-Marshalleck et al. 2002). In 2000, these species accounted for approximately 99 percent of the 500,990 lbs. of shellfish harvested in Corpus Christi Bay, which had an ex-vessel value of $707,517. Historically, the eastern oyster was one of the most commercially important shellfish species in Corpus Christi Bay, but has not been harvested from this area since 1997 (Auil-Marshalleck et al. 2002).

3.1.1.3 Construction and Operation Impacts

Construction of the CCL Terminal will involve dredging of the berthing area and turning basin to accommodate large LNG carriers ("LNGCs"), and construction of dock facilities. Dredging of these facilities will permanently convert existing habitat types (open bay, seagrass, coastal marsh, and tidal flat) to a deeper water habitat, (similar to that which currently exists in the La Quinta Channel. Currently, the United States Army Corps of Engineers ("USACE") is conducting dredging in the CCL Terminal area for the La Quinta Channel Extension (see Resource Report 1, Section 1.13 for more information).

Approximately 118.0 acres would be affected by dredging. Of the 118.0 acres, approximately 95.9 acres is currently shallow open water habitat that would be deepened to 46 feet NAVD88 plus 2 feet paid overdredge plus 2 feet advanced maintenance, with side slopes of 3:1 to match the adjacent La Quinta Turning Basin. The Project would therefore permanently alter this habitat, changing it from shallow water to deep water. Impact on EFH species would depend on the species use of deeper water habitats. Many of the species that occupy shallow-water habitats may also inhabit the deeper water habitats that currently exist in the adjacent La Quinta Channel and Turning Basin sometime during their life cycle. Many species reside or migrate through both inshore and offshore areas at different stages of their lives and during different seasons throughout the year.

Of the 95.9 acres of shallow open water habitat that would be dredged, approximately 9.7 acres is currently submerged aquatic seagrass beds, 6.8 acres is cordgrass saltmarsh, another 2.14 acres is currently coastal marsh and vegetated tidal flat, and another 7.6 acres is currently black mangrove. Portions of these habitats would be permanently converted to open water habitat. Of the 26.2 acres of existing EFH functioning habitat within the CCL Terminal site, 22.8 acres of seagrass, coastal marsh, cordgrass saltmarsh, vegetated tidal flat, and black mangrove would be lost. These habitats are valuable habitat types relative to fish and EFH as they provide a food rich environment for productive foraging and refuge to juveniles and prey species from predators. Alteration of these habitats can cause a reduction or loss of juvenile or prey species' rearing habitats and an alteration in the timing of life history stages.

Although dredging activities will have a permanent impact on species specific to shallow habitats, most species are capable of occupying a variety of habitats, including those created by dredging for the CCL Terminal. Creation of deeper water habitats will also provide additional thermal refuge for shallow-water species during summer and winter temperature extremes.

In addition to the loss or alteration of certain shallow water aquatic habitats, the primary impacts to fishes associated with dredging include possible entrainment of organisms by dredging machinery and increased turbidity due to re-suspension of bottom sediments (Nightingale and Simenstad 2001). Incidental take of benthic organisms due to entrainment will potentially occur during the dredging of the berthing and maneuvering areas, but would be expected to have a minimal impact on the fishery resources of Corpus Christi Bay. Maintenance dredging occurs throughout Corpus Christi Bay and in the La Quinta Channel on a periodic basis, approximately once every four years. CCL anticipates maintenance dredging activities within the berth area not more than once every three years. Each maintenance dredging event is anticipated to last for less than 30 days, including mobilization and demobilization activities, and dredge volumes are not expected to exceed 200,000 cubic yards. Impacts from maintenance dredging are expected to be similar to the impacts described above.

Tubular steel piles will be installed as part of the construction for breasting/mooring dolphins and unloading platforms/trestles. Pile driving activities are expected to occur up to 24 hours per day, seven days per week, over an approximately four- to six-month period. In some cases, driving steel piles can generate intense underwater sound pressure waves that can adversely affect nearby marine organisms. Although the effects of pile driving are poorly studied and there appears to be substantial variation in a

species' response to sound, intense sound pressure waves can change fish behavior or injure/kill fish through rupturing swim bladders or causing internal hemorrhaging. The degree to which an individual fish exposed to sound waves would be affected is dependent upon variables such as the peak sound pressure level and frequency as well as the species, size, and condition of a fish (e.g., small fish are more prone to injury by intense sound waves than are larger fish of the same species). In some cases, sound pressure levels greater than 155 decibels can illicit avoidance behaviors or stun small fish (NOAA Fisheries 2003). Sounds greater than 190 decibels are thought to physically injure some fish (Hastings 2002). The presence of predators can also influence how a fish might be affected by pile driving (e.g., fish stunned by pile driving activities may be more susceptible to predators).

The intensity of the sound pressure levels produced during pile driving depends on a variety of factors including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile driving hammer. For example, driving hollow steel piles with impact hammers produce intense, sharp spikes of sound that can injure fish. In some cases, fish may be startled by the first few strikes of an impact hammer. However, this response can wane and the fish may remain in the area (NOAA Fisheries 2001). As such, the potential effect on fish from impact hammers could be magnified since fish would not only be exposed to intense sound waves but may not avoid pile driving activities, which would prolong their exposure to the potentially harmful sounds and increase their risk of injury or death. In a review of studies documenting fish kills associated with pile driving, NOAA Fisheries (2003) reported that all have occurred during use of an impact hammer on hollow steel piles. On the other hand, the rapid repetitions of vibratory hammers produce relatively low intensity sound waves. Evidence also suggests that fish consistently display an avoidance response to sound from a vibratory hammer, even after repeated exposure (Dolat 1997; Knudsen et al. 1997).

The type of hammer that will be used to drive piles during construction has not yet been identified. Driving tubular steel piles with an impact hammer in similar settings has been shown to generate sound levels from 192 to 194 decibels, above the level that is thought to injure some fish. Depending on the specific conditions at the CCL Terminal site, these sounds can have a transmission loss rate of 0.021 to 0.046 decibels per foot (Nedwell and Edwards 2002; Nedwell et al. 2003). Based on these values, the use of an impact hammer at the Terminal site could generate underwater sound levels great enough to injure some fish from a steel pile and otherwise affect some fish as far as 1,860 feet from a steel pile (i.e., 155 decibels). Although the sound waves of the greatest intensity will be limited to the immediate vicinity of the piles within the slip, sound levels of 155 decibels could extend to the far shore of the La Quinta Channel while piles for some of the mooring dolphins are being driven. Because the piles will be located in a recently dredged slip, it is likely that construction noise and activities will cause many marine species to avoid the area of the most intense sound levels.

Ship and boat traffic associated with construction and operation of the CCL Terminal will also generate underwater sounds. Although vessel sounds will not generally be of the intensity produced from driving steel piles, vessels (LNGCs, tugs, construction barges) operating in the La Quinta Channel may cause

sounds that elicit responses in fish. Most research suggests that fish exhibit avoidance behavior in response to engine noise (International Council for the Exploration of the Sea 1995). At the same time, research conclusions tend to suggest that since the effects are transient (i.e., once the ship passes, behavior returns to normal), then the long-term effects on populations are negligible. However, it is nearly impossible to separate the effects of noise disturbance from other modern stresses on fish populations such as pollution or overfishing (Stocker 2001).

CCL does not expect fisheries to be impacted by the operation of the CCL Terminal. Operation of the marine facilities will involve frequent berthing of large ships and an increase in large-vessel traffic in the La Quinta Channel, but such activities are common in the vicinity of the CCL Terminal site and therefore a significant impact due solely to CCL Terminal operation is not expected.

Every ship has the potential to transport invasive species on its hull, and over the past several centuries the green crab (*Carcinus maenas*) and the periwinkle (*Littorea littorea*) have been transported by vessel transits across the Atlantic Ocean. The effect of invasive species on local benthic habitat is variable, depending on their behavior, physiological tolerances for temperature, salinity, and other abiotic factors, competitiveness with native species, opportunistic characteristics, and a variety of other factors. Given the short stay of each vessel, invasion by reproduction will be minimized.

The construction and dredging activities may lead to a temporary increase in sedimentation within Corpus Christi Bay in the immediate CCL Terminal area. The direct impact of sedimentation could be increased turbidity within the water column due to the suspension of sediment from the dredging. However, a turbid water column is likely common in the La Quinta Channel due to the deep draft ship traffic as well as the current dredging associated with the La Quinta Channel Extension.

The mechanical suspension of sediments also has the potential to affect EFH by impacting the foraging and habitat afforded by the submerged aquatic vegetation ("SAV") communities in the vicinity of the CCL Terminal site, as well as the reproductive success of certain taxa listed under EFH. However, the type of dredge equipment proposed for the CCL Terminal site will limit the resuspension of sediments into the water column, thus minimizing or limiting the impacts to EFH. The tides are wind dominated, which results in relatively higher tides in summer and spring with lower tides in winter and fall because of the prevailing wind. Because of the change in the width to depth ratio of the La Quinta Channel, overall currents would be expected to be relatively low, particularly at or near the bottom where dredging would occur. Based on the general hydraulic characteristics of the site and the proposed depth of dredging, most of the sediment that would become suspended during the dredging process is expected to be short term and the water quality would return to background levels a short distance from the point of disturbance (McLellan et. al., 2004). Sediments are anticipated to settle within several hundred feet of the cutterhead, largely within the dredging footprint. A more detailed discussion on dispersion of sediments is provided in Resource Report 2.

Impacts resulting from sedimentation are expected to be temporary, short-term, and localized based on the following reasons:

- The materials to be dredged are primarily stiff clays with some silty deposits. These types of soils typically do not create high turbidity levels during dredging;
- The dredging will be performed with a hydraulic cutterhead dredge, which generally creates less turbidity than other types of dredges (i.e., mechanical bucket or hopper dredges);
- With a cutterhead dredge, the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity; and
- Considering the hydraulic characteristics of the site and the depth of excavation, most of the sediment that does become suspended during the dredging process is expected to settle within or near the dredging footprint as opposed to migrating to adjacent areas.

Other short-term impacts potentially occurring during construction include spills or leaks of hazardous materials and temporary water quality impacts resulting from stormwater runoff. CCL will implement its Spill Prevention, Control, and Countermeasure Plan ("SPCC Plan") to avoid or minimize such impacts (see Appendix 2B of Resource Report 2). To facilitate stormwater drainage, a system of drainage ditches will be constructed within the CCL Terminal site. These ditches will connect to a larger, existing drainage ditch that runs along the western edge of the CCL Terminal site (the La Quinta Ditch) and flows into Corpus Christi Bay. Adherence to National Pollutant Discharge Elimination System ("NPDES") regulations will minimize impacts to fisheries resources at the CCL Terminal site through the protection of water quality from stormwater discharges.

3.1.1.4 Mitigation

CCL will implement the FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* ("Plan") and *Wetland and Waterbody Construction and Mitigation Procedures* ("Procedures") to prevent upland construction activities from impacting finfish and/or shellfish habitats. Impacts to coastal marsh and seagrass habitats will be mitigated through implementation of CCL's Aquatic Resources Mitigation Plan (Appendix 3B of this resource report). A summary of the proposed mitigation is discussed in Section 3.1.5.3.

3.1.2 Terrestrial Wildlife

The CCL Terminal site lies within Blair's (1950) Tamaulipan Biotic Province, which supports a diverse fauna composed of a mixture of species common in neighboring biotic provinces, including neotropical species from the south, grassland species from the north and northwest, Austroriparian species from the northeast, and some Chihuahuan species from the west and southwest.

The CCBNEP (Tunnell et al. 1996) estimates that a total of 924 vertebrate species occur within the CCBNEP study area, which includes the CCL Terminal site. This includes 30 amphibians, 87 reptiles, 494 birds, and 79 mammals. The CCBNEP study area amphibians and reptiles are predominantly

terrestrial, with the exception of five species of sea turtles. Birds constitute the largest vertebrate group, including 19 orders and 55 families. With 155 species, *Passeriformes*, which includes the majority of the Neotropical migrants, is the most abundant group of birds. Most of the waterbirds potentially occurring in the CCBNEP study area are in one of two groups: shorebirds (*Charadriiformes*), with 80 species, and waterfowl (*Anseriformes*), with 38 species. The CCBNEP study area mammals are predominantly terrestrial, with the exception of 17 species of marine mammals.

The CCL Terminal site contains six habitat types including open bay, seagrass, coastal marsh, tidal flat, coastal grasses and forbs, and scrub/shrub. The following paragraphs provide an overview of the wildlife resources likely to occur in these habitat types.

Seagrass beds are inhabited by a variety of birds, including many members of the families waders (*Ardeidae*), sandpipers (*Scolopacidae*), plovers and allies (*Charadriidae*), gulls and terns (*Laridae*), pelicans (*Pelecanidae*), cormorants (*Phalacrocoracidae*), grebes (*Podicipedidae*), loons (*Gaviidae*), rails and allies (*Rallidae*), eagles and ospreys (*Accipitridae*), and waterfowl (*Anatidae*) (Tunnell et al. 1996).

Due to salinity stress, few species of reptiles and no amphibians are likely to occur in the coastal marshes at the CCL Terminal site (Tunnell et al. 1996). However, some species, such as the diamondback terrapin (*Malaclemys terrapin littoralis*) and Gulf salt marsh snake (*Nerodia fasciata clarki*), are known to inhabit brackish marshes along the Gulf Coast (Carr 1952; Garrett and Barker 1987). The American alligator (*Alligator mississipiensis*) utilizes low-salinity coastal marshes as both feeding and nesting areas (Garrett and Barker, 1987). Many species of wading and aquatic shorebirds feed on the emergent plants, benthic invertebrates, and small fishes found in coastal marshes (Bellrose 1976). Some of the common bird species likely to inhabit CCL Terminal site coastal marshes include mottled ducks (*Anas fulvigula*), lesser snow goose (*Chen caerulescens*), willets (*Cataptrophorus semipalmatus*), clapper rails (*Rallus longirostris*), great blue heron (*Ardea herodias*), tricolored heron (*Egretta tricolor*), black-crowned night heron (*Nycticorax nycticorax*), great egret (*Casmerodius albus*), snowy egret (*Egretta caerulea*), lesser scaup (*Aythya affinis*), bufflehead (*Bucephala albeola*), white pelican (*Pelecanus erythrorhynchos*) and the cormorants (*Phalacrocorax* spp.) (Bent 1929; Daiber 1982; Stutzenbaker 1988; Ruth 1990; Tunnell et al. 1996). Herbivorous mammals, such as nutria (*Coypus coypu*) and white-tailed deer (*Odocoileus virginianus*), are known to feed on marsh vegetation (White 1973; Tunnell et al. 1996). Few carnivorous rodents actually reside within coastal marshes. However, the rice rat (*Oryzomys palustris*) is considered a wetland species (Hamilton 1976; Shard 1967) that is common within the CCL Terminal site. Other mammals that occasionally forage in coastal marshes include the cotton rat (*Sigmodon hispidus*), fulvous harvest mouse (*Reithrodonomys fulvescens*), house mouse (*Mus musculus*), and raccoon (*Procyon lotor*) (Linscombe and Kinler 1985).

Tidal flats provide excellent habitat for numerous species of gulls, terns, herons, shorebirds, and wading birds. Some common species known to occur in the vicinity of the CCL Terminal site include the laughing gull (*Larus atnicilla*), ring-billed gull (*Larus delawarensis*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), great blue heron, snowy egret, sanderlings (*Calidnis alba*), least sandpiper (*Calidnis minutilla*), roseate spoonbill (*Ajaia ajaja*), and white ibis (*Eudocimus albus*) (Tunnell

et al. 1996). Mammals likely to occur within the CCL Terminal site tidal flats include the gray fox (*Urocyon cineroargentatus*), raccoon, coyote (*Canis latrans*), white tailed deer, and eastern cottontail (*Sylvilagus floridanus*) (Tunnell et al. 1996).

At least 19 species of lizards and 36 species of snakes occur in the Tamaulipan Biotic Province (Blair, 1950) and therefore could potentially occur in the terrestrial portion (coastal grasses and forbs, and scrub/shrub habitat types) of the CCL Terminal site. Amphibian species most likely to occur within the CCL Terminal site include Blanchard's cricket frog (*Acnis creptians blanchardi*), Texas toad (*Bufo speciosus*), Great Plains narrowmouth toad (*Gastnophryne olivacea*), and bullfrog (*Rana catesbiana*). Terrestrial reptiles most likely to occur within the CCL Terminal site include the western glass lizard (*Ophisaurus attenuatus attenuatus*), six-lined racerunner (*Cnemidophorus sexlineatus soxlineatus*), keeled earless lizard (*Holbnookiapropinqua propinqua*), Texas spotted whiptail (*Cnemidophonus gulanis*), western coachwhip (*Masticophis flagellum tesaceus*), ground snake (*Sonora semiannulata*), and western diamondback rattlesnake (*Crotalus atrox*). Bird species of the Tamaulipan Biotic Province (Blair 1950) associated with terrestrial habitats similar to those that occur within the CCL Terminal site include many species of raptors and songbirds. At least 61 mammalian species occur or have occurred within recent times in the Tamaulipan Biotic Province (Blair 1950). Mammals likely to occur in the terrestrial portion of the CCL Terminal site include the black-tailed jackrabbit (*Lepus californicus*), feral hogs (*Sus scrofa*), Gulf Coast kangaroo rat (*Dipodomys compactus*), rice rat (*Oryzomys palustris*), fulvous harvest mouse (*Reithrodontomys fulvescens*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and coyote (*Canis latrans*).

3.1.2.1 Construction and Operation Impacts

Most of the CCL Terminal-related disturbances will occur in previously disturbed areas, which are already marginal habitat for wildlife. However, construction and operation of the CCL Terminal will have a slight impact on wildlife resources through the permanent loss or conversion of non-industrial habitats. Other impacts (e.g., incidental take of wildlife) are expected to be minimal. Areas adjacent to the CCL Terminal site and throughout the Corpus Christi Bay area are also heavily industrialized and likely deter faunal resources from utilizing the area. For opportunistic species that thrive in disturbed habitats, the adjacent areas provide similar and ample habitats for wildlife displaced temporarily during and permanently after construction of the CCL Terminal. Construction within the scrub/shrub habitat type will involve clearing of shrubby and herbaceous undergrowth. Following construction, these cleared areas will be maintained in an herbaceous state or will be part of the CCL Terminal. The conversion of existing scrub/shrub habitat to grassland are not expected to have a significant impact on the faunal resources within the CCL Terminal site as most of these species typically inhabit both habitat types.

3.1.2.2 Mitigation

To minimize impacts to wildlife, CCL has selected a highly disturbed site to construct the CCL Terminal. To avoid construction related impacts to wildlife habitats, CCL has restricted the size of construction

areas to the maximum practicable extent. CCL will also implement the FERC's Plan and Procedures to avoid or minimize off-site impacts.

3.1.3 Marine Resources

3.1.3.1 Marine Mammals

A number of marine mammals are commonly observed in the Gulf, some species with a greater affinity to coastal, inshore waters, while others are more commonly observed offshore in deeper, pelagic waters. Many species are also commonly observed in shipping channels in Texas and Louisiana, the most common and prolific being the bottlenose dolphin. Marine mammal movements and migrations are often related to both the physical and biological attributes of the ocean, with animals avoiding extreme temperatures and following food sources. Enacted in October 21, 1972, the Marine Mammal Protection Act serves to protect all marine mammals, both in coastal waters and on the high seas. Twenty-nine species of marine mammals have been observed in the Gulf, seventeen of which are also listed as threatened or endangered by the federal and/or state governments (Table 3.1-2). The threatened and endangered species assessment for aquatic species, including marine mammals, was performed in July 2012. This assessment is included in Appendix 3C of this resource report.

TABLE 3.1-2

Marine Mammals that Have Been Observed in the Gulf of Mexico

Common Name	Scientific Name	Status	
		Federal	Texas
Northern Right Whale[1]	*Eubalaena glacialis*	E	E
Humpback Whale[1]	*Megaptera novaeangliae*	E	E
Fin Whale[1]	*Balaenoptera physalus*	E	E
Sei Whale[1]	*Balaenoptera borealis*	E	
Minke Whale	*Balaenoptera acutorostrata*		
Blue Whale[1]	*Balaenoptera musculus*	E	
Sperm Whale[1]	*Physeter macrocephalus*	E	E
Dwarf Sperm Whale	*Kogia simus*		T
Pygmy Sperm Whale	*Kogia breviceps*		T
Killer Whale	*Orcinus orca*		T
Pygmy Killer Whale	*Feresa attenuate*		T
Cuvier's Beaked Whale	*Ziphius cavirostris*		T
Gervais' Beaked Whale	*Mesoplodon europaeus*		T
Blainville's Beaked Whale	*Mesoplodon densirostris*		
Sowerby's Beaked Whale	*Mesoplodon bidens*		
Bryde's Whale	*Balaenoptera edeni*		
Short-finned Pilot Whale	*Globicephala macrorhynchus*		T
False Killer Whale	*Pseudorca crassidens*		T
Melon-headed Whale	*Peponocephala electra*		
Atlantic Spotted Dolphin	*Stenella frontalis*		T
Pantropical Spotted Dolphin	*Stenella attenuate*		

TABLE 3.1-2

Marine Mammals that Have Been Observed in the Gulf of Mexico

Common Name	Scientific Name	Status	
		Federal	Texas
Striped Dolphin	*Stenella coeruleoalba*		
Clymene Dolphin	*Stenella clymene*		
Spinner Dolphin	*Stenella longirostris*		
Bottlenose Dolphin	*Tursiops truncates*		
Risso's Dolphin	*Grampus griseus*		
Fraser's Dolphin	*Lagenodelphis hosei*		
Rough-toothed Dolphin	*Steno bredanensis*		T
West Indian Manatee	*Trichechus manatus*	E	

[1] Indicates species under the jurisdiction of NOAA Fisheries (NOAA Fisheries 2012b)
T = Threatened
E = Endangered

3.1.3.2 Sea Turtles

Five of the world's seven sea turtle species have been recorded in the Gulf: green, hawksbill, Kemp's ridley, leatherback, and loggerhead. All five species are listed as threatened or endangered under the Endangered Species Act and are managed jointly by the United States Fish and Wildlife Service ("USFWS") and NOAA Fisheries. These species are also listed as threatened or endangered by the state government. These species are discussed in further detail in Section 3.1.6.

3.1.3.3 Construction and Operation Impacts

In general, impacts to marine resources, including those under the jurisdiction of NOAA Fisheries, would be similar to those described in Section 3.1.1.3 for fishery resources. There is a low probability of most of these marine resources occurring in the vicinity of the CCL Terminal site. The most likely effect on marine mammals and sea turtles is for LNGCs to strike a whale or turtle. However, LNGCs would represent only a modest increase in boat traffic over current conditions. Since such activities already are common in the vicinity of the CCL Terminal site and since there are no known feeding, breeding or maturation areas for marine mammals that are near the CCL Terminal site, a significant impact to marine resources due solely as a result of the CCL Terminal is not expected.

Vessel Strikes

CCL has no authority over the navigational operations of LNGCs. However, in support of the effort to minimize the potential for collisions with protected species of sea life, CCL will provide LNGC captains with the web links to the NOAA and United States Coast Guard ("USCG") issued document, notices, and regulations addressing vessel strike avoidance measures and reporting requirements. The internet site web pages and documents that the web links point to can be directly displayed and/or downloaded by

LNGC captains, LNGC fleet management, and/or the U.S. agents for the LNGCs. The web site addresses are:

- http://www.nmfs.noaa.gov/pr/shipstrike/msr.htm
- http://www.nmfs.noaa.gov/pr/shipstrike/

LNGC operators trading to terminals in North America are also familiar with the now long-existing measures identified by NOAA. Therefore, CCL does not anticipate any significant impacts associated with LNGC traffic.

Ballast Water

The CCL Terminal is designed to load approximately 200 to 300 LNGCs per year that could result in ballast water discharge activities. LNGCs arriving at the CCL Terminal could include the largest presently existing (Q-Max class) LNGCs with capacities of approximately 267,000 cubic meters ("m^3"), with the capacity to discharge approximately 9-30 million gallons of ballast water at a rate up to 1.7 million gallons per hour. The discharge of ballast water from ships could potentially impact marine organisms through the unintentional introduction of non-indigenous aquatic organisms. Ballast is a necessary safety feature of commercial shipping that provides control of longitudinal trim and transverse stability during voyages and while in port. Controlling ballast weight and placement also ensures adequate submergence of the propeller, reduces stresses on the ship's hull, and controls both the longitudinal and vertical locations of the center of gravity as required for safe navigation and operation of ships.

The International Maritime Organization ("IMO") established the Convention for the Control and Management of Ships' Ballast Water and Sediments to address water performance standards for ships during ballast water exchange. This Convention has not yet been signed by sufficient nations to enter into force, nor has the U.S. yet become a signatory to it. The focus of this convention is on deterring the spread of invasive species and human health related microbes, not on water quality. The convention guidelines require that ships discharge less than 10 viable organisms per cubic meter greater than or equal to 50 micrometers in minimum dimension, and less than 10 viable organisms per milliliter less than 50 micrometers in minimum dimension and greater than or equal to 10 micrometers in minimum dimension; and discharge of the indicator microbes shall not exceed the specified concentrations. The indicator microbes, as a human health standard, include, but are not be limited to:

- Toxicogenic *Vibrio cholerae* (O1 and O139) with less than 1 colony forming unit ("cfu") per 100 milliliters or less than 1 cfu per 1 gram (wet weight) zooplankton samples;
- *Escherichia coli* less than 250 cfu per 100 milliliters; and
- Intestinal enterococci less than 100 cfu per 100 milliliters.

The USCG has inspection and regulatory enforcement jurisdiction over all shipping in U.S. waters. To minimize and avoid potential impacts to wildlife species that could result from ballast water discharges, the USCG will require all LNGCs visiting the CCL Terminal (and all other U.S. waters) to adhere to all applicable ballast water management rules and regulations, including EPA's "Vessel General Permit" ("VGP") requirements and to biological discharge standards that are presently identical to the IMO's Ballast Water Convention's D-2 standard. The USCG ballast water management regulations are stated in 33 Code of Federal Regulations ("CFR") 151, Subparts C and D. Additional information regarding USCG enforcement of environmental regulations and requirements for ships in U.S. waters can be found on the USCG's Environmental Standards Division web page at: http://www.uscg.mil/hq/cg5/cg522/cg5224/.

To minimize and avoid potential impacts to wildlife species that could result from ballast water discharges, CCL will adhere to any and all ballast water rules and regulations, including the IMO's convention for ballast water and the Port of Corpus Christi Authority ("PCCA") general and specific discharge prohibitions (regulations) currently in place. CCL will ensure that any visiting ships provide documentation to demonstrate their compliance with ballast water regulations and best management practices prior to allowing any ballast water to be discharged into the CCL marine berth.

Cooling Water

The LNGCs will re-circulate water to cool the ship's engines while at the berth and either loading or unloading LNG. While at the berth, the LNGC's engines are only running the generators which do not require the same magnitude of power that must be generated for underway propulsion purposes. Significantly less cooling water is required during this type of operation than while the LNGC is under way.

The cooling water is withdrawn and discharged below the water line on the sides of the ship through screened water ports, also known as "sea chests." The velocity across the screened ports is slow enough that most mobile organisms would be able to move away from the port and not be impinged on the screen. Smaller and less mobile organisms would pass through the screens and be entrained with the cooling water passing through the cooling system of the LNGC and then returned to the marine berth. The natural productivity rate of these types of organisms is such that number of organisms affected by the cooling system is far less than the natural mortality in natural systems.

The LNG cargo loading rate is approximately the same as the LNG cargo unloading rate specified for the previously approved CCLNG Import Terminal (12,000 m^3/hour maximum). Hence, the potential impact due to the operation of the CCL Project is no different than what was previously approved for the CCLNG Import Terminal.

3.1.3.4 Mitigation

CCL has no authority over the navigational operations of LNGCs. However, in support of the effort to minimize the potential for collisions with protected species of sea life, CCL will provide LNGC captains

with the web links to the NOAA and USCG issued documents, notices, and regulations addressing vessel strike avoidance measures and reporting requirements. The internet site web pages and documents that the web links point to can be directly displayed and/or downloaded by LNGC captains, LNGC fleet management, and/or the U.S. agents for the LNGCs. The web site addresses are:

- http://www.nmfs.noaa.gov/pr/shipstrike/msr.htm
- http://www.nmfs.noaa.gov/pr/shipstrike/

In addition, CCL will provide training on avoiding potential impacts to the West Indian manatee for all personnel involved in construction and operation of the CCL Terminal. This training will include:

a. Information advising that manatees may be found in La Quinta Channel;
b. Materials, such as a poster, to assist in identifying the mammal;
c. Instructions not to feed or water the animal; and
d. Directions to call the Corpus Christi Ecological Services Field Office of the USFWS in the event that a manatee is sighted in or near the Project area.

The USCG has inspection and regulatory enforcement jurisdiction over all shipping in US waters. To minimize and avoid potential impacts to wildlife species that could result from ballast water discharges, the USCG will require all LNGCs visiting CCL (and all other US waters) to adhere to all applicable ballast water management rules and regulations, including EPA's VGP requirements and to biological discharge standards identical to the IMO's Ballast Water Convention's D-2 standard. Additionally, the CCL Terminal would comply with PCCA general and specific discharge prohibitions (regulations) currently in place. The USCG ballast water management regulations are stated in 33 CFR 151, Subparts C and D.

3.1.4 Migratory Birds

Most native, migratory birds are protected under the Migratory Bird Treaty Act ("MBTA"), originally passed in 1918. The MBTA implements the U.S. commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource, protecting more than 800 species of birds. The MBTA provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird, unless authorized under a permit issued by the Secretary of the Interior. Take is defined in regulations as to: "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.13). Executive Order 13186 (January 2001) directs federal agencies to consider the effects of agency actions on migratory birds, with emphasis on bird species of concern.

Migratory birds follow broad routes called "flyways" between breeding grounds in Canada and the United States and wintering grounds in Central and South America. The CCL Terminal site is within the Central Flyway. The Central Flyway runs through the central portion of the United States and includes the states

of Montana, Wyoming, Colorado, New Mexico, Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota, and the Canadian provinces of Alberta, Saskatchewan and the Northwest Territories. Most birds that move along the Central Flyway travel from Canada through the central states, eventually reaching the tropics of South America via the Gulf (USFWS 2011).

A number of migratory birds have the potential to fly through the CCL Terminal site. The CCL Terminal site is located in a highly industrialized area, although several locations on the site as well as the dredged material placement area ("DMPA") north of the CCL Terminal site may provide some marginal habitat. The highly industrial nature of the CCL Terminal site and surrounding area make it an unlikely stopover area for migrants. The high amount of activity on the properties surrounding the CCL Terminal site likely prohibits migratory birds from utilizing the marginal habitat within the CCL Terminal site. There are proposed structures within the CCL Terminal site that may pose a risk to migratory bird species that may fly through the area. These structures include the LNG tanks, the process flare tower, and the marine flare. The tanks are large structures and will likely be avoided by avian species. The process flare tower is a self-supported structure, 500 feet tall, and will have aircraft warning lights. The marine flare is a guy wire supported structure, 148 feet tall, which will have visual markers on the wires to prevent collisions by diurnal species. Though there is potential for minor impacts to migratory bird species, construction and operation of the CCL Terminal is not expected to have population-level impacts to migratory bird species. Moreover, there are several areas in the vicinity of the CCL Terminal, including the Aransas National Wildlife Refuge, Mustang Island State Park, Lake Corpus Christi State Park, and Padre Island National Seashore that provide suitable, high quality habitat for a variety of species.

CCL sent an inquiry letter to the USFWS on January 12, 2012 requesting information on resources under that agency's jurisdiction, which includes migratory birds. CCL has not received a response from the USFWS to date; however, a copy of any correspondence received from the USFWS will be filed with the FERC upon receipt. As a measure to protect any migratory birds that may be found in the CCL Terminal site, CCL will avoid clearing woody vegetation during the peak nesting period between March 1 and August 31 of any year. If vegetation clearing must be conducted during this time, CCL will survey for migratory bird nests no more than three weeks prior to commencing work. If an active migratory bird nest is found, CCL will consult with the USFWS to identify the most appropriate measure to be taken to avoid or minimize impacts.

3.1.5 Vegetation

3.1.5.1 Existing Resources

The CCL Terminal site lies within the southeastern portion of the Gulf Prairies and Marshes vegetational region (Gould 1975), which is subdivided into two vegetative units: 1) the low marshes with tide water influence and 2) the prairies or grasslands located farther inland (Hatch et al. 1990). Field surveys of the CCL Terminal site identified the following habitat/community types within the two vegetative units:

- Low marshes with tide water influence
  – Open bay

  - Seagrass
  - Coastal marsh
  - Tidal flats

- Inland prairies or grasslands
  - Coastal grasses and forbs
  - Scrub/shrub

Because the open bay habitat type lacks vegetation, it will not be discussed in the following sections. Lists of representative plant species that occur in each of the remaining habitat types are provided below.

Seagrass

Seagrasses are submergent flowering plants (angiosperms) that grow primarily in shallow (less than two meters) estuarine waters (den Hartog 1967), often forming dense meadows or beds. Five species of seagrass occur within the Corpus Christi Bay area (Tunnell and Judd 2002): shoal grass (*Halodule wrightii*), manatee grass (*Cymodocea filiformis*), turtle grass (*Thalassia testudinum*), clover grass (*Halophila engelmanni*), and widgeon grass (*Ruppia maritima*). Within the bay near the CCL Terminal site, seagrasses occur along the margin of Corpus Christi Bay and along a spoil island located across the La Quinta Channel from the CCL Terminal site as discontinuous and patchy beds of primarily shoal grass.

Coastal Marsh

Coastal marshes occur as a narrow band of vegetation, lining the edge of Corpus Christi Bay. These areas consist of a nearly monotypic stand of smooth cordgrass (*Spartina alterniflora*) with small patches of black mangrove (*Avicennia germinans*).

Tidal Flat

Tidal flats within the CCL Terminal site consist of sparse (less than 30 percent coverage) patches of glasswort (*Salicornia* spp.) and saltwort (*Batis maritima*). These areas occur as a narrow band, bordered bayward by coastal marsh and inland by coastal grasses and forbs.

Coastal Grasses and Forbs

Grass and forb species within the CCL Terminal site include:

- Marshhay cordgrass (*Spartina patens*)
- Saltgrass (*Distichlis spicata*)
- Bermuda grass (*Cynodon dactylon*)
- Camphor daisy (*Machaeranthera phyllocephala*)
- Sea ox-eye (*Borrichia frutescens*)
- Coastal dropseed (*Sporobolus virginicus*)
- Sea oats (*Uniola paniculata*)

Scrub/Shrub

Scrub/shrub species within the CCL Terminal site include:

- Woody overstory
  - Mesquite (*Prosopis juliflora*)
  - Saltcedar (*Tamarix ramosissima*)
  - Sugarberry (*Celtis laevigata*)
  - Carolina holly (*Ilex ambigua*)
  - Georgia holly (*Ilex longipes*)
  - Various palm trees
- Herbaceous undergrowth
  - Western ragweed (*Ambrosia psilostachya*)
  - Common sunflower (*Helianthus annus*)
  - Indian blanket-flower (*Gaillardia grandiflora*)
  - Prickly pear (*Opuntis* sp.)
  - Scarlet sage (*Salvia coccinca*)
  - Silver-leaf night-shade (*Solanum elegnifolium*)
  - Variety of grasses

3.1.5.2 Construction and Operation Impacts

Most of the construction activities associated with the CCL Terminal will occur in previously disturbed areas. Construction within the upland scrub/shrub habitat type will involve clearing of shrubby and herbaceous undergrowth. Following construction, these cleared areas will be maintained in an herbaceous state or will be converted to industrial use. Impact on wetland vegetation types from construction and operation of the marine basin facilities is discussed in Resource Report 2.

3.1.5.3 Mitigation

CCL will comply with all Project-specific recommendations and requirements associated with their dredging permits and will implement the FERC's Plan and Procedures during construction of the CCL Terminal. Mitigation measures for impacts on coastal marsh and seagrass habitats are discussed in Resource Report 2.

3.1.6 Threatened and Endangered Species

Through database research and correspondence with the Texas Parks and Wildlife Department ("TPWD") and the USFWS, a total of 37 state and/or federally threatened and endangered species have been identified as potentially occurring in San Patricio and Nueces Counties, Texas. These species are listed below in Table 3.1-3. In addition, 17 species of threatened or endangered marine mammals could occur in the Gulf within the area traversed by LNGCs (see Table 3.1-2).

TABLE 3.1-3

Federal and State Listed Threatened and Endangered Species Potentially Occurring in Nueces and San Patricio Counties, Texas

Common Name	Scientific Name	Status[1]		Probability of Occurrence at CCL Terminal Site[2]
		Federal	State	
Plants[3]				
South Texas ambrosia	*Ambrosia cheiranthifolia*	E	E	Low
Slender rush-pea	*Hoffmannseggia tenella*	E	E	Low
Fish				
Opossum pipefish	*Microphis brachyurus*	---	T	Moderate
Smalltooth sawfish[4]	*Pristis pectinata*	E[5]	E	Moderate
Amphibians				
Sheep frog	*Hypopachus variolosus*	---	T	Low
Black-spotted newt	*Notophthalmus meridionalis*	---	T	Low
South Texas siren	*Siren* sp.	---	T	Low
Reptiles				
Loggerhead sea turtle[4]	*Caretta caretta*	T	T	Moderate
Green sea turtle[4]	*Chelonia mydas*	T	T	Moderate
Leatherback sea turtle[4]	*Dermochelys coriacea*	E	E	Low
Atlantic hawksbill sea turtle[4]	*Eretmochelys imbricata*	E	E	Low
Texas tortoise	*Gopherus berlandieri*	---	T	Low
Kemp's Ridley sea turtle[4]	*Lepidochelys kempii*	E	E	Moderate
Timber/canebrake rattlesnake	*Crotalus horridus*	---	T	Low
Texas horned lizard	*Phrynosoma cornutum*	---	T	Moderate
Texas scarlet snake	*Cemophora coccinea lineri*	---	T	Moderate
Texas indigo snake	*Drymarchon melanurus erebennus*	---	T	Moderate
Birds				
Brown pelican	*Pelecanus occidentalis*	---	E	High
Reddish egret	*Egretta rufescens*	---	T	Moderate
White-faced ibis	*Plegadis chihi*	---	T	Moderate
Texas Botteri's sparrow	*Aimophila botterii texana*	---	T	High
White-tailed hawk	*Buteo albicaudatus*	---	T	Moderate
Peregrine falcon	*Falco peregrinus*	---	T	Low
American peregrine falcon	*Falco peregrinus anatum*	---	T	Low
Northern aplomado falcon	*Falco femoralis septentrionalis*	E[5]	E	Moderate
Whooping crane	*Grus Americana*	E/CH	E	Moderate
Piping plover	*Charadrius melodus*	T/CH	T	Low
Eskimo curlew	*Numenius borealis*	E[5]	E	Low
Sooty tern	*Sterna fuscata*	---	T	Low
Wood stork	*Mycteria americana*	---	T	Moderate
Mollusks				

TABLE 3.1-3

Federal and State Listed Threatened and Endangered Species Potentially Occurring in Nueces and San Patricio Counties, Texas

Common Name	Scientific Name	Status[1]		Probability of Occurrence at CCL Terminal Site[2]
		Federal	State	
Golden orb	*Quadrula aurea*	---	T	Low
Mammals				
Southern yellow bat	*Lasiurus ega*	---	T	Low
White-nosed coati	*Nasua narica*	---	T	Low
Red wolf	*Canus rufus*	E[5]	E	Low
Ocelot	*Leopardus pardalis*	E	E	Low
Gulf Coast Jaguarundi	*Herpailurus yagouaroundi cacomitli*	E	E	Low
West Indian manatee	*Trichechus manatus*	E	E	Low

[1] E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
T = Threatened: species, which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
CH = Critical habitat. No critical habitats have been identified within the CCL Terminal site. Critical habitat is present to the west of the CCL Terminal site and at Aransas Pass for piping plover (14 FR 23476 23600; 5/19/09)

[2] Probability based on habitat present within the CCL Terminal site.

[3] Neither of these plants were identified during field surveys in 2003.

[4] Indicates species under the jurisdiction of NOAA Fisheries (NOAA Fisheries 2012b)

[5] Species that appear on the TPWD species list, but do not appear on the USFWS list as occurring in Nueces or San Patricio Counties, TX.

Source:

USFWS 2012; http://www.fws.gov/southwest/es/EndangeredSpecies/EndangeredSpecies_Lists/ Endangered Species_Lists_Main.

TPWD 2011; http://gis.tpwd.state.tx.us/TpwEndangeredSpecies/DesktopDefault.aspx.

A threatened and endangered species assessment was conducted for aquatic resources (Appendix 3C of this resource report) and terrestrial resources (Appendix 3D of this resource report) that have the potential to occur within the CCL Terminal site. These assessments were performed in June 2011 and re-assessed in March 2012 for the CCL Terminal site. Of the 33 aquatic and terrestrial species that have the potential to occur within the CCL Terminal site, nine were eliminated from further discussion due to lack of habitat and/or occurrence records. All of the remaining 24 species were given determinations of "no effect" or "not likely to adversely affect." Only two species (the brown pelican and Texas Botteri's sparrow) have a high potential of occurring within the CCL Terminal site. Both species are expected to move a short distance away during times of higher activity and return to pre-disturbance behavior shortly thereafter. CCL is continuing to consult with the USFWS and the TPWD regarding the potential presence of listed species within the area affected by construction and operation of the CCL Terminal and copies of all correspondence to date are included in Appendix 1B of Resource Report 1. Results of these consultations and additional information on listed species, if required, will be provided to the FERC when available.

3.1.6.1 Construction and Operation Impacts

The results of field surveys suggest that only 16 threatened and endangered species have at least a moderate probability of occurring within the CCL Terminal site habitat types, and only two have a high probability of occurring within the CCL Terminal site at all. Impacts to threatened and endangered species are similar to impacts described in Sections 3.1.1.3, 3.1.2.1, 3.1.3.3, and 3.1.5.2.

3.1.6.2 Mitigation

Mitigation for threatened and endangered species will be the same as that discussed in Sections 3.1.1.4, 3.1.2.2, 3.1.3.4, and 3.1.5.3. In addition to the mitigation proposed in those sections, CCL will employ additional mitigation measure to protect the piping plover. The environmental inspector will conduct a survey of tidal flats before and after construction and will submit photo-documentation to the Corpus Christi Ecological Field Office of the USFWS showing that temporarily affected tidal flats have been properly restored. The environmental inspector will also be on-site during construction in tidal flats to assist workers in avoiding any impacts to piping plovers during construction.

3.2 PIPELINE

The Pipeline lies within the Gulf Prairies and Marshes vegetation region, as described by Hatch et al. (1990). This region can be subdivided into two vegetation units: (1) the gulf marshes covering approximately 500,000 acres, and (2) the gulf prairies or grasslands covering nearly nine million acres (Hatch et al. 1990). The low gulf marshes comprise a narrow strip of land adjacent to the coast that is commonly covered with saline water and ranges in elevation from sea level to just a few feet above sea level. The gulf prairies extend 30 to 80 miles inland of the gulf marshes and have a nearly flat topography ranging from sea level to 250-feet above sea level (Hatch et al. 1990).

The low marsh areas to the south of the Pipeline route provide natural wildlife habitat for upland game and waterfowl. The higher elevations of the gulf marshes are used for livestock and wildlife production. Most land within the gulf marshes is not well suited for cultivation because of periodic flooding and saline soils. The gulf prairies are used for crops, livestock grazing, wildlife production, and increasingly for urban and industrial centers. Approximately one-third of the area is cultivated, mostly for rice, sorghum, corn, and tame pastures. Bermuda grass and several introduced bluestems (*Dichanthium sp.* and *Bothriochloa sp.*) are common tame pasture grasses (Hatch et al. 1990).

Aerial photographs and a preliminary field reconnaissance of the Pipeline route revealed the presence of four different community types based on vegetative resources, land use, and other environmental factors. These include industrial land, agricultural land, open land, and wetlands.

3.2.1 Fisheries

3.2.1.1 Fishery Classification

The diversity of the freshwater fishes of south Texas includes species whose ranges extend from the Western United States to the Gulf Coast United States. As detailed in Table 2.2-1 of Resource Report 2,

nine streams will be crossed by the Pipeline, two of which (Oliver Creek and Chiltipin Creek) are perennial. The remaining seven crossings are intermittent drainages, ditches or canals that do not support fish species.

All waterbodies that will be crossed by the Pipeline are classified as warmwater fisheries. Table 3.2-1 provides a list of representative game and commercial fish species with potential to occur within the waterbodies that will be crossed by the Pipeline (TNHC 2003; TPWD 2003a).

TABLE 3.2-1

Representative Game and Commercial Fish Species with Potential to Occur in Waterbodies Crossed by the Pipeline

Common Name	Scientific Name	Fishery Classification
Largemouth bass	*Micropterus salmoides*	Warmwater
Blue catfish	*Ictalurus furcatus*	Warmwater
Channel catfish	*Ictalurus punctatus*	Warmwater
Flathead catfish	*Pylodictis olivaris*	Warmwater
Bluegill	*Lepomis macrochirus*	Warmwater
Red ear sunfish	*Lepomis microlophus*	Warmwater

3.2.1.2 Fisheries of Special Concern

No fisheries of special concern, state or federally listed threatened and endangered species, or fish of significant commercial and recreational value were identified as potentially occurring in waterbodies that will be crossed by the Pipeline during previous review and agency consultations. Consultation letters requesting information on sensitive and important resources along the Pipeline route were sent to agencies on July 6, 2012. Corpus Christi Pipeline has not received any information indicating the Pipeline will cross significant commercial and recreational fishing resources.

3.2.1.3 Construction and Operation Impacts

Pipeline construction across a waterbody can potentially impact warmwater fisheries. Installation of a pipeline across a stream may cause temporary increases in suspended solids concentrations and streambed sedimentation. Corpus Christi Pipeline will cross the two perennial waterbodies (Oliver Creek and Chiltipin Creek) via the horizontal directional drill ("HDD") method to avoid potential impacts. Crossing methods for the remaining seven waterbodies has not yet been determined. Corpus Christi Pipeline will provide crossing information the FERC prior to construction.

3.2.2 Wildlife

3.2.2.1 Existing Resources

The Pipeline will cross four general community types; industrial land, agricultural land, open land, and wetlands. The following paragraphs provide an overview of the wildlife resources likely to occur in these community types.

Industrial Land

Industrial land in the Pipeline corridor mostly consists of highly disturbed and modified areas at the south end of the Pipeline near the CCL Terminal site, and road crossings. These areas do not support much vegetation, and most wildlife would be expected to use or traverse these areas only on occasion.

Agricultural Land

Agricultural land within the Pipeline area consists of active cropland. Agricultural fields planted in a variety of legumes and row crops provide food and cover for several species of wildlife. These areas provide an important food source in the form of seeds, foliage, and insects for a variety of songbirds, waterfowl, and game birds. The northern mocking bird (*Mimus polyglottos*) and mourning dove (*Zenaida macroura*) are common birds found in agricultural habitats (Tveten 1993; Kaufman 2000). Small mammals such as the hispid cotton rat (*Sigmodon hispidus*) are common in this agricultural habitat as well (Davis 1994). Reptiles such as the Great Plains rat snake (*Elaphe guttata emoryi*) can be found in this cover type within the Pipeline area (Dixon 2000).

Open Land

Dominant wildlife species found within the open land habitat type include reptiles such as the western glass lizard (*Ophisaurus attenuatus attenuatus*), six-lined racerunner (*Cnemidophorus sexlineatus sexlineatus*), keeled earless lizard (*Holbnookiapropinqua propinqua*), Texas spotted whiptail (*Cnemidophonus gulanis*), western coachwhip (*Masticophis flagellum tesaceus*), ground snake (*Sonora semiannulata*), and western diamondback rattlesnake (*Crotalus atrox*) (Dixon 2000). Bird species associated with this habitat type include many species of raptors and songbirds (Tveten 1993; Kaufman 2000). Mammals likely to occur within this habitat type include the black-tailed jackrabbit (*Lepus californicus*), Gulf Coast kangaroo rat (*Dipodomys compactus*), marsh rice rat (*Onyzomys palustnis*), fulvous harvest mouse (*Reithrodontomys fulvescens*), common raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and coyote (*Canis latrans*) (Davis 1994).

Wetlands

The Pipeline will cross palustrine emergent wetlands at four locations. Only one of these wetlands is jurisdictional and will be crossed via the HDD method to minimize and/or avoid potential impacts to these resources. Refer to Resource Report 2, Section 2.2.3 for the locations and description of the vegetation in these wetlands. Typical wildlife species found within palustrine emergent wetland habitats include the Woodhouse's toad (*Bufo woodhousii*), eastern narrow-mouth toad (*Gastrophryne*

carolinensis), bronze frog (*Rana clamitans*), missouri slider (*Chrysemys floridana*), speckled king snake (*Lampropeltis getulus*), diamondback water snake (*Nerodia rhombifer*), red-winged blackbird (*Agelaius phoeniceus*), American widgeon (*Anas americana*), American bittern (*Botaurus lentiginosus*), common snipe (*Capella gallinago*), great egret (*Casmerodius albus*), marsh hawk (*Circus cyaneus*), North American mink (*Mustela vison*), marsh rice rat, and the swamp rabbit (*Sylvilagus aquaticus*) (Gosselink et al. 1979).

3.2.2.2 Construction and Operation Impacts

To minimize construction related impacts to wildlife habitats, Corpus Christi Pipeline will implement the FERC's Plan and Procedures. No aboveground facilities are proposed in wetland habitats.

Impacts to terrestrial wildlife are expected to be short term and minimal. The Pipeline will not cross any areas that have been identified as sensitive habitats. Most of the Pipeline-related construction activities will occur in previously disturbed agricultural areas. Areas adjacent to the Pipeline area provide similar and ample habitats for wildlife displaced temporarily during and permanently after construction of the Pipeline. Areas required for construction only (temporary impacts) will be allowed to re-vegetate, thus restoring the pre-construction structure and function of affected habitat types. Operation of the Pipeline is not expected to impact wildlife. Table 3.2-2 outlines construction and operation impacts to each habitat type.

TABLE 3.2-2

Habitat/Vegetation Type Affected by Construction and Operation of the Pipeline

Habitat Type	Area Affected	
	Construction (Acres)[1]	Operation (Acres)[2]
Agricultural Land	296.0	133.3
Open Land	93.0	38.4
Industrial Land	31.7	6.6
Wetland	0.0	0.0
Total	**420.7**	**178.3**

[1] Includes nominal 120-foot construction right-of-way, which includes temporary workspace ("TWS") and permanent operational right-of-way. Also includes access roads and additional temporary workspace ("ATWS").
[2] Includes permanent operational right-of-way and aboveground facilities.

3.2.3 Migratory Birds

A summary of the MBTA is provided in Section 3.1.4.

The largest impact on migratory birds from the Pipeline will be from direct construction activities, primarily right-of-way clearing. Impacts would be the greatest if right-of-way clearing occurred during the breeding season. However, because the most type of habitat that will be crossed by the Pipeline is

active agricultural lands, these impacts are expected to be minor. Executive Order 13186 requires the federal agency to identify where unintentional "take" (i.e., unintended death, harm, or harassment) is likely to have a measurable negative effect to migratory bird populations. If adult birds must move from the right-of-way to avoid temporary construction, this impact will be of limited duration and will not result in a substantial or long-term impact on migratory birds. This will not constitute a population-level impact given the stability of local populations and the abundance of available habitat outside of the Pipeline right-of-way.

The linear nature of the Pipeline and the use of previously and continually disturbed areas will minimize impacts on migratory bird species. Construction noise and activities may result in the temporary displacement of migratory birds. Due to the relatively short duration of construction activities and the current use of the area, the Pipeline will not have a significant impact of any kind on migratory birds. Corpus Christi Pipeline sent an inquiry letter to the USFWS on July 6, 2012 requesting information on resources under their jurisdiction. Corpus Christi Pipeline has not received a response from the USFWS to date; however, a copy of any correspondence received from the USFWS will be filed with the FERC upon receipt. As a measure to protect any migratory birds that may be found along the Pipeline route, Corpus Christi Pipeline will avoid clearing woody vegetation during the peak nesting period between March 1 and August 31 of any year. If vegetation clearing must be conducted during this time, Corpus Christi Pipeline will survey for migratory bird nests no more than three weeks prior to commencing work. If an active migratory bird nest is found, Corpus Christi Pipeline will consult with the USFWS to identify the most appropriate measure to be taken to avoid or minimize impacts.

3.2.4 Vegetation

3.2.4.1 Existing Resources

The Pipeline lies within the southeastern portion of the Gulf Prairies and Marshes vegetational region (Hatch et al. 1990), which is subdivided into two vegetative units: (1) the low marshes with tide water influence; and (2) the prairies or grasslands located farther inland (Hatch et al. 1990). The Pipeline falls within the prairies or grasslands vegetative unit. This unit can be further subdivided into the following community types: industrial land, agricultural land, open land, and wetlands. Lists of representative plant species that occur in each of the habitat types are provided below.

Industrial Land

The industrial facilities that will be crossed by the Pipeline include roadways covered in gravel or pavement and contain little or no vegetative coverage.

Agricultural Land

Primary crops grown in the area that will be crossed by the Pipeline include cotton, sorghum, soybeans, and corn.

Open Land

Herbaceous vegetation associated with open land typically consists of western ragweed (*Ambrosia psilostachya*), common sunflower (*Helianthus annus*), Indian blanket-flower (*Gaillardia grandiflora*), prickly pear (*Opuntis sp*.), scarlet sage (*Salvia coccinca*), silver-leaf night-shade (*Solanum elegnifolium*), and a variety of grasses including King Ranch bluestem (*Bothriochloa ischaemum*), Texas windmillgrass (*Chloris texensis*), Bermuda grass (*Cynodon dactylon*), Johnson grass (*Sorghum halepense*), and buffelgrass (*Pennisetum ciliare*). Located within the open land habitat are scattered scrub/shrub species dominated by huisache (*Acacia smallii*), retama (*Parkinsonia aculeata*), bluewood condalia (*Condalia hookeri*), and honey mesquite (*Prosopis glandulosa*) (Gould 1975; Hatch et al. 1990).

Wetlands

Vegetation species typical of the palustrine emergent wetlands that will be crossed by the Pipeline include: bulltongue (*Sagittaria lancifolia*), alligator weed (*Alternanthera philoxeroides*), spikerush (*Eleocharis* sp.), coontail (*Ceratophyllum demersum*), white water-lily (*Nymphaea odorata*), horned bladderwort (*Utricularia cornuta*), spiderlily (*Hymenocallis* sp.), maidencane (*Panicum hemitomom*), pondweed (*Potamogeton* sp.), soft rush (*Juncus effusus*), seashore paspalum (*Paspalum vaginatum*), southern naiad (*Najas guadalupensis*), Walteri millet (*Echinochloa walteri*), saltgrass (*Distichlis spicata*), water hyssop (*Bacopa* sp.), rattle bush (*Sesbania* sp.), smartweed (*Polygonum* sp.), saltmeadow cordgrass (*Spartina patens*), flatsedge (*Cyperus* sp.), three-square bulrush (*Scirpus pungens*), and delta duck-potato (*Sagittaria platyphylla*) (Correll and Johnson 1970).

3.2.4.2 Construction and Operation Impacts

Approximately 18.0 miles of the Pipeline will cross agricultural lands. After installation of the Pipeline, crops will still be allowed to be grown within the permanent right-of-way.

About 4.7 miles of the Pipeline route will cross open land, consisting of upland grasslands and scrub/shrub vegetation. This includes pasture and rangelands. The permanent Pipeline easement in open land will be kept in a herbaceous state.

Corpus Christi Pipeline will minimize long-term impacts where possible through restoration of pre-construction vegetation in temporarily affected areas. The Pipeline will not permanently remove any areas of native vegetation.

3.2.4.3 Mitigation

Corpus Christi Pipeline will implement measures from the FERC's Plan and Procedures during construction, restoration, and operation of the Pipeline. Use of these measures will minimize short- and long-term impacts to vegetation within areas disturbed during construction and within the permanent operational right-of-way. To quickly restore vegetation cover in non-agricultural areas, Corpus Christi Pipeline will seed these areas following completion of right-of-way regrading. Table 3.2-3 lists the seed mixture and rates that will be applied.

TABLE 3.2-3

Seed Mixtures for the Pipeline

Temporary Seed Mixture	Application Rate (pounds per acre)
Oats	64
Hairy vetch	16
Foxtail millet	25
Rye	25
Permanent Seed Mixture	**Application Rate (pounds per acre)**
Green sprangletop	8
Little bluestem	15
Indiangrass	20
Switchgrass	16

3.2.5 Threatened and Endangered Species

3.2.5.1 Existing Resources

Through online database research and consultation with the TPWD and the USFWS, a total of 34 state and/or federally threatened and endangered species have been identified as potentially occurring in San Patricio County, Texas. These species are listed below in Table 3.2-4.

A desktop review of aerial photography, topographic maps, and the *County Soil Survey of San Patricio and Aransas Counties, Texas* (1979) indicate that the Pipeline will not cross potential suitable habitat for these species (habitats that are suitable for a given species are those in which there is a moderate probability of that species occurring). A threatened and endangered species assessment was performed for the Pipeline in July 2012 (Appendix 3E of this resource report). Of the 34 listed species with the potential to occur in San Patricio, County, seven were eliminated due to lack of habitat. The remaining 27 species were given determinations of "not likely to adversely affect." A review was conducted of the TPWD Biological Conservation Database for the previously approved project (CP04-44-000, CP04-45-000, and CP04-46-000). No state or federally listed species, or their habitat, was identified within 2,000 feet of the Pipeline or aboveground facilities. Corpus Christi Pipeline has begun consultation with the TPWD. See Appendix 1B of Resource Report 1 for copies of all correspondence with the TPWD to date.

TABLE 3.2-4

Federal and State Listed Threatened and Endangered Species in San Patricio County, Texas

Common Name	Scientific Name	Status [1]	
		Federal	State
Fish			
Opossum pipefish	*Microphis brachyurus*	---	T
Smalltooth sawfish	*Pristis pectinata*	E[2]	E
Amphibians			
Sheep frog	*Hypopachus variolosus*	---	T
Black-spotted newt	*Notophthalmus meridionalis*	---	T
South Texas siren	*Siren* sp.	---	T
Reptiles			
Loggerhead sea turtle	*Caretta caretta*	T	T
Green sea turtle	*Chelonia mydas*	T	T
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Texas tortoise	*Gopherus berlandieri*	---	T
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	E
Timber/canebrake rattlesnake	*Crotalus horridus*	---	T
Texas horned lizard	*Phrynosoma cornutum*	---	T
Texas scarlet snake	*Cemophora coccinea lineri*	---	T
Texas indigo snake	*Drymarchon melanurus erebennus*	---	T
Birds			
Brown pelican	*Pelecanus occidentalis*	---	E
Reddish egret	*Egretta rufescens*	---	T
White-faced ibis	*Plegadis chihi*	---	T
White-tailed hawk	*Buteo albicaudatus*	---	T
Peregrine falcon	*Falco peregrinus*	---	T
American peregrine falcon	*Falco peregrinus anatum*	---	T
Northern aplomado falcon	*Falco femoralis septentrionalis*	E[2]	E
Whooping crane	*Grus Americana*	E/CH	E
Piping plover	*Charadrius melodus*	T/CH	T
Eskimo curlew	*Numenius borealis*	E[2]	E
Sooty tern	*Sterna fuscata*	---	T
Wood stork	*Mycteria americana*	---	T
Mollusks			
Golden orb	*Quadrula aurea*	---	T
Mammals			
Southern yellow bat	*Lasiurus ega*	---	T
White-nosed coati	*Nasua narica*	---	T
Red wolf	*Canus rufus*	E[2]	E
Ocelot	*Leopardus pardalis*	E	E

TABLE 3.2-4

Federal and State Listed Threatened and Endangered Species in San Patricio County, Texas

Common Name	Scientific Name	Status [1]	
		Federal	State
Gulf Coast Jaguarundi	*Herpailurus yagouaroundi cacomitli*	E	E
West Indian manatee	*Trichechus manatus*	E	E

[1] E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
T = Threatened: species, which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
CH = Critical habitat. No critical habitats have been identified within the Pipeline route. Critical habitat is present to the west of the CCL Terminal site for piping plover (14 FR 23476 23600; 5/19/09)

[2] Species that appear on the TPWD species list, but do not appear on the USFWS list as occurring in San Patricio County, TX.

Source:

USFWS 2012; http://www.fws.gov/southwest/es/EndangeredSpecies/EndangeredSpecies_Lists/Endangered Species_Lists_Main.

TPWD 2011; http://gis.tpwd.state.tx.us/TpwEndangeredSpecies/DesktopDefault.aspx.

3.2.5.2 Construction and Operation Impacts

The Corpus Christi Field Office of the USFWS issued a Finding of No Effect (USFWS 2003) for the previously approved project utilizing essentially the same route. Therefore, the Pipeline is not expected to affect federally or state listed threatened or endangered species. Updated consultation with the USFWS for the Pipeline is ongoing.

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Appendix 3A
EFH Assessment

Corpus Christi Liquefaction Project

ESSENTIAL FISH HABITAT ASSESSMENT

Prepared for

Corpus Christi Liquefaction, LLC

Prepared by

August 2012

1.0 INTRODUCTION

In 1976, the Magnuson-Stevens Act ("MSA") was passed in order to promote fish conservation and management. The MSA granted the National Marine Fisheries Service ("NOAA Fisheries") legislative authority for fisheries regulation in the United States within a jurisdictional area located between three miles to 200 miles offshore, depending on geographical location. NOAA Fisheries established eight regional fishery management councils, each responsible for the proper management and harvest of finfish and shellfish resources within their respective geographic regions. Fishery management councils have developed Fisheries Management Plans ("FMP"), which outline measures to ensure the proper management and harvest of the finfish and shellfish within these waters.

Recognizing that many marine fisheries are dependent on nearshore and estuarine environments for at least part of their life cycles, new habitat conservation provisions to the MSA (Public Law 94-265, as amended in 1996 and Public Law 104-297 as amended in 1998) were added, along with other goals, to promote more effective habitat management and protection of marine fisheries. The protection of the marine environments important to marine fisheries, referred to as essential fish habitat ("EFH"), is required in the review of projects conducted under Federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). All estuaries and estuarine habitats in the northern Gulf of Mexico are considered EFH (GMFMC, 1998; 2005; 2010).

Federal agencies that authorize, fund, or undertake activities that may adversely impact EFH must consult with the NOAA Fisheries. Although absolute criteria have not been established for conducting EFH consultations, NOAA Fisheries recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as the National Environmental Policy Act ("NEPA") and Endangered Species Act ("ESA"), in order to reduce duplication and improve efficiency. Generally, the EFH consultation process includes the following steps:

1) **Notification** – The action agency should clearly state the process being used for EFH consultations (*e.g.*, incorporating EFH consultation into the Environmental Impact Statement (EIS) or Rivers and Harbors Act Section 10 permit).

2) **EFH Assessment** – The action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of impacts. Specifically, the EFH Assessment should include: 1) a description of the proposed action; 2) an analysis of the effects (including cumulative effects) of the proposed action on EFH, the managed fish species, and major prey species; 3) the Federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation, if applicable.

3) **EFH Conservation Recommendations** – After reviewing the EFH Assessment, NOAA Fisheries would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.

4) **Agency Response** – The action agency may respond to NOAA Fisheries within 30 days of receiving NOAA Fisheries' recommendations to conserve EFH. The action agency will

> notify NOAA Fisheries that a full response to the conservation recommendations will be provided by a specified completion date agreeable to all parties. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH.

In 2004, NOAA Fisheries agreed to be a cooperating agency for the previously authorized, but not constructed CCLNG Import Terminal. That project received authorization on April 18, 2005 under Federal Energy Regulatory Commission ("FERC" or "Commission") Docket No. CP04-37-000 by Corpus Christi LNG, L.P. for the CCLNG Import Terminal. During that process, NOAA Fisheries provided recommendations to the USACE on February 14, 2005 and the FERC on March 14, 2005 regarding mitigation and EFH conservation for the project. An inquiry letter was sent to NOAA Fisheries dated January 12, 2012 by Corpus Christi Liquefaction, LLC ("CCL") to inform NOAA Fisheries of the current Project. On June 27, 2012, a representative of NOAA Fisheries participated in an inter-agency meeting that was sponsored by the FERC, the lead Federal agency for reviewing the Project under NEPA. Heather Young from NOAA Fisheries, Galveston, Texas, was contacted on August 7, 2012 (Attachment E-2) by a representative of CCL to discuss EFH species that should be included in this EFH Assessment. An assessment of potential effects of the Project on EFH, incorporating NOAA Fisheries comments on the CCLNG Import Terminal and the conversation from August 7, 2012 is included below.

2.0 FEDERALLY MANAGED SPECIES

Information regarding EFH was obtained through correspondence with NOAA Fisheries, from the Gulf of Mexico Fisheries Management Council ("GMFMC") and from the South Atlantic Fishery Management Council ("SAFMC").

GMFMC has identified EFH for the Gulf of Mexico ("Gulf"), including the CCL Terminal location, as required by the 2005 amendment to the MSA (GMFMC, 2005). Additionally, joint effort with the SAFMC has identified EFH within the Gulf for species that range within both the Gulf and Atlantic waters. The EFH information from NOAA Fisheries on species habitats and life stages is available at a scale such that Corpus Christi Bay is grouped into a single area of consideration. The NOAA Fisheries Habitat Conservation Essential Fish Habitat Mapper indicates that EFH is available for three shellfish species (juveniles and adults of brown, pink, and white shrimp), juvenile and adult Spanish mackerel, 8 sharks (neonate finetooth; neonate and adult lemon; neonate and juvenile spinner and scalloped hammerhead; neonate, juvenile and adult bonnethead, blacktip, bull, and Atlantic sharpnose), juvenile and adult red drum, and 5 species of reef fish and snapper-grouper complex species (juvenile and adult gray snapper and lane snapper; eggs, larvae, juvenile and adult dog snapper, goliath grouper, and yellowmouth grouper) within Corpus Christi Bay (NOAA Fisheries, 2012; GMFMC, 2004).

In a September 3, 2003, letter to Corpus Christi LNG, L.P.'s consultant (Attachment E-1), NOAA Fisheries identified post-larval, juvenile and subadult white shrimp, brown shrimp, red drum, post-larval and juvenile pink shrimp, and subadult Spanish mackerel as the EFH species of concern in the Project area (NOAA Fisheries, 2003). The letter further states that the categories of EFH in the vicinity of the Project include estuarine emergent marsh, seagrass, estuarine water column, and estuarine mud and sand substrates. Since 2003, the GMFMC has amended EFH to

FMPs in accordance with Subpart J of 50 CFR Part 600. In 2004, the Council completed a Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (2004 EFH EIS) addressing all required EFH components included in the amendment to the MSA (GMFMC, 2005). The 2005 EFH Amendment delineated EFH as areas of higher species density, based on the NOAA Atlas (NOAA, 1985) and functional relationships analysis for the red drum, reef fish, coastal migratory pelagics, shrimp, stone crab, and spiny lobster FMPs; and on known distributions for the Coral FMP. The following assessment of potential effects of the Project on EFH addresses the associated species and life stages as identified in the September 3, 2003, letter from NOAA Fisheries, subsequent additions through FMP amendments, and recent correspondence with NOAA Fisheries.

Reef fish and coastal migratory pelagics managed by the GMFMC and SAFMC FMPs, include: all estuaries; the U.S./Mexico border to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 100 fathoms. Additionally, sharks are managed through Amendment 1 to the Final Consolidated Highly Mobile Species ("HMS") FMP. EFH for snapper-grouper species includes coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings on and around the shelf break zone from shore to at least 600 feet (but to at least 2,000 feet for wreckfish) where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical complex. EFH includes the spawning area in the water column above the adult habitat and the additional pelagic environment, including *Sargassum*, required for larval survival and growth up to and including settlement. For specific life stages of estuarine dependent and nearshore snapper-grouper species, EFH includes areas inshore of the 100-foot contour, such as attached macroalgae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub (mangrove fringe); oyster reefs and shell banks; unconsolidated bottom (soft sediments); artificial reefs; and coral reefs and live/hard bottom.

A detailed description of life history characteristics and habitat preferences of each species, based primarily on the research referenced in CCL's application to the FERC, is provided below. Species described are those identified as having potential EFH in the CCL Terminal location based on NOAA EFH Mapping and utilization of estuarine habitat as indicated by the GMFMC in its final EIS for EFH for the Gulf of Mexico FMPs (NOAA Fisheries, 2012; GFMFC 2004). Personal communication with NOAA Fisheries in Galveston, TX, confirmed that those species described below had the potential for EFH in the CCL Terminal location (NOAA Fisheries, Personal Communication). No field surveys were conducted to verify the presence or absence of these species in the Project area.

White Shrimp

The white shrimp is one of the important penaeids along the Atlantic and Gulf coasts. White shrimp are found in estuaries and out to depths of approximately 40 meters ("m") offshore in the coastal waters extending from Florida to Texas and are most abundant in the central and western Gulf. Non-spawning adult white shrimp inhabit offshore waters in the winter and move inshore in the spring. Spawning generally occurs offshore in water depths of less than 27 m from spring to late fall peaking during June and July. Eggs are demersal and share the same distribution as spawning adults. Larval white shrimp hatch within 12 hours of spawning and begin to migrate

through passes toward estuaries as they develop into post-larvae. Estuarine migration peaks between June and September.

Juvenile white shrimp are most abundant in turbid estuaries along the western coast of the Gulf and, within these estuarine nurseries, reach their greatest densities in marsh edge habitats and in areas with submerged aquatic vegetation. However, juvenile white shrimp are also common in marsh ponds, channels, inner marshes, shallow subtidal areas and oyster reefs. In non-vegetated areas, postlarvae and juveniles inhabit mostly muddy substrates with large quantities of detritus (GMFMC, 2004). Sub-adult white shrimp move from the estuaries to coastal areas in late August and September.

Brown Shrimp

Adult brown shrimp inhabit neritic waters (over the continental shelf from low tide to a depth of approximately 110 m) throughout the Gulf, but are more abundant off the coasts of Texas, Louisiana, and Mississippi. Non-spawning adults prefer turbid waters to soft sediments (*i.e.*, mud and sand). In the spring and fall, adult brown shrimp move to slightly deeper water (46 to 91 m) to spawn. Brown shrimp eggs are demersal and usually hatch when temperatures are greater than 24 degrees Celsius ("°C"). Larval brown shrimp are most abundant offshore but do occur in waters that range from 0 to 82 m deep. Post-larval brown shrimp migrate toward estuaries in the spring, typically reaching their destination between February and April. Late post-larval and juvenile brown shrimp are most abundant in shallow (<1 m) estuarine habitats in the spring and early summer but typically are present through the fall.

Juvenile brown shrimp reach their greatest abundances in turbid estuaries but tolerate waters with less suspended material. Within the estuarine environment, juvenile brown shrimp prefer marsh edges and areas with submerged vegetation, but occur throughout the vegetated and non-vegetated portions of the estuary and in the lower reaches of its tributaries. Sub-adults are most abundant in slightly deeper waters of 1 to 18 m and prefer sand, mud and shell substrates to the vegetated bottoms preferred by juveniles. As they develop, sub-adult brown shrimp continue to migrate toward deeper waters, eventually leaving the estuarine nurseries in mid-summer.

Pink Shrimp

Adult pink shrimp typically inhabit offshore marine waters, where they reach their greatest densities over depths of 9 to 44 m. Adults prefer coarse sand and shell substrates with relatively little organic material. Spawning occurs offshore at depths between 4 and 48 m. Pink shrimp have demersal eggs that give rise to planktonic larvae.

Larvae migrate toward estuarine nursery areas in the spring and late fall. Upon reaching these nurseries, post-larval pink shrimp assume a benthic lifestyle, burrowing into the substrate during the day and foraging above the substrate at night. Juvenile pink shrimp inhabit nearly all U.S. estuaries in the Gulf, but reach their greatest abundances in Florida where they prefer non-turbid waters with an abundance of seagrass, which provides cover and habitat for prey, and avoid marsh habitats. Post-larvel, juvenile and sub-adults also prefer coarse substrates, such as sand, shell and mud mixtures (GMFMC, 2004).

Red Drum

The red drum occurs in a variety of habitats over different substrates throughout the Gulf. Habitats range in depth from about 40 m offshore to very shallow in estuarine wetlands with substrates that include sand, mud and oyster reefs. Adult red drum are roving predators that opportunistically feed on a variety of invertebrate and vertebrate prey including crab, shrimp and other fishes. Spawning occurs from September through November over deeper waters protected from currents such as the mouths of bays and inlets, and on the Gulf side of barriers islands. Eggs typically hatch between late summer and early fall in the open waters of the Gulf and are subsequently transported on tides and currents into estuarine nursery areas.

Larval red drum are most abundant is estuaries from mid-August through late November. Within these estuarine nurseries, larvae, post-larvae, and juveniles prefer habitats protected from currents with submerged and emergent vegetation and muddy substrates, but also tolerate non-vegetated hard and soft-bottomed areas. Larval and post-larval red drum feed primarily on copepods whereas juveniles feed on a wide variety of small invertebrates. Juvenile red drum become most abundant in early winter. Much like the adult red drum, late juveniles utilize a wide variety of habitats. However, they still prefer protected waters and do not become abundant in open waters until mid-September to early October. Estuarine wetlands are very important to larval and juvenile red drum and while adult red drum use estuaries they tend to spend more time offshore as they age (GMFMC, 2004).

Spanish Mackerel

The Spanish mackerel is a coastal pelagic fish that typically occurs in waters up to 75 m deep in coastal areas throughout the Gulf. Adults are most prevalent in coastal waters, but will inhabit estuarine areas, especially those with higher salinity, during seasonal migrations, and in pursuit of prey. They are, however, considered rare and occur infrequently in Gulf estuaries (GMFMC, 2004). Important spawning areas are located in waters over the inner continental shelf of northeastern and north-central Gulf, where spawning occurs from May through September.

Eggs are pelagic, occurring in waters over the inner continental shelf of the northern Gulf with depths of greater than 50 m during the spring and summer. Larvae are common from May to October in these same offshore areas over depths ranging from nine to 84 m, but are most common in waters less than 50 m deep. Estuaries and coastal waters serve as year-round nurseries for juvenile Spanish mackerel.

Gray (Mangrove) Snapper

Gray snapper range from North Carolina to Brazil, including Bermuda, the Caribbean, and northern Gulf (SAFMC, 1998). Juveniles can occasionally be found as far north as Massachusetts (Manooch, 1988). Gray snapper are capable of inhabiting a wide variety of habitats. Offshore benthic habitats include shipwrecks, ledges, hard bottom, coral reefs, and rocky outcroppings to depths of 180 m, while inshore habitats consist of seagrasses, mangroves, and rock piles (Bortone and Williams, 1986; Manooch, 1988; Florida Museum, 2012). Smaller, younger fish are typically found utilizing more inshore habitats, such as seagrass beds and areas of soft sediments, compared to larger, older adults (Manooch, 1988; Florida Museum, 2012). Adults and juveniles are euryhaline and can tolerate a salinity range from 0 to 37 psu and have

even been recorded in freshwater lakes and rivers of southern Florida (SAFMC, 1998; GMFMC, 2004; Florida Museum, 2012). They also are found utilizing waters with temperatures between 13° and 32.5°C (Bortone and Williams, 1986). Eggs and larvae are pelagic until larvae settle at inshore nurseries consisting of seagrass beds, mangroves, jetties, or pilings, approximately three weeks after hatching, typically from July through September (Bortone and Williams, 1986; Domeier et al., 1996; SAFMC, 1998; GMFMC, 2004, Florida Museum, 2012).

This species does not exhibit extensive movements and remains in the same area for extended periods of time, except during spawning season (SAFMC, 1998; Florida Museum, 2012). Gray snapper do demonstrate daily movements associated with feeding and schooling. Gray snapper migrate from inshore waters to offshore waters to spawn between April and November, with spawning correlated with lunar cycles (Manooch, 1988; Domeier et al., 1996; Florida Museum, 2012). Spawning locations have not been identified but are believed to be associated with reefs and shipwrecks (Domeier et al., 1996). Individuals are capable of spawning multiple times during a season (Florida Museum, 2012). This species is an opportunistic predator. Adult gray snapper prey nocturnally on fishes, shrimp, and crabs (Manooch, 1988; Florida Museum, 2012). Crustaceans are a primary component of the adult gray snapper's diet (Starck and Schroeder, 1971).

Dog Snapper

Dog snapper are distributed from Massachusetts to Sao Paulo, Brazil including the Gulf and the Caribbean Sea. Dog snapper are encountered around rocky and coral reefs between depths of 5-30 meters. Juveniles sometimes occur in estuaries and rivers and are the sole lutjanid to do so (FishBase, 2012). Dog snapper have similar a similar life history to other Lutjanidae, being oviparous breeders that spawn in offshore waters in March. The pelagic eggs float with plankton for a period of time but little is known of their further development (GMFMC, 2004; Florida Museum, 2012). Common Prey Species. Dog snapper are nocturnal and feed on fishes, shrimps, crabs, gastropods, and cephalopods (FishBase, 2012).

Lane Snapper

Lane snapper are distributed from North Carolina to southern Brazil, including the Gulf and the Caribbean Sea. Lane snapper are abundant in the Antilles, off Panama, and the northern coast of South America (Florida Museum, 2012). These fish prefer clear near shore water over rocky bottoms near coral reefs and in sandy areas or seagrass with abundant shrimp. Juveniles use inshore waters as nurseries. Lane snapper occur up to 400 m deep. (Florida Museum, 2012). Lane snapper spawn from March to September throughout their range, and both sexes are able to spawn after the first year (GMFMC, 2004). Lane snapper are opportunistic predators feeding on a variety of prey, such as small bottom fishes like grunts, but also shrimps, crabs, and cephalopods (Florida Museum, 2012)

Goliath Grouper

Goliath grouper are distributed from Florida to Brazil, including Bermuda, Caribbean Sea, and Gulf (Florida Museum, 2012). They are most abundant off eastern Florida south to the Florida Keys (SAFMC, 1998, GMFMC, 2004). This species is also found in the eastern Atlantic from Senegal to Congo, Africa and in the eastern Pacific from the Gulf of California to Peru (Florida

Museum, 2012). Rocks, corals, caves, shipwrecks, ledges, and muddy substrates, in waters with depths less than 46 m, are the preferred habitat of territorial adults, while juveniles are found in estuarine areas associated with mangroves and oyster bars (Sadovy and Eklund, 1999; Florida Museum, 2012). Eggs and larvae are pelagic with larvae becoming benthic approximately 25 days after hatching (Florida Museum, 2012). Spawning events occur around shipwrecks, rock ledges, and reefs from July through September and are correlated with lunar events (Florida Museum, 2012). Spawning aggregations containing over 100 goliath groupers have been observed with all recorded aggregations (except Bermuda) occurring between 15ºN and 26ºN latitudes (Sadovy and Eklund, 1999; Florida Museum, 2012). These aggregations primarily consist of the largest and oldest individuals of the population (Coleman et al., 2000). Goliath grouper are considered sedentary and typically do not move among reefs, except to form aggregations (Sadovy and Eklund, 1999). Goliath groupers are opportunistic feeders that prey mainly on crustaceans (spiny lobster, shrimp, and crabs) and fishes (stingrays and parrotfishes) but also consume octopus and young sea turtles (Florida Museum, 2012).

Yellowmouth Grouper

Yellowmouth grouper are native to the western Atlantic from Florida to southern Brazil, including the Gulf, Florida Keys, Bahamas, Cuba, and throughout the Caribbean (IUCN, 2010). In the Gulf of Mexico, yellowmouth grouper occur off of the Campeche Banks, the west coast of Florida, Texas Flower Garden Banks, and the northwest coast of Cuba (GMFMC, 2004). Yellowmouth grouper prefer rocky and coral bottoms from shoreline to at least 55 m deep. Smaller yellowmouth grouper are common in mangrove areas (IUCN, 2010). Little information is available on yellowmouth grouper life history, however yellow mouth grouper are pelagic spawners and sex-reversal is possible for this species (IUCN, 2010). Spawning occurs primarily in spring and summer, with peaks in April and May off the west coast of Florida (GMFMC, 2004). Juveniles commonly occur in mangrove-lined lagoons and move into deeper water as they grow (GMFMC, 2004). Yellowmouth grouper feed primarily on fishes (IUCN, 2010).

Lemon Shark

The lemon shark is managed under the Large Coastal Shark MU in the Shark MU through the Final Atlantic Consolidated FMP for HMS (NOAA Fisheries, 2010). The species is found in the temperate/tropical regions of the Atlantic, Pacific and Caribbean. In the northwest Atlantic, its distribution ranges from New Jersey to southern Brazil, including the Gulf (Compagno, 1984b; Florida Museum, 2012). Utilization of diverse habitat is characteristic of the species and includes oceanic waters, coral reefs, mangroves, bays, sounds, estuaries, and river mouths (Florida Museum, 2012). The lemon shark is found from surface waters to depths of 90 m (Florida Museum, 2012). Young sharks are typically found utilizing habitats closer to shore than adults (Compagno, 1984b). Lemon shark nurseries have been recorded in the Florida Keys, Tampa Bay, FL, and along the Gulf coast of Texas (McCandless et al., 2002). Lemon sharks typically inhabit deeper waters during the daytime and move to shallower waters at night (Florida Museum, 2012). Off Florida, this species also migrates south into deeper water during the winter (Compagno, 1984b). Lemon sharks mate and give birth to live young during the spring and summer, from May to September (Compagno, 1984b). Lemon sharks consume a variety of crustaceans, mollusks, and fishes (croaker, jack, mullet, ray, and shark) located over sandy or muddy substrates (Compagno, 1984b; Florida Museum, 2012).

NOAA Fisheries has designated EFH for adult and neonates within the Project area for this species (NOAA Fisheries, 2009) Neonate lemon shark (≤68 cm TL) EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath in the Gulf between Texas mid-coast and the Florida Keys. Juvenile lemon shark (69 to 235 cm TL) EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath in areas along Texas and eastern Louisiana (NOAA Fisheries, 2009).

Bull Shark

The bull shark is managed under the Large Coastal Shark MU in the Shark MU through the Final Atlantic Consolidated FMP for HMS (NOAA Fisheries, 2006). Bull sharks are a circumglobal species and in the northwest Atlantic are distributed from Massachusetts to Florida, including the Gulf. The shark is considered most common off southern Florida and in the Gulf (Castro, 1983; Compagno, 1984b). This shallow-water species is common in both tropical and subtropical regions and in marine, estuarine, and freshwater habitats and can journey long distances up large rivers (NOAA Fisheries, 1999). The bull shark typically occupies shallow coastal waters less than 30 m deep but has been observed at depths to 152 m deep. Adults occupy deeper waters than juveniles. Bull sharks typically stay near the bottom, rarely utilizing surface waters (Compagno, 1984b). Bull shark nurseries have been recorded in low salinity estuaries extending from North Carolina to the Gulf of Mexico (McCandless et al., 2002). Bull sharks migrate north, as far as Massachusetts, along the coast during the summer and then return south as waters cool (Compagno, 1984b). Mating occurs in late spring or early summer (June or July), with birth to live young occurring in estuaries and river mouths the following year, from April to June (Castro, 1983; Compagno, 1984b). Bull sharks are opportunistic feeders that prey on a wide variety of bony fishes, shark species, and invertebrates. Additionally, stomach contents have revealed that this species also consumes sea turtles, sea birds, and marine mammals (Compagno, 1984b).

NOAA Fisheries has designated EFH for neonates, juveniles and adults within the Project area for this species (NOAA Fisheries, 2009). Neonate bull shark (≤95 cm TL) EFH is designated as shallow coastal waters, including inlets and estuaries in the Gulf between Texas, and the west coast of Florida, with localized areas off of Mississippi and the Florida Panhandle. The mid-east coast of Florida to South Carolina is also EFH for bull sharks (NOAA Fisheries, 2009). Juvenile bull shark (84 to 225 cm TL) EFH is designated as shallow coastal waters, inlets, and estuaries in waters less than 25 m off western Florida and in the Gulf of Mexico from Texas through the Florida Keys (NOAA Fisheries, 2009). Adult bull shark (≥226 cm TL) EFH is designated for this life stage is in western Florida through the Florida Keys and also the Texas coast and eastern Louisiana.

Finetooth Shark

The finetooth shark is managed under the Small Coastal Shark MU through the Final Consolidated Atlantic HMS FMP (NOAA Fisheries, 2006). In the western Atlantic Ocean, the finetooth shark is distributed from North Carolina south to Cuba and southern Brazil, including the Gulf (Compagno, 1984a). Not a lot is known about habitat associations of this species. Finetooth sharks form large schools and are located in waters close to shore to depths of 10 m (Compagno, 1984a). Finetooth shark estuarine nursery areas have been documented from South

Carolina (e.g., Bulls Bay, SC) to the Gulf (Castro, 1993; McCandless et al., 2002). Finetooth sharks give birth to live young from May to June (Florida Museum 2012). This species feeds on bony fishes (mullet, Spanish mackerel, spot, and menhaden), crustaceans, and cephalopods (Compagno, 1984a; Florida Museum, 2012).

NOAA Fisheries has designated EFH for neonates within the Project area for this species (NOAA Fisheries, 2009). Neonate finetooth shark (65 cm TL) EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath in the Gulf off of Texas, eastern Louisiana, Mississippi, Alabama, and the Florida Panhandle (NOAA Fisheries, 2009).

Spinner Shark

The spinner shark is managed under the Large Coastal Shark MU through the Final Consolidated Atlantic HMS FMP (NOAA Fisheries, 2006). Spinner sharks are found in the Atlantic, Pacific, and Indian Oceans, as well as the Mediterranean Sea. In the western Atlantic, the spinner shark ranges from North Carolina to Argentina, including the northern Gulf, Cuba, and the Bahamas (Manooch, 1988). The spinner shark ranges from inshore to offshore waters over continental and insular shelves and is typically found in depths ranging from of less than 30 m to depths of more 75 m (Compagno, 1984a; Florida Museum, 2012). Juveniles inhabit shallower waters, including lower portions of bays (Florida Museum, 2012). Spinner shark nurseries have been recorded from Cape Hatteras, NC through the Gulf, including Bulls Bay, SC (Castro, 1993; McCandless et al., 2002). The spinner shark is considered a highly migratory species that moves south and into deeper waters during autumn and winter months and inshore for reproducing or feeding in the spring and summer. They usually migrate in schools. In the Gulf and off Florida, live young are born in spring to early summer (Compagno, 1984a). Spinner sharks feed on schooling fishes (sardines, herring, and anchovies), squid, skates, rays, and other sharks (Manooch, 1988). This species is often seen in schools, leaping out of the water while spinning in pursuit of prey (Florida Museum, 2012).

NOAA Fisheries has designated EFH for juveniles and neonates within the Project area for this species (NOAA Fisheries, 2009). Neonate spinner shark (≤ 71 cm TL) EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath in the Gulf along Texas, eastern Louisiana, the Florida Panhandle, and the western coast of Florida. Juvenile spinner shark (72 to 184 cm TL) EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath in the Gulf of Mexico between Texas and the Florida Panhandle and along the west coast of Florida to the Florida Keys.

Scalloped Hammerhead Shark

The scalloped hammerhead shark is managed under the Large Coastal Shark MU through the Final Consolidated Atlantic HMS FMP (NOAA Fisheries, 2006). Scalloped hammerhead sharks are found in warm-temperate to tropical waters worldwide over the continental shelf and slope (Castro, 1983; Compagno, 1984a). In the western Atlantic, the scalloped hammerhead's range extends from New Jersey to Brazil, as well as the Gulf and the Caribbean Sea (Florida Museum, 2012). This species inhabits waters from the surface to depths of 275 m and is found close to shore, in bays and estuaries, preferring water temperatures of at least 22°C (Castro, 1983; Compagno, 1984a). Typically, scalloped hammerhead sharks spend the day close to shore and move to deeper waters at night to feed (Florida Museum, 2012). Scalloped hammerheads give

birth once a year in the summer starting around June in shallow coastal nurseries found from Virginia to the Gulf (Castro, 1993; McCandless et al., 2002). This species forms large schools when it migrates seasonally north to south along the eastern U.S. coast (NOAA Fisheries, 1999). Scalloped hammerhead sharks consume a wide variety fishes, as well as invertebrates, and have been reported feeding only at night (Compagno, 1984a).

NOAA Fisheries has designated EFH for juveniles and neonates within the Project area for this species (NOAA Fisheries, 2009). Neonate scalloped hammerhead shark (≤ 62 cm TL) EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath in the Gulf from Texas to the southern west coast of Florida. (NOAA Fisheries, 2009). Juvenile scalloped hammerhead shark (63 to 227 cm TL) EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath in the Gulf from the southern to mid-coast of Texas, eastern Louisiana to the southern west coast of Florida (NOAA Fisheries, 2009).

Bonnethead Shark

The bonnethead shark is managed under the Small Coastal Shark MU in the Shark MU through the Final Atlantic Consolidated FMP for HMS (NOAA Fisheries, 2006). The bonnethead shark is limited to warm waters in the Atlantic Ocean ranging from coastal southern New England south to the Gulf and Brazil and is most common in the Caribbean Sea, including Cuba and the Bahamas. In the Pacific, this shark species also ranges from southern California to Ecuador (Castro, 1983). Bonnethead sharks inhabit shallow coastal waters, where they are typically associated with sandy or muddy substrates (Castro et al., 1999). This species inhabits continental and insular shelves, over reefs, estuaries, seagrass beds, and shallow bays from depths of 10 to 80 m (Compagno, 1984b). Bonnethead shark nurseries have been identified in estuaries from South Carolina south along the Atlantic coast into the Gulf (McCandless et al., 2002). Bonnethead sharks prefer water temperatures warmer than 21°C and migrate accordingly back and forth to the equator throughout the year. This species migrates to inshore areas of the North Carolina, South Carolina, and Georgia during the summer and off Florida and the Gulf from spring through fall. During the winter, it moves southward to deeper waters. This species mates, off the coast of Florida, during the spring and autumn and gives birth to live young during the late summer through early fall in shallow waters (Castro, 1983; Branstetter, 2002; Lombardi-Carlson et al., 2003). Bonnethead sharks prey primarily upon benthic species, including shrimp (mantis and pink), crab (blue, spider, purse, and stone), octopus, and fishes during the daytime (Castro, 1983; Branstetter, 2002).

NOAA Fisheries has designated EFH for neonates, juveniles and adults within the Project area for this species (NOAA Fisheries, 2009). Neonate (≤ 38 cm TL), juvenile (39 to 82 cm TL), and adult (≥83 cm TL) bonnethead shark EFH is designated as shallow coastal waters, inlets, and estuaries in the Gulf along Texas, and from eastern Mississippi through the Florida Keys. (NOAA Fisheries, 2009).

Blacktip Shark

The blacktip shark is managed under the Large Coastal Shark MU in the Shark MU through the Final Atlantic Consolidated FMP for HMS (NOAA Fisheries, 2006). This shark is found worldwide in predominantly tropical seas but occurs seasonally in warm-temperate coastal waters. In the western Atlantic Ocean, it ranges from coastal southern New England southward

to southern Brazil, encompassing nearly all of the eastern U.S., Gulf, and Caribbean Sea (Garrick, 1982). The blacktip is considered rare in New England and is most abundant off South Carolina, Georgia, and Florida in summer (Castro, 1983). The blacktip shark ranges from inshore estuarine waters, including bays and mangrove swamps, to offshore habitats (coral reefs) but rarely is found at depths greater than 30 m. This species often stays near the surface. Although often recorded offshore, it is not considered a true oceanic shark species. It has a wide salinity tolerance but generally does not move far into riverine systems (Compagno, 1984a). Neonate and juvenile sharks utilize nursery areas and can remain there for up to a year. Blacktip shark nurseries have been identified in nearshore and estuarine waters (muddy substrates or seagrass beds with depths of 2 to 4 m) from North Carolina through the Gulf (Castro, 1993; NOAA Fisheries, 1999; McCandless et al., 2002). Recent analysis has determined that sharks in Gulf and Atlantic nurseries are genetically distinct and separate from one another (Keeney et al., 2003). Large schools of blacktip sharks, off the coast of Florida, seasonally migrate north to south along the coast up to 1,159 NM (NOAA Fisheries, 1999; Keeney et al., 2003). This species migrates to deeper waters during the winter and utilizes coastal waters of the southeastern U.S. during the summer (Castro, 1983; Manooch, 1988). Blacktip sharks give birth to live young in inshore nursery grounds, during late spring to early summer (April to June) after 10 to 11 months gestation period (Castro, 1983; Compagno, 1984a). Blacktip sharks are active mid-water hunters, feeding on benthic and pelagic fishes (menhaden, rays, herring, butterfish, sardines, and other shark species), cephalopods (squids), and other invertebrates (Compagno, 1984a; Manooch, 1988).

NOAA Fisheries has designated EFH for neonates, juveniles and adults within the project area for this species (NOAA Fisheries, 2009). Neonate (≤ 69 cm TL), juvenile (69 to 155 cm TL) and adult (155 cm TL) blacktip shark EFH is designated as coastal areas in the Gulf from Texas through the Florida Keys.

Atlantic Sharpnose Shark

The Atlantic sharpnose shark is managed under the Small Coastal Shark MU through the Final Consolidated Atlantic HMS FMP (NOAA Fisheries, 2009). This shark is a subtropical-tropical species found throughout the Atlantic Ocean. The Atlantic sharpnose shark inhabits the waters of the northeastern coast of North America from New Brunswick to Florida, extending to the Yucatan area in the Gulf (Castro 1983; Florida Museum, 2012). This shark is a common year-round coastal inhabitant from South Carolina south to the Gulf and is a seasonally abundant migrant off Virginia (NOAA Fisheries, 1999). The Atlantic sharpnose shark is most abundant in warm-temperate to subtropical waters of the continental shelf, from inshore areas such as estuaries to the surf zone and out over the shelf in water as deep as 280 m, but it mostly remains in waters less than 10 m deep (Florida Museum, 2012). This demersal shark has a broad salinity tolerance and has been found up rivers, such as the Pascagoula River in Mississippi (Florida Museum, 2012). This species and its nursery areas can also be found in estuarine habitats (Castro, 1993). The Atlantic sharpnose shark performs inshore-offshore movements seasonally, moving into deeper offshore waters during winter as water temperatures fall (Compagno, 1984a; Florida Museum, 2012). Atlantic sharpnose sharks typically mate in late spring and early summer with females migrating offshore during their pregnancy (Florida Museum, 2012). This species moves back inshore to give birth to live young in shallow, protected areas during the late spring to early summer of the following year, from North Carolina to central Florida (Castro

1983; 1993). Off North Carolina, Atlantic sharpnose sharks typically give birth starting in May (Castro, 1993). This species feeds on fishes (menhaden, eel, silverside, wrasse, jack, toadfish, filefish, smallmouth flounder, herring, anchovy, pipefish, sea robin stargazer, and puffer), worms, shrimp, crabs, and mollusks (Florida Museum, 2012; Branstetter, 2002).

NOAA Fisheries has designated EFH for neonates, juveniles and adults within the project area for this species (NOAA Fisheries, 2009). Neonate (40 cm TL), juvenile (41 to 78 cm TL), and adult (79 cm TL) Atlantic sharpnose shark EFH is designated as shallow coastal areas such as bays and estuaries out to a 25 m isobath within the Gulf between Texas and the Florida Keys.

EFH Species in Corpus Christi Bay

The GFMFC final EIS for EFH for the Gulf FMPs (GFMFC, 2004) and the Consolidated Atlantic HMS FMP (NOAA Fisheries, 2010) provide detailed information on life history and relative abundance for species identified as having EFH in the Project area. For the species and life stages identified a summary of the Corpus Christi Bay estuary EFH species life stage is provided in Table 2-1.

Spawning and larval development of the penaeid shrimp occur in the Gulf. They have similar life history stages, are estuarine-dependent and vary seasonally in abundance. Adult white shrimp begin to appear in Corpus Christi Bay with a major peak of abundance beginning in August during the high salinity season extending through the end of March, are common in the spring as salinity decreases and begin to migrate back to the sea during June when bay salinities begin to increase. Juveniles are common in the bay during decreasing and low salinities from November to June becoming abundant from July to October. Brown shrimp utilize the same nursery grounds as the white shrimp during the growth period from the post-larval stage to the adult stage. Adult brown shrimp distribution from April to October is rare and they are not present in the bay between March and November. The juvenile shrimp population is highly abundant in the upper portion of Nueces Bay from April to June and commonly found in the entire Corpus Christi Bay system throughout the year. For the pink shrimp, adults are not present whereas juveniles commonly occur almost year-round except during July when they are rarely present in the bay.

Table 2-1
Summary of Corpus Christi Bay EFH Information

Species	Eggs	Larvae / Neonates	Juveniles	Adults
HIGHLY MIGRATORY SPECIES				
Lemon Shark *(Negaprion brevirostris)*	NA	X		X
Bull Shark *(Carcharhinus leucas)*	NA	X	X	X
Finetooth Shark *(C. isodon)*	NA	X		
Spinner Shark *(C. brevipinna)*	NA	X	X	
Scalloped Hammerhead Shark *(Sphyrna lewini)*	NA	X	X	

Table 2-1 Summary of Corpus Christi Bay EFH Information				
Species	**Eggs**	**Larvae / Neonates**	**Juveniles**	**Adults**
Bonnethead Shark *(Sphyrna tiburo)*	NA	X	X	X
Blacktip Shark *(C. limbatus)*	NA	X	X	X
Atlantic Sharpnose Shark *(Rhizoprionodon terraenovae)*	NA	X	X	X
COASTAL MIGRATORY PELAGICS				
Spanish Mackerel (*Scomberomorus maculatus*)	X	X	X	X
REEF FISH/SNAPPER-GROUPER				
Gray Snapper *(Lutjanus. griseus)*			X	X
Dog Snapper *(L. jocu)*	X	X	X	X
Lane Snapper *(L. sunagris)*			X	X
Goliath Grouper *(Epinephelus itajara)*	X	X	X	X
Yellowmouth Grouper *(Mycteroperca interstitialis)*	X	X	X	X
INVERTEBRATES				
Brown Shrimp (*Farfantepenaeus aztecus*)	X	X	X	X
White Shrimp (*Litopenaeus setiferus*)	X	X	X	X
Pink Shrimp (*Farfantepenaeus duorarum*)	X	X	X	X
Source: NOAA EFH MAPPER, 2012; GFMFC, 2004				

Adult and juvenile forms of red drum are common throughout the year. Adult Spanish mackerel are common throughout the year except the November through March period of decreasing salinity when they are rarely present in Corpus Christi Bay. Conversely, the juvenile Spanish mackerel do not occur in Corpus Christi Bay during the November through March period and only rarely occur during the time between April and October.

Snappers are common in all warm marine waters of the world. Most are inshore dwellers, although some occur in open-water. Some species enter estuaries and mangroves, with the latter functioning as nursery grounds. The serranids (grouper) form a large and important element of the tropical marine fish faunas around the world. Most are carnivorous bottom dwellers, associated (as adults) with hard-bottomed substrates, and rocky reefs. Of these species, the goliath grouper is most abundant in the Eastern Gulf (GFMFC, 2004). Smaller yellowmouth grouper are known to prefer mangrove habitat (GFMFC, 2004).

Shark habitat can be described in four broad categories: (1) coastal, (2) pelagic, (3) coastal-pelagic, and (4) deep-dwelling. Coastal species inhabit estuaries such as Corpus Christi Bay, the nearshore and waters of the continental shelves. Pelagic species, on the other hand, range widely in the upper zones of the oceans, often traveling over entire ocean basins. Coastal-pelagic species are intermediate in that they occur both inshore and beyond the continental shelves, but have not demonstrated mid-ocean or transoceanic movements. Deep-dwelling species inhabit the dark, cold waters of the continental slopes and deeper waters of the ocean basins. Blacktip, finetooth, bull, lemon, spinner, bonnethead, scalloped hammerhead and Atlantic sharpnose sharks are all considered coastal sharks (NOAA Fisheries, 2010). Sharks feed on many prey including menhaden, cephalopods, shrimp, blue crabs, mullet, lobster, sardines, marine catfish, and pinfish. They also eat fast-swimming bony fishes and small sharks. Each of these shark species has the potential to occur within Project area habitat types.

Most estuarine species, particularly shrimp, red drum, as well as reef fish- and snapper-grouper-associated species, spawn offshore and move inshore to take advantage of rich estuarine waters while they develop before emigrating offshore as adults. Seagrass and coastal marsh habitats typically serve as nursery areas for juvenile penaeid shrimp and red drum, therefore these species are likely to occur in these habitats during the early phase of their life cycle. Red drum inhabit estuaries throughout their life cycle but exhibit less affinity towards vegetated areas as they age and therefore have a moderate probability of occurrence in all Project area habitat types. Estuarine dependent and nearshore reef fish and snapper-grouper species, utilize areas inshore of the 100-foot contour, such as attached macroalgae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub (mangrove fringe); oyster reefs and shell banks; unconsolidated bottom (soft sediments); artificial reefs; and coral reefs and live/hard bottom for all life stages and therefore have a moderate probability of occurrence in all Project area habitat types. Other species, such as coastal migratory pelagics (Spanish mackerel, king mackerel, cobia) and highly mobile species (sharks) utilize estuaries opportunistically in pursuit of prey mainly as adults.

3.0 POTENTIAL EFFECTS ON EFH

Based on comparisons of habitat preferences as described above and the aforementioned characteristics of the major habitat types, open bay habitat and seagrass habitat near the proposed CCL Terminal site could potentially function as EFH for the following species: eggs, larvae, juvenile and adult brown shrimp, pink shrimp, white shrimp; juvenile and adult gray snapper, lane snapper, red drum, and Spanish mackerel; eggs, larvae, juvenile and adult dog snapper, goliath grouper, and yellowmouth grouper; neonate finetooth shark; neonate and adult lemon shark; neonate and juvenile spinner and scalloped hammerhead sharks; and, neonate, juvenile and adult bonnethead, blacktip, bull, and Atlantic sharpnose sharks. Of these, adult brown shrimp, pink shrimp, gray snapper, goliath grouper, and Spanish mackerel are considered rare or not present in Corpus Christi Bay (GMFMC, 2003; 2004; E&E, 2003) and therefore are not likely to occur in the vicinity of the proposed Project. Highly mobile species (*e.g.*, coastal sharks) that utilize estuaries opportunistically in pursuit of prey mainly as adults would likely experience temporary displacement by construction of the proposed Project.

Coastal marsh habitat and tidal flat habitat near the proposed CCL Terminal site could potentially function as EFH during periods of inundation for the following species: eggs, larvae,

juvenile and adult brown shrimp, pink shrimp, white shrimp; juvenile and adult gray snapper, lane snapper, red drum, and Spanish mackerel; eggs, larvae, juvenile and adult dog snapper, goliath grouper, and yellowmouth grouper; neonate finetooth shark; neonate and adult lemon shark; neonate and juvenile spinner and scalloped hammerhead sharks; and, neonate, juvenile and adult bonnethead, blacktip, bull, and Atlantic sharpnose sharks. Of these, adult brown shrimp, pink shrimp, gray snapper, goliath grouper, and Spanish mackerel are considered rare or not present in Corpus Christi Bay (GMFMC, 2003; 2004; E&E, 2003) and therefore are not likely to occur in the vicinity of the proposed Project.

In addition to being designated as EFH, the tidally influenced wetlands, seagrass, mud and sand substrates and shallow water habitats in the Project area provide nursery, foraging and refuge habitats that support various recreationally and economically important marine fishery species such as spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys spp*.), Atlantic croaker (*Micropogonias undulatus*), black drum (*Pogonias cromis*), Gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*) and blue crab (*Callinectes sapidus*). Such estuarine-dependent species serve as prey for other fisheries managed by GMFMC (*e.g.*, red drum, mackerels, snappers and groupers) and highly migratory species managed by NOAA Fisheries (*e.g.*, billfishes and sharks).

CCL proposes to use a hydraulic cutterhead dredging system to remove approximately 4,867,290 cubic yards of mostly virgin stiff clays with interbedded sand and silty layers to create the berthing area and maneuvering basin at the CCL Terminal. Maintenance dredging may be required approximately every four years and the volume is assumed to be 200,000 cubic yards each occurrence. During the dredging operation, potential effects on water quality could include temporary increased turbidity surrounding the hydraulic cutterhead of the dredge as well as around the mixing zone where the water from the dredging activities reenters the bay. Disturbance of bottom sediments during dredging can significantly increase turbidity and down-current deposition of re-suspended sediments. Very high levels of turbidity can result in the physical impairment of estuarine species (*e.g.*, turbidity induced clogged gills resulting in suffocation, or abrasion of sensitive epithelial tissue). Dredging with a hydraulic cutterhead dredge generally creates less turbidity than other types of dredges (*i.e.*, mechanical bucket or hopper dredges). With a cutterhead dredge, the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity. Herbich and Brahme (1984) discuss the mechanism of turbidity generation around the cutterhead, and based on model studies reported that turbidity at the cutterhead moved horizontally in all directions but its vertical movement was very limited.

Ward (1997) describes the tidal flushing in Corpus Christi Bay as a restricted flow, tidal regime switching from a semi-diurnal to diurnal. The tides are wind dominated which results in relatively higher tides in summer and spring with lower tides in winter and fall because of the prevailing wind. Because of the change in the width to depth ratio of the La Quinta Channel, overall currents would be expected to be relatively low, particularly at or near the bottom where dredging would occur.

CCL proposes to dispose of dredged material in upland areas on and immediately north of the proposed CCL Terminal site. Return water from the dredged material disposal areas would flow into an existing drainage canal along the western boundary of the CCL Terminal site and back

into Corpus Christi Bay. Dredged material return water is addressed in the CCL Section 401 permit.

Based on the general hydraulic characteristics of the site and the proposed depth of dredging, most of the sediment that would become suspended during the dredging process is expected to be short term and the water quality would return to background levels a short distance from the point of disturbance (McLellan et. al., 2004). Impacts to EFH due to water quality impacts from dredging are therefore expected to be short term and minimal, and turbidity control methods are not expected to be required.

Entrainment of aquatic organisms by dredging machinery can impact EFH species directly, or indirectly through the removal of prey species (*e.g.*, benthic invertebrates) or food species (*e.g.*, macroalgae), disrupting energy flow and biotic interactions. Entrainment of benthic organisms during the dredging of the proposed berthing and maneuvering areas is expected, however, entrainment would not be extensive enough to have a significant impact on the fishery resources of Corpus Christi Bay. In addition, benthic organisms typically have rapid re-colonization rates that would limit impacts to the biota of these areas due to entrainment to short-term impacts.

Dredging can also result in the chemical impairment of the water column due to the suspension of contaminated sediments. The Final Environmental Impact Statement for the Corpus Christi Ship Channel Improvement Project (COE, 2003) reported the results of sediments that were sampled and analyzed for organic and metallic chemicals. The COE's EIS included samples from the La Quinta Channel extension that would overlap the area of the proposed dredging. In addition, Corpus Christi LNG, L.P. collected three sediment cores from the proposed dredging area and had them analyzed for metals. In the United States Army Corps of Engineers ("COE") Final EIS, the results were compared to the Effects Range Low ("ERL"), which are used by NOAA as screening levels for assessing sediment quality. These are conservative concentration levels and are considered the lowest concentrations where effects on the marine ecology have been observed. These levels are used to identify sediment that may require additional evaluations before decisions on disposal or beneficial re-use are made.

In 1985 samples from the La Quinta Channel, arsenic ranged from 12 to 15 milligrams per kilogram ("mg/kg") in all six samples, which is above the ERL of 8.2 mg/kg. Six samples were taken from the same stations in 1990 and again in 2000, and all metals were below the ERL levels. Three samples were taken in 2000 from the La Quinta extension and analyzed for metals, and all metals were below the ERLs. The samples taken in 1985 were analyzed for PCBs and pesticides and all detections were below ERL levels. The samples taken in 1990 and 2000 were analyzed for PCBs, pesticides, and PAHs, and all detections were below ERL levels. The COE concluded that, overall, there is no indication of current water quality problems in the La Quinta Channel reach, or problems that would result from dredging to extend the La Quinta Channel (COE, 2003).

The results of the analysis of CCL's core samples were compared to the Protective Concentration Levels ("PCL") for Tier 1 commercial/industrial soil protective of Class 3 groundwater. All concentrations were below the PCL level.

Dredging and the direct removal of suitable benthic substrates can impact EFH by removing suitable cover or settlement structure. Dredging typically homogenizes bottom substrates, reducing the structural complexity of habitats. Field surveys of the Project site revealed that the open bay habitats that would be dredged already consist of a homogenous bed of fine substrates. Dredging of these areas would therefore not significantly alter the existing bottom type, with the exception of vegetated areas, discussed below.

Approximately 118.0 acres would be affected by the proposed Project dredging. Of the 118.0 acres, approximately 95.9 acres is currently shallow open water habitat that would be deepened to 46 feet NAVD88 plus 2 feet paid overdredge plus 2 feet advanced maintenance, with side slopes of 3:1 to match the adjacent La Quinta Turning Basin. The Project would therefore permanently alter this habitat, changing it from shallow water to deep water. Impact on EFH species would depend on the species use of deeper water habitats. Many of the species that occupy shallow-water habitats may also inhabit the deeper water habitats that currently exist in the adjacent La Quinta Channel and Turning Basin sometime during their life cycle. Many species reside or migrate through both inshore and offshore areas at different stages of their lives and during different seasons throughout the year.

Of the 95.9 acres of shallow open water habitat that would be dredged, approximately 9.7 acres is currently submerged aquatic seagrass beds, 6.8 acres is cordgrass saltmarsh, another 2.14 acres is currently coastal marsh and vegetated tidal flat, and another 7.6 acres is currently black mangrove. Portions of these habitats would be permanently converted to open water habitat. Of the 26.2 acres of existing EFH functioning habitat within the CCL Terminal site, 22.8 acres of seagrass, coastal marsh, cordgrass saltmarsh, vegetated tidal flat, and black mangrove would be lost. These habitats are valuable habitat types relative to fish and EFH as they provide a food rich environment for productive foraging and refuge to juveniles and prey species from predators. Alteration of these habitats can cause a reduction or loss of juvenile or prey species' rearing habitats and an alteration in the timing of life history stages.

While the existing functions of the permanently impacted seagrass, coastal marsh, cordgrass altmarsh, vegetated tidal flat, and black mangrove would be lost, this area would function as open water habitat (EFH for adult and juvenile brown shrimp, pink shrimp, white shrimp, red drum and Spanish mackerel).

The permanent conversion of wetlands as a result of the proposed dredging will require compensatory mitigation to comply with the COE's Section 404(b)1 guidelines. On October 18, 2005, the COE issued the Section 404/10 Individual Permit (modified on June 14, 2012; Permit Number SWG-2007-01637 [formerly number 23561]) to Corpus Christi LNG, L.P. which specified compensatory mitigation in the form of constructing 16 breakwaters (totaling 2.35 acres) along the coast of Shamrock Island.

CCL has prepared an aquatic resources mitigation plan in consultation with a number of resource agencies addressing measures to mitigate for unavoidable impact to 25.55 acres of wetlands from construction of the CCL Terminal. The plan identified five potential mitigation options and identified an offsite mitigation option – Shamrock Island alternative – as its preferred mitigation. The Shamrock Island alternative will include wetland creation and preservation at Shamrock Island through the creation of breakwaters around portions of the island. The mitigation plan will result in a net gain of wetland functions and values in Corpus Christi Bay. The mitigation plan

has been approved by the COE and CCL plans to have a contractor perform the mitigation during the fall of 2012.

In addition to impacts from dredging during construction of the Project, sound pressure waves produced during pile driving activities to construct the marine terminal may result in impacts on nearby fish species with EFH designations and their prey. Although the effects of pile driving are poorly studied and there appears to be substantial variation in a species' response to sound, intense sound pressure waves can change fish behavior or injure/kill fish through rupturing swim bladders or causing internal hemorrhaging. The intensity of the sound pressure levels produced during pile driving depends on a variety of factors including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile-driving hammer. The degree to which an individual fish exposed to sound waves would be affected is dependent upon variables such as the peak sound pressure level and frequency as well as the species, size, and condition of a fish (*e.g.,* small fish are more prone to injury by intense sound waves than are larger fish of the same species). Depending on the specific conditions at the site, pile driving activities could generate underwater sound levels great enough to injure some fish or cause them to be more susceptible to predation.

In a review of studies documenting fish kills associated with pile driving, NOAA Fisheries (2003) reported that all have occurred during use of an impact hammer on hollow steel piles. CCL has not yet identified the type of hammer that would be used to drive piles during construction of the marine terminal. However, because the piles would be located in a recently dredged unloading slip, it seems likely that construction noise and activities would cause many fish to avoid the area of the most intense sound levels.

Ship and boat traffic associated with construction and operation of the Project would also generate underwater sounds. Although vessel sounds would not generally be of the intensity produced from driving steel piles, project vessels (LNG carrier ships ["LNGCs"], tugs, construction barges) operating in the La Quinta Channel could result in sounds that illicit responses in fish. Most research suggests that fish exhibit avoidance behavior in response to engine noise (ICES, 1995). At the same time, research conclusions tend to suggest that since the effects are transient (*i.e*., once the ship passes, behavior returns to normal), then the long-term effects on populations are negligible (Stocker, 2001).

It is expected that any LNGC calling at the CCL Terminal would be in full compliance with the domestic requirements for ballast water management as specified in the National Invasive Species Act of 1996 and international standards that were adopted on February 13, 2004. Additionally, the CCL Terminal would comply with Port of Corpus Christi Authority ("PCCA") general and specific discharge prohibitions (regulations) currently in place.

While taking on LNG cargo at the CCL Terminal, LNGCs will discharge seawater ballast to maintain stability. In accordance with IMO regulations, LNGCs are required to undergo mid-ocean ballast water exchange during transit, so that the source of the ballast water discharged at the Project will not be from a foreign port but will be from the open sea. Ballast water is exchanged through seachests and it is estimated to take between 25 and 72 hours to complete ballast water discharge while at dock depending on the rate of LNG cargo loading.

Ballast discharge is necessary to maintain a constant draft at the berth. Ballast discharge will consist of close to or slightly higher salinity levels normally occurring in the CCL Terminal area. Negative effects on marine life will be minimized by a number of factors. First, ballast water salinity will be within the salinity range tolerated by local marine species. Thus, temporary spikes in salinity are not anticipated to adversely affect fish and other marine organisms. Second, ballast water will be discharged near the bottom of the waterway, where salinity levels are naturally higher and the ballast water can enter the saltwater wedge and move toward the open Gulf. Third, as the LNGCs move into and out of the marine berth, the amount of water displaced by the LNGC (on average 110,000 tons per vessel) will be circulated into, around and out of the berth and will facilitate rapid mixing of any ballast water and flushing of the marine berth on a per ship basis. The net effect is enhanced and rapid dilution of any ballast water upon departure of the LNGC. Finally, the amount of freshwater flowing into the Corpus Christi Bay from the Nueces River, as well as other freshwater sources along the La Quinta Channel, exceeds anticipated ballast discharge. Thus, the ballast water will be quickly diluted to ambient salinity. Therefore, any effects on salinity are expected to be temporary and localized, and are not expected to have any negative effects on the marine life in and around the CCL Terminal.

If it is necessary for ballast water to be taken on at the CCL Terminal, during cargo delivery, each LNGC would discharge its entire cargo to LNG storage tanks on shore. As with LNG export, LNGCs discharging LNG cargo would take on seawater ballast to maintain a constant draft at the berth. Aquatic species in the immediate vicinity of the ship berths could therefore be impacted by entrainment during ballast water intake.

CCL will not own the LNGCs bringing LNG to the CCL Terminal or loading LNG from the CCL Terminal and will not have contractual control over the LNGC operations related to ballasting and any resulting invasive species issues. As a practical matter ballast water is a requirement to maintain stability while at the berth. Because proper ballasting is a safety issue, CCL will not be in a position to second guess the LNGC's officers in using their judgment as to the timing or amount of ballast water to discharge or take, which can vary due to certain factors (e.g., existing weather and sea conditions).

4.0 CONSERVATION MEASURES

CCL has attempted to avoid or minimize impacts on coastal resources, including EFH, by identifying a site for the proposed CCL Terminal that is adjacent to an existing deep water shipping channel, a site with existing industrial activity or history of industrial activity, and a site that would minimize impact on coastal wetlands. Because the proposed site is immediately adjacent to the existing La Quinta Turning Basin and Channel, the need for dredging would be limited to that required for the CCL Terminal maneuvering basin and berths.

Unavoidable adverse impacts as a result of the proposed Project are described above. To mitigate for unavoidable impact on wetlands, CCL has prepared an aquatic resources mitigation plan (see Appendix 3B of Resource Report 3) to avoid or reduce wetland impacts and to avoid a net loss of wetlands as necessary to comply with the COE's Section 404(b)1 guidelines. Wetland mitigation at Shamrock Island is planned to occur during the fall of 2012.

5.0 CONCLUSIONS OF THE EFH ASSESSMENT

Construction and operation of the proposed Project would have temporary and long-term effects on EFH. In general, temporary impacts are not expected to be significant considering the proposed dredging method and the localized effect of the actions compared to the area of Corpus Christi Bay that would be unaffected. Dredging of the proposed berthing and maneuvering basin would temporarily affect EFH by disturbing bottom sediments and increasing turbidity in the vicinity of dredging activity, which can have adverse physiological effects on finfish and shellfish species. Hydraulic dredging would also directly affect some benthic species that would be entrained during dredging. However, considering the nature of the sediments that would be dredged and the use of hydraulic cutterhead dredging and the temporary nature of the dredging, these impacts should not be significant.

Impacts to EFH from the deposition of sediments re-suspended by dredging activities are expected to be minimal. Considering the hydraulic characteristics of the site and the depth of excavation, most of the sediment that does become suspended during the dredging process is expected to settle within or near the dredging footprint as opposed to migrating to adjacent areas. Field studies (McLellan et. al., 1986) of cutterhead dredges indicated that elevated turbidity is limited to the lower portion of the water column and turbidity levels are at background within several hundred feet of the cutterhead dredging operation. Because of the design of the channel, suspended sediments would be expected to stay within the confines of the dredged channel.

With the exception of areas of coastal wetland, dredging of open bay habitats is not expected to result in a significant alteration of habitat structure, as the area of the bay near the CCL Terminal site generally lacks habitat structure/cover. Also, considering the re-colonization rates of potentially affected benthic species and the relatively limited area affected by dredging, these losses would not be extensive enough to have a significant impact on the fishery resources of Corpus Christi Bay.

The primary impact on EFH would be the permanent loss of approximately 95.9 acres of shallow open water habitat, of which 22.8 acres consist of seagrass, coastal marsh, cordgrass saltmarsh, vegetated tidal flat, and black mangrove. This habitat provides valuable habitat for EFH managed species as they provide a food-rich environment for foraging, and refuge for juveniles and prey species utilized by EFH species. To compensate for this permanent loss of habitat, CCL will implement wetland mitigation designed to avoid a net loss of wetlands as necessary to comply with the COE's Section 404(b)1 guidelines. The compensatory mitigation includes the installation of breakwaters at Shamrock Island in Corpus Christi Bay during the fall of 2012.

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ATTACHMENT E-1

Letter from the National Marine Fisheries Service (NOAA Fisheries) Habitat Conservation Division to Ecology and Environmental, Inc.
Essential Fish Habitat Designation
Federally Managed Species

September 3, 2003

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

Southeast Regional Office
9721 Executive Center Drive N.
St. Petersburg, Florida 33702

September 3, 2003

Mr. Michael Johns
Project Director
Ecology and Environment, Inc.
720 North Post Oak Road, Suite 200
Houston, Texas 77024

Dear Mr. Johns:

The National Marine Fisheries Service (NOAA Fisheries) Habitat Conservation Division has reviewed the plans for the proposed Corpus Christi Liquified Natural Gas (LNG) Terminal Project, in San Patricio, Texas, to be located east of the City of Portland adjacent to the La Quinta Ship Channel. The applicant, Cheniere LNG, Inc. is preparing to file an application with the Federal Energy Regulatory Commission (FERC) for a proposed LNG terminal. Your letter requests site specific information on essential fish habitat and critical habitat within the project vicinity.

The project site is located in an area that has been identified as Essential Fish Habitat (EFH) by the Gulf of Mexico Fishery Management Council (GMFMC) for postlarval, juvenile, and subadult white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), red drum (*Sciaenops ocellatus*), postlarval and juvenile pink shrimp (*Farfantepenaeus duorarum*), and subadult Spanish mackerel (*Scomberomorous maculatus*). Categories of EFH in the vicinity of the project area include estuarine emergent marsh, seagrass, estuarine water column and estuarine mud and sand substrates. Detailed information on red drum, Spanish mackerel, shrimp, and other Federally managed fisheries and their EFH is provided in the 1998 amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC. The 1998 EFH amendment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (P.L. 104 - 297).

In addition to being designated as EFH, the tidally influenced wetlands, seagrass, mud and sand substrates and shallow water habitats in the project area provide nursery, foraging and refuge habitats that support various recreationally and economically important marine fishery species, such as spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys spp.*), Atlantic croaker (*Micropogonias undulatus*), black drum (*Pogonias cromis*), gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*), and blue crab (*Callinectes sapidus*). Such estuarine-dependent organisms serve as prey for other fisheries managed under the MSFCMA by the GMFMC (e.g., red drum, mackerels, snappers, and groupers) and highly migratory species managed by NOAA Fisheries (e.g., billfishes and sharks).

Section 305(b)(4)(A) of the MSFCMA requires that NOAA Fisheries provide EFH Conservation Recommendations for any Federal agency action or permit that may result in adverse impacts to EFH. We will provide the required official EFH Conservation Recommendations, as needed, after FERC has provided us with a detailed report on the potential impacts of the project on EFH.

Finally, the project area may be within the known distribution limits of Federally listed threatened species that are under purview of NOAA Fisheries. In accordance with the Endangered Species Act of 1973, as amended, it is the responsibility of the Federal Energy Regulatory Commission to identify actions that may affect endangered or threatened species or their habitat. Determinations involving species under NOAA Fisheries' jurisdiction should be reported to Ms. Georgia Cranmore of our Protected Resources Division (PRD) at the letterhead address. If it is determined that the activities may adversely affect any species listed as endangered or threatened and under PRD purview, then formal consultation must be initiated.

If we may be of further assistance, please contact Mr. Rusty Swafford of our Galveston Facility at (409) 766-3699.

Sincerely,

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

ATTACHMENT E-2

Personal Communication with NOAA Fisheries, Galveston, Texas

August 7, 2012

TETRA TECH EC, INC.

TELEPHONE / PERSONAL CONVERSATION REPORT

PROJECT NAME:	Corpus Christi Liquefaction Project	**PROJECT NUMBER:**	106-4483
TETRA TECH CALLER:	Timothy Feehan		
CONVERSATION WITH:	Heather Young		
AGENCY:	NOAA Fisheries – Galveston TX		
EMAIL ADDRESS:			
PHONE NUMBER:	409-766-3699		
SUBJECT:	Corpus Christi Bay EFH Species		
DATE AND TIME:	August 7, 2012;11:00 ET		

SUMMARY OF CONVERSATION:

We spoke about the species originally included in the EFH consultation with NOAA back in 2003. These species remain valid and should be included in the updated EFH Assessment. However, since then, more information has become available concerning a number of reef fish that could be included. We reviewed the list of species that I developed. Heather mentioned that she is currently doing an assessment for Laguna Madre, so it was fortunate that I called at this time. The final EFH EIS contains tables that help eliminate certain species. Species in Corpus Christi Bay would be from Ecoregion 5, with life stages in estuarine habitat in abundance that was at least considered "common" to the area. Reef fish that should be covered by the EFH Assessment include:

- Gray Snapper
- Dog Snapper
- Lane Snapper
- Goliath Grouper
- Yellowmouth Grouper

Additionally, coastal shark species have been addressed through Highly Migratory Species. EFH exists for some coastal shark species. At this time, Heather suggests that I include the 8 species I originally identified. She has an inquiry in with others at NOAA Fisheries to determine which species should be included with her assessment of Laguna Madre. We would need to address the same species. Until I hear from her, the sharks that need to be covered by the EFH Assessment include:

- Lemon Shark
- Bull Shark
- Finetooth Shark
- Spinner Shark

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- Scalloped Hammerhead Shark
- Bonnethead Shark
- Blacktip Shark
- Atlantic Sharpnose Shark

She mentioned that she would be the one to review the EFH Assessment when complete and would not expect too much changing from the original except for the additional species. I also brought up the fact that information from the ELMR Project that identified abundance for species based on salinity zone was no longer available or apparently not updated. She agreed that I would not find any additional information and that the NOAA EFH Mapper would be the primary source for species maps now. She expects that the ELMR information would be removed from the updated assessment.

Heather stated that she would follow up on shark information as soon as she got it.

Contact Signature: 

160 Federal Street, 3rd Floor, Boston, MA 02110
Tel 617.443.7500 Fax 617.737.3480
www.tteci.com

Appendix 3B
Aquatic Resources Mitigation Plan

CORPUS CHRISTI LIQUEFACTION TERMINAL
AND
CHENIERE CORPUS CHRISTI PIPELINE PROJECT
AQUATIC RESOURCES MITIGATION PLAN

Prepared for:

Corpus Christi Liquefaction, LLC
and
Cheniere Corpus Christi Pipeline, L.P
700 Milam, Suite 800
Houston, Texas 77002

Prepared by:
PBS&J
1880 S. Dairy Ashford, Suite 300
Houston, Texas 77077

Revised (August 2007) by:
TRC
7324 Southwest Freeway, 12th Floor
Houston, Texas 77074

Revised (August 2012) by:
HDR Engineering, Inc.
555 N. Carancahua, Suite 1600
Corpus Christi, Texas 78401

Contents

Tables

Appendices

ACRONYMS AND ABBREVIATIONS

Bscf	Billion Standard Cubic Feet
CBBEP	Coastal Bend Bays & Estuaries Program, Inc.
CCL	Corpus Christi LNG Terminal
DGPS	Differentially Corrected Global Positioning Satellite System
DMPA	Dredge Material Placement Area
DMPA 2	Dredge Material Placement Area 2, also known as Facility 200
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
LNG	Liquefied Natural Gas
LQSC	La Quinta Ship Channel
mcy	Million Cubic Yards
MLV	Mainline Valve
MLT	Mean Low Tide
NMFS	National Marine Fisheries Service
PMZ	Plume Management Zone
RAP	Response Action Plan
SAV	Submerged Aquatic Vegetation
TCEQ	Texas Commission on Environmental Quality
TGLO	Texas General Land Office
TPWD	Texas Parks and Wildlife Department
TNC	The Nature Conservancy
USACE	U.S. Army Corps of Engineers

1.0 PROJECT DESCRIPTIONS

This revision to the Aquatic Resources Mitigation Plan was developed to document the commitment of Corpus Christi Liquefaction, LLC (CCL) and Cheniere Corpus Christi Pipeline, L.P (CCP) to the mitigation sequencing process. Section 1.0 herein describes provides a brief Project description. Section 2.0 describes aquatic resources within the Project Area. Section 3.0 describes the extent of impacts to aquatic resources within the Project area as a result of construction activities. Section 4.0 describes CCL's and CCP's proposal to compensate for unavoidable aquatic impacts.

1.1 CORPUS CHRISTI LIQUEFACTION TERMINAL

The proposed CCL Terminal will liquefy, store, and export liquefied natural gas ("LNG") for supply to domestic and international natural gas markets. The CCL Terminal will be located on the north shore of Corpus Christi Bay in San Patricio and Nueces Counties, Texas, in what is currently primarily industrial land and upland scrub/shrub habitat. The proposed CCL Terminal facilities will consist of a marine terminal with associated LNG transfer lines, storage facilities, facilities for LNG liquefaction and send-out, additional utilities, infrastructure, and support systems required for operation of the CCL Terminal.

CCL includes a marine terminal with a maneuvering area and a protected double-berth LNG loading/unloading dock. These facilities will be capable of loading approximately 200 to 300 ships per year, or approximately one ship every 1.5 days. The marine facilities will also include a construction dock for receipt of large equipment via barge. The proposed docking slip will be dredged to a depth of minus 45 feet Mean Low Tide ("MLT"). A 3:1 slope will form the sides of the slip, portions of which will be protected using articulated block mats or other suitable means of stabilization. A sizeable expansion of the existing maneuvering area within the La Quinta Channel will be dredged to minus 45 feet MLT in which side slopes will also be 3:1. Construction of the proposed berths and maneuvering area will require the dredging of approximately 4.8 million cubic yards ("mcy") of material.

1.2 CHENIERE CORPUS CHRISTI PIPELINE

The CCP Project involves the construction of a 23-mile natural gas pipeline extending from the CCL Terminal to north of Sinton, Texas in what is primarily upland pasture and agricultural lands. The new 48-inch pipeline will be used to transport natural gas interstate and intrastate natural gas transmission pipeline systems to the CCL Terminal. The pipeline facilities will consist of a 23-mile, 48-inch diameter steel pipeline, launcher and receiver traps, mainline valves ("MLV"), and metering stations/delivery points with multiple possible pipeline system interconnects, totaling approximately 178 acres of operational impact.

2.0 AQUATIC RESOURCE BASELINE INVENTORY

Aquatic resources within the CCL Terminal and CCP Project areas include wetlands, essential fish habitat ("EFH"), and open-water areas. The following is a discussion of the aquatic resources within these areas.

2.1 CORPUS CHRISTI LIQUEFACTION TERMINAL

A wetland delineation was prepared by PBS&J, on behalf of CCL, on June 7, 2004, and accepted by the USACE on July 15, 2004 (D-16153). The area was resurveyed on June 20 and 21st, 2007 and then by HDR Engineering, Inc. (HDR) on June 8, 2011 and March 22, 2012. The surveys identified three wetland communities within the proposed CCL Terminal area as tidal flats, coastal marsh, and seagrass. All tidally influenced wetlands are considered to support EFH, as determined through literature reviews, field investigations, and correspondence with resource agencies. Please refer to Table 2.1-1.

Table 2.1-1 Wetlands Identified within the CCL Project Terminal Project Area

Wetland Type		Total Acres
Seagrass		10.2
Coastal Marsh	Mangroves	7.6
	Spartina	6.7
Tidal Flat	Vegetated	2.1
	Non-vegetated	3.4
Total		**30.0**

In addition, approximately 67.4 acres of open water exist within the footprint of the terminal facility. According to National Marine Fisheries Service (NMFS), this open-water area is classified as EFH because it contains tidally-influenced waters (estuarine water column) and tidally-influenced water bottoms (estuarine mud bottoms). These habitat types have been designated by NMFS as EFH for post-larval, juvenile, and sub-adult life stages of brown shrimp, white shrimp, and red drum. Geotechnical investigations have described existing substrate within this area to be 16 to 20 percent sand with the balance composed of mostly soft clays.

2.2 CORPUS CHRISTI PIPELINE PROJECT

CCP conducted environmental investigations for the proposed CCP Project in February and April 2004 and then again May 8-10, 2012. As of the most recent investigation in May 2012 four palustrine emergent (PEM) wetlands and nine waterbodies (eight of which are jurisdictional) were identified within the construction work area (CWA). Refer to Tables 2.1-2 and 2.1-3 for descriptions of existing wetlands and waterbodies within the CWA.

Table 2.1-2 Wetlands Occurring Along the Corpus Christi Pipeline

Wetland ID	Milepost	Cowardin Classification	Jurisdictional Status	Description
MP-18-2 [c/]	18.03	PEM	Jurisdictional	Has discreet or confined surface or shallow subsurface connection to a tributary that flows to navigable water of the United States. Crossed by HDD to avoid surface impacts.
MP-18.5-3	18.47	PEM	Non-jurisdictional	Isolated wetland surrounded by land being utilized as cattle pasture.
MP-20-1 [c/]	20.13	PEM	Non-jurisdictional	Located in roadside ditch that was constructed in uplands for highway drainage. Crossed by HDD to avoid surface impacts.
MP-21-1	21.34	PEM	Non-jurisdictional	Isolated wetland surrounded by land being utilized as cattle pasture.
Total				

[a/] Temporary impacts based on 75-foot construction right-of-way

[b/] Permanent impacts based on 50-foot wide permanent right-of-way

[c/] Areas where no impacts will occur because area will be crossed via bore or HDD.

Table 2.1-3 Waterbodies Crossed by the Corpus Christi Pipeline

Stream ID	Milepost	Waterbody	Jurisdictional Status	Description
MP-0-1	0.50	Drainage Ditch	Jurisdictional	Manipulated seasonal RPW in agricultural land.
MP-1-1	1.20	Drainage Ditch	Jurisdictional	Manipulated perennial RPW in agricultural land.
MP-2-1	2.35	Drainage Ditch	Jurisdictional	Manipulated seasonal RPW in agricultural land.
MP-4.5-1	4.70	Canal/Ditch	Jurisdictional	Manipulated seasonal RPW in agricultural land.
MP-12.5-1	12.85	Canal/Ditch	Jurisdictional	Natural seasonal RPW in agricultural land.
MP-16.5-1	16.65	Oliver Creek	Jurisdictional	Manipulated perennial RPW in agricultural land.
MP-18-1	17.91	Chiltipin Creek	Jurisdictional	Manipulated perennial RPW in agricultural land.
MP-18-3	18.00	Tributary to Chiltipin Creek	Jurisdictional	Natural ephemeral drainage in cattle pasture.
MP-18.5-2	18.54	Drainage Ditch	Non-jurisdictional	Ephemeral drainage in cattle pasture.

[a/] Crossing widths calculated in linear feet and are from the ordinary high water mark on each bank.
RPW=relatively permanent water.

3.0 AQUATIC RESOURCE IMPACT ANALYSIS

3.1 CORPUS CHRISTI LIQUEFACTION TERMINAL

As with any natural resource impact assessment relative to the design of a facility, the concept of mitigation sequencing was applied, including consideration for Avoidance, Minimization, and Compensation. An application to amend the existing Section 10/404 Permit (DA Permit 23561) was submitted to the USACE on August 31, 2012 and provides an in depth discussion of alternatives, including avoidance and minimization efforts. Section 3.0 herein discusses impacts that could not be further avoided or minimized. Compensation is discussed in Section 4.0.

Table 3.1-1 identifies each wetland community and the extent of impacts within the construction work area (temporary wetland impacts) and the operation area (permanent wetland impacts) of the proposed CCL Terminal Facility. All communities, submerged and emergent, are considered EFH as determined through literature reviews, field investigations, and correspondence with resource agencies (NOAA, September 2003). A total of 27.45 acres of wetlands will be impacted during construction (12.88 acres of impact are authorized by the original USACE permit). Of the 27.45 acres, the operation of the CCL Terminal Facility will permanently impact 25.55 acres and temporarily impact 1.9 acres (Appendix A, Figure 1). Permanent impacts are considered those areas which may not revert to pre-construction conditions. Temporary impacts are those areas that are disturbed during construction, but once construction is complete, the area will be restored to preconstruction contours and allowed to naturally revegetate.

Table 3.1-1 Wetlands Impacted by the CCL Project

Wetland Type		Total Acres	Previously Permitted Impacts (Ac)	Impacts Associated With Proposed Permit Amendment (Ac)			Difference Between Originally Permitted and Proposed Permanent Impacts (Ac)
				Construction (Temporary) Impacts*	Operational (Permanent) Impacts**	Total	
Seagrass		10.2	6.04	0.12	9.17	9.29	3.13
Coastal Marsh	Mangroves	7.6	2.01	0.63	6.72	7.35	4.71
	Smooth Cordgrass	6.7	2.76	0.28	5.91	6.19	3.15
Tidal Flat	Vegetated	2.1	1.62	0.38	0.99	1.37	-0.63
	Unvegetated	3.4	0.45	0.49	2.76	3.25	2.31
Total		**30**	**12.88**	**1.9**	**25.55**	**27.45**	**12.67**

* Construction impacts include only temporary construction-related impacts. All temporary impacts will be allowed to naturally re-vegetate.

** Permanent wetland impacts include only impacts associated with permanent conversion of wetland to non-wetland use.

As indicated in Table 3.1-2 below, existing open-water habitat areas (classified as EFH) within the CCL Terminal Project area totals approximately 67.4 acres. During construction and operation, an additional 10.9 acres of open-water habitat will be created. Because open water is considered EFH (NOAA, 2003), the dredging of upland areas will create additional EFH and aquatic habitat.

Table 3.1-2 Open Water Within CCL Terminal Project Area

Facility	Existing Open Water Impacted (Ac)	New Open Water Created (Ac)
Berthing Area	67.4	10.9

To minimize impacts to the aquatic environment, dredging of the berthing area will be accomplished by the use of a combination of hydraulic "cutterhead" dredges and mechanical dredges. The technique employed by the cutterhead dredge utilizes a rotating cutterhead that will displace the material to be dredged, and a suction pipe located directly behind the cutterhead creates a low-pressure field that pulls the material and water into the suction pipe, forming slurry. The slurry is pumped through the discharge pipe to the dredged material placement area ("DMPA"). Mechanical dredges are of the bucket type and usually require spoil transport to the DMPA or side casting. Approximately 4.8 mcy of material will be dredged from the berthing area and construction dock using these two methods.

Initial dredging activities may result in temporary disturbances to EFH due to increased turbidity in the water column from fine materials resuspended during the dredging and consequent entrainment or burial of species (GMFMC, 1998). When using a cutterhead-type dredge, increases in suspended solids are typically restricted to the immediate area of the cutter due to material being cut but not sucked up by the dredge. This type of dredge is considered to produce less turbidity than other common dredge types, such as bucket dredges. Turbidity is most common near the bottom, and suspended solid concentrations decrease exponentially in the vertical water column. Thus, increased turbidity would likely be confined to the deeper water or the immediately adjacent water bottom of the La Quinta Channel, and not affect the surrounding shallow water areas of Corpus Christi Bay. If turbidity levels are increased within surrounding areas due to dredging, levels are not expected to exceed ambient conditions during natural disturbances such as abrupt weather pattern changes associated with frontal approach and passage.

Species with EFH in La Quinta Channel that could be affected by initial dredging include post-larval, juvenile, and sub-adult life stages of brown shrimp, white shrimp, and red drum. Juvenile brown shrimp, white shrimp, and red drum typically utilize shallow water habitats. Although these species may be impacted during dredging activities, they are considered to be motile during both juvenile and adult life stages and are highly capable of eluding adverse conditions. CCL's proposed mitigation plan for impacts to aquatic resource habitats that may harbor EFH within the CCL terminal berthing area is provided in Section 4.0, Aquatic Resources Compensatory Mitigation Plan.

3.2 CORPUS CHRISTI PIPELINE

Four herbaceous wetlands were identified within the proposed Corpus Christi Pipeline Project limits. Table 3.2-1 identifies each wetland and the extent of construction (temporary) and operation (permanent) impacts within the Corpus Christi Pipeline Project. Approximately five square feet (SF) of wetlands will be permanently impacted by construction of the Corpus Christi Pipeline Project. There will be no temporary loss of wetlands due to the construction of the Corpus Christi Pipeline Project. No wetlands will be converted from one type to another wetland type.

Table 3.2-1 Wetlands Occurring Along the Corpus Christi Pipeline

Wetland ID	Milepost	Temporary Impact (square feet)[a/]	Temporary Impact (acre)[a/]	Permanent Impact (square feet)[b/]	Permanent Impact (acre)[b/]	Cowardin Classification	Jurisdictional Status	Description
MP-18-2 [c/]	18.03	0	0.00	0	0.00	PEM	Jurisdictional	Has discreet or confined surface or shallow subsurface connection to a tributary that flows to navigable water of the United States. Crossed by HDD to avoid surface impacts.
MP-18.5-3	18.47	0	0.00	0	0.00	PEM	Non-jurisdictional	Isolated wetland surrounded by land being utilized as cattle pasture.
MP-20-1 [c/]	20.13	0	0.00	0	0.00	PEM	Non-jurisdictional	Located in roadside ditch that was constructed in uplands for highway drainage. Crossed by HDD to avoid surface impacts.
MP-21-1	21.34	0	0.00	5	<0.01	PEM	Non-jurisdictional	Isolated wetland surrounded by land being utilized as cattle pasture.
Total		**0**	**0.00**	**5**	**<0.01**			

[a/] Temporary impacts based on 75-foot construction right-of-way

[b/] Permanent impacts based on 50-foot wide permanent right-of-way

[c/] Areas where no impacts will occur because area will be crossed via bore or HDD.

Nine waterbodies are crossed by the proposed CCP Project. Table 3.2-2 identifies each waterbody crossed by the proposed pipeline. Based on the field investigations, none of these waterbodies have been identified as potential EFH. All waterbodies will be crossed with the open-cut or bore method and will be restored to pre-construction status.

Table 3.2-2 Waterbodies Crossed by the Corpus Christi Pipeline

Stream ID	Milepost	Waterbody	Crossing Width[a/]	Crossing Method	Jurisdictional Status	Description
MP-0-1	0.50	Drainage Ditch	35	TBD	Jurisdictional	Manipulated seasonal RPW in agricultural land.
MP-1-1	1.20	Drainage Ditch	73	TBD	Jurisdictional	Manipulated perennial RPW in agricultural land.
MP-2-1	2.35	Drainage Ditch	45	TBD	Jurisdictional	Manipulated seasonal RPW in agricultural land.
MP-4.5-1	4.70	Canal/Ditch	37	TBD	Jurisdictional	Manipulated seasonal RPW in agricultural land.
MP-12.5-1	12.85	Canal/Ditch	20	TBD	Jurisdictional	Natural seasonal RPW in agricultural land.
MP-16.5-1	16.65	Oliver Creek	140	HDD	Jurisdictional	Manipulated perennial RPW in agricultural land.
MP-18-1	17.91	Chiltipin Creek	50	HDD	Jurisdictional	Manipulated perennial RPW in agricultural land.
MP-18-3	18.00	Tributary to Chiltipin Creek	14	TBD	Jurisdictional	Natural ephemeral drainage in cattle pasture.
MP-18.5-2	18.54	Drainage Ditch	8	TBD	Non-jurisdictional	Ephemeral drainage in cattle pasture.

[a/] Crossing widths calculated in linear feet and are from the ordinary high water mark on each bank.
RPW=relatively permanent water.

4.0 AQUATIC RESOURCES COMPENSATORY MITIGATION PLAN

4.1 CORPUS CHRISTI LIQUEFACTION TERMINAL

While reviewing the potential locations for the CCL project, CCL considered a variety of environmental constraints, including aquatic resource impacts. During the planning phase of the terminal facility, it was CCL's intent to avoid aquatic resources to the maximum extent practicable. As such, the proposed location of the terminal and berth is situated primarily in an upland area. The facilities are oriented in a manner that minimizes impacts to aquatic resources and EFH to the maximum extent practicable. Although the proposed CCL Terminal cannot avoid all aquatic resources located within the proposed CCL Terminal area, impacts have been minimized to the greatest extent possible, and compensatory mitigation is proposed to offset the unavoidable impacts to aquatic resources.

Based on the current wetland delineation as prepared by HDR in August 2012, the proposed terminal will impact a total of 27.45 acres of wetlands, of which 25.55 acres will be impacted on a permanent basis (Table 3.1-1). Compensatory mitigation for 12.88 was authorized by the original permit. Mitigation for the newly proposed permanent impacts (12.67 acres) (which make up the balance of the 25.55 total acres), will be evaluated during the USACE permit amendment process (as discussed early, a request to amend the USACE permit was submitted to USACE on August 31, 2012).

In order to compensate for the unavoidable 12.88 acres of permanent wetland impacts, CCL was authorized to mitigate for the wetlands with in-kind wetland creation and wetland preservation outside the limits of the terminal property on Shamrock Island. See DA Permit No. 23561.
The newly proposed impacts (by habitat type) are listed below:

- Seagrass: 3.13 acres
- Mangroves: 4.71 acres
- Smooth Cordgrass: 3.15 acres
- Vegetated Flats: 0.63 acres
- Unvegetated Flats: 2.31 acres

Total: 25.55 acres

In addition to the currently authorized mitigation at Shamrock Island (see Section 4.1.1), CCL is proposing to develop in-kind mitigation at two locations within the project vicinity to compensate for newly proposed impacts (see Sections 4.1.2 and 4.1.3). Once the mitigation is completed, there will be no net loss of wetland function or value.

4.1.1 Shamrock Island Mitigation Plan

Relative to previously permitted impacts at the CCL Terminal site, the objective was to develop a mitigation plan that will compensate for adverse impacts to wetlands as a result of construction activities. In association with the original permitting process, multiple meetings were held to discuss the matter of wetland mitigation for the CCL Terminal Project. On June 24, 2004, a meeting was attended by National Marine Fisheries ("NMFS"), Texas Parks and Wildlife Department ("TPWD"), U.S. Fish and Wildlife Service ("USFWS"), and the Texas General Land Office ("TGLO"). During this time, CCL presented multiple mitigation options, both on- and off-site. Off-site mitigation options included Shamrock Island, Goose Island State Park, Aransas Pass City Park, and Nueces Bay/Causeway Bird Islands. After a brief discussion of on-site mitigation, it was determined not be a viable option due to exposure to ship traffic associated with La Quinta Channel. It was also concluded that mitigation at Aransas Pass City Park and

Nueces Bay/Causeway Bird Islands would not be feasible due to conflicting plans or because it would limit mitigation to out-of-kind compensation.

A second meeting was held on August 16, 2004, that highlighted Shamrock Island as the preferred mitigation option; regulatory agencies present included NMFS, USFWS, TPWD, and the USACE. During this meeting, it was discussed that Shamrock Island mitigation would provide more seagrass mitigation in lieu of other wetland type mitigation, including high-marsh and low-marsh habitats. As a result of the development process, it was concluded that Shamrock Island would be the proposed mitigation location. Shamrock Island is located along the eastern shoreline of Corpus Christi Bay, Texas, approximately 2 miles west of Mustang Island. The island interior is uninhabited by humans, and is a complex mosaic of lagoons and wetlands. The island serves as an important rookery to a number of nesting bird species, in particular, the royal tern. It is CCL's belief that through wetland mitigation at Shamrock Island, wetlands will not only be protected and preserved, but there will also be additional wetland habitat created.

Shamrock Island History

Shamrock Island formed as a series of spits that were connected to Mustang Island. A number of navigation channels were dredged in the 1950's, which severed the "land bridge" that connected the main spit to land. Erosion of the land bridge by Hurricane Celia in 1970 further dissected the island, and as a result of the detachment from Mustang Island, there is no significant sediment source for the island. This lack of sand has caused beach erosion and loss of wetlands along the northern end of the island as sand from the north continues to be transported to the south. The continued erosion will diminish vital bird nesting habitat.

In 1998, a shoreline stabilization project was implemented to address the continued erosion and to stabilize the northern portion of the island. Components of this project included the installation of an offshore breakwater that connected to the northwestern shoreline and continued around to the northeastern tip of the island. A feeder beach was constructed where the GT connected to the island in order to provide a continued sand supply to the southern beaches. In the lee of the breakwater, a marsh restoration project was implemented.

The feeder beach constructed in 1998 has reached its design life of five years. In addition, some of the GT's have been damaged, which has resulted in less protection of the island. The need to further protect the island and the requirement for mitigation as a result of the USACE's nearby project at Packery Chanel, have resulted in the current Shamrock Island Habitat and Enhancement Project, and the formation of a team of representatives from the Coastal Bend Bays & Estuary Program, Inc. (CBBEP), The Nature Conservancy (TNC), TGLO, TPWD, USFWS, and the Environmental Protection Agency (EPA) (the "Team").

In association with the Packery Channel mitigation effort, the Corpus Christi Bays Estuaries Program, has constructed a series of nine low-crested detached rock breakwaters (breakwaters 8 through 16). The City of Corpus Christi will construct breakwaters 3 and 4 as mitigation for a recently authorized municipal waterline project. The goals for these breakwaters are to: facilitate the vegetative recruitment of submerged aquatic vegetation ("SAV"); help stabilize the northern shoreline of Shamrock Island; and, protect habitat and the ecological function of Shamrock Island.

Biological Assessment

A biological assessment was originally conducted in June 2004 to characterize habitat areas on Shamrock Island. In January 2005, an updated assessment was completed to document any changes to the habitat assessment. As a result of the updated assessment, habitat areas on the southern end of the island were modified slightly to indicate the presence of additional marsh habitat, ponds, *Spartina alterniflora*, mangroves and uplands. Habitat areas in the middle part of the island generally remained the same, with the addition of tern habitat along the western shoreline. The most significant habitat modifications occurred at the northern end of the island, with the observation of large stands of *Spartina alterniflora* and mangroves that fringe the shorelines. In addition, oyster reefs were noted in several locations at both the southern and northern ends.

As a result of the updated assessment, modifications to habitat acreage amounts were noted. The updated assessment indicates that approximately 1.86 acres of mangroves (previously 0.44 acre), 7.05 acres of *Spartina alterniflora* (previously 4.64 acres), 32.52 acres of marsh (previously 43.59 acres), 93.68 acres of seagrass habitat (previously 72.04 acres), 27.88 acres of upland (previously 23.88 acres), and 8.22 acres of tern habitat (previously 3.85 acres) exist on the island. Most of the habitat acreage amounts increased as a result of the updated assessment with the exception of marsh habitat. A decrease in marsh habitat is most likely due to these areas being reassessed as *Spartina alterniflora*, upland, or mangrove habitat. Reassessment of a small cove in the middle of the island revealed additional seagrass habitat not previously documented in the June 2004 habitat characterization. In addition to the habitat types previously documented, approximately 0.23 acre of new oyster habitat was noted.

Please note that habitat locations and acreage approximations are general characterizations and have not been verified with the use of a differentially-corrected global positioning satellite system (DGPS).

CCL Conceptual Mitigation Plan – Shamrock Island

To continue the Shamrock Island Habitat and Enhancement Project, CCL proposes to construct the remaining breakwaters (numbered 1-2, 5-7, and 17-26) bordering the western side and northern end of Shamrock Island (Appendix A, Figure 2). The combination of this additional protection in breakwaters numbered will create a sheltered area of 27.8 acres of SAV habitat, and 1.30 acres of submerged hard substrate. It also preserves 38.73 acres of SAV, 4.41 acres of *Spartina*, 0.57 acres of mangroves, 1.65 acres of unvegetated tidal flats, 13.08 acres of vegetated tidal flats, 0.05 acres of hard substrate, and 10.44 acres of uplands. Refer to Table 4.1-1 for a complete summary of the currently permitted mitigation totals at Shamrock Island.

Table 4.1-1 Mitigation Total for Shamrock Island Breakwaters

Habitat Type	Requested Mitigation Ratio	CCLNG Impact (acres)	Required Mitigation (acres)	Shamrock Island Component[1]	Created Habitats (acres)	Preserved Habitat (acres)	Total Habitats (acres)		
							Created	Preserved	Total
Submerged aquatic vegetation (SAV)	3 to 1	8.03	24.09	NRB 17-27	20.2	19.53	27.8	38.728	66.528
				SRB 5-7	6.5	11.269			
				SRB 1-2	1.1	7.929			
Smooth cordgrass (Spartina)	2 to 1	5.38	10.76	NRB 17-27	--	0.788	--	4.41	4.41
				SRB 5-7	--	3.421			
				SRB 1-2	--	0.201			
Mangroves	3 to 1	3.4	10.2	NRB 17-27	--	0.239	--	0.567	0.567
				SRB 5-7	--	0.234			
				SRB 1-2	--	0.094			
Unvegetated tidal flats	1 to 1	1.37	1.37	NRB 17-27	--	0.816	--	1.652	1.652
				SRB 5-7	--	0.587			
				SRB 1-2	--	0.249			
Vegetated tidal flats	1 to 1	0.37	0.37	NRB 17-27	--	2.802	--	13.076	13.076
				SRB 5-7	--	8.294			
				SRB 1-2	--	1.98			
Hard substrate	N/A	--	--	NRB 17-27	0.886	0.03	1.299	0.049	1.348
				SRB 5-7	0.248	0.019			
				SRB 1-2	0.165	--			
Uplands	--	--	--	NRB 17-27	--	0.827	--	10.441	10.441
				SRB 5-7	--	9.255			
				SRB 1-2	--	0.359			

[1] NRB 17-27 - North Reach Breakwaters 17 through 27
SRB 5-7 - South Reach Breakwaters 5 through 7
SRB 1-2 - South Reach Breakwaters 1 through 2

4.1.2 Beneficial Use Site 6 Mitigation Plan

Relative to the newly proposed impacts at the CCL Terminal site, the objective is to develop a mitigation plan that will compensate for adverse impacts to SAV as a result of construction activities. Detailed coordination of proposed SAV mitigation at Beneficial Use Site 6 (BUS6) with the landowner (Port of Corpus Christi Authority) and resources agencies will occur during the USACE permitting process.

Beneficial Use Site 6 History

BUS6 is a 192 acre site designed to beneficially utilize dredged material from the La Quinta Ship Channel Extension Project, which is a separable element of the Corpus Christi Ship Channel Improvements Project (CCSIP). The La Quinta Ship Channel Extension and BUS6 are currently under construction by USACE and the Port of Corpus Christi Authority (PCCA). As mitigation for SAV impacts associated with the CCSIP, BUS6 will provide a 45 acre shallow water area with 15 of the 45 acres planted with SAV. See Appendix A, Figure 3.

Biological Assessment

Construction of BUS6 is scheduled to be complete in spring of 2013. Upon completion, BUS6 will comprise 192 acres of relatively shallow water habitat. The 45 acres designated as mitigation for the CCSIP will be built to elevations conducive to seagrass recruitment and survival. The remaining 147 will be shallower than pre-construction conditions, but the ultimate depth is currently unknown. If portions of the remaining 147 acres are built to elevations conducive to seagrass survival, they can be planted with SAV with a relatively high likelihood of success. If portions of the remaining 147 acres are not built to elevations conducive to seagrass survival, these areas can likely be raised with material from the CCL berths to elevations that are likely to support SAV. Regardless of the potential need to raise areas to elevations conducive to SAV, there is a high likelihood CCL could successfully mitigate for the newly proposed 9.17 acres of SAV impacts within the remaining 147 acre area.

Beneficial Use Site 6 Mitigation Plan

CCL proposes to provide SAV mitigation with BUS6 at a 3:1 ratio if areas need to be raised to elevations conducive to SAV and at a 6:1 ratio if areas are already at elevations conducive to SAV. Exact locations within BUS6 along with other details related to SAV mitigation will be coordinated with PCCA and the resource agencies during the USACE permitting process. Table 4.1-2 shows the amount of seagrass mitigation that would be provided within BUS6 under each of the scenarios above.

Table 4.1-2 Mitigation Total for BUS6

Resource Type	Proposed Impacts (Ac)	Mitigation Alternative	Mitigation Ratio	Proposed Mitigation (Ac)
Seagrass (SAV)	9.17	Creation	3 to 1	27.5
		Enhancement	6 to 1	55.0

4.1.3 City of Aransas Pass Park Mitigation Plan

The City of Aransas Pass owns a public park between South Commercial Street and the Gulf Intracoastal Waterway (GIWW). The park comprises a community swimming pool, community baseball and softball fields, and other public amenities. The park also comprises an area adjacent to the GIWW that has been used historically for mitigation construction projects. See Appendix A, Figure 4.

City of Aransas Pass Park History

Numerous successful mitigation projects have been construction in the eastern-most portion of the park (adjacent to the GIWW). More specifically SAV, mangrove, and smooth cordgrass mitigation has been successfully constructed in this area. Not only have these mitigation projects been determined successful by USACE, but they've become park amenities, supporting birding, fishing, kayaking and other

ecotourism uses. These mitigation sites were constructed primarily from uplands that had been degraded by dredged material placement and/or four wheel drive vehicle use.

Biological Assessment

This area comprises additional uplands adjacent to the existing mitigation sites. These areas are either degraded from similar uses to those described above and/or are of relatively low habitat quality. These uplands areas are candidates for lowering to saltmarsh and tidal flat elevations. Very similar concepts have been applied at this location and have been very successful in terms of wetland vegetation recruitment and survival. Thus, there is a high likelihood that mitigation for saltmarsh and tidal flat impacts could be successful here again.

City of Aransas Pass Park Mitigation Plan

CCL proposes to provide mitigation for saltmarsh and tidal flat impacts adjacent to existing mitigation sites within the park. CCL proposes to develop a mosaic of saltmarsh and tidal flat habitats at a 3:1 ratio. Exact locations within the park along with other details related to wetland mitigation will be coordinated with City of Aransas Pass and the resource agencies during the USACE permitting process. Table 4.1-3 shows the amount and type of mitigation that would be provided at this site.

Table 4.1-3 Mitigation Total for City of Aransas Pass Park

Resource Type	Proposed Impacts (Ac)	Mitigation Alternative	Mitigation Ratio	Proposed Mitigation (Ac)
Mangroves	4.71	Creation	3 to 1	14.1
Smooth Cordgrass	3.15	Creation	3 to 1	9.5
Vegetated Flats	0.63	Creation	3 to 1	1.9
Unvegetated Flats	1.31	Creation	3 to 1	3.9
Total	**9.8**			**29.4**

4.1.4 Monitoring

CCL Terminal Post-construction Monitoring Plan

Following construction of the proposed CCL Terminal, post-construction monitoring of the existing/avoided aquatic resources within the adjacent (areas of access) to the terminal will be conducted over a three-year period. Results of the 2005 Hydrogeomorphic Assessment will be utilized as baseline data. The monitoring plan will include:

- Flagging or staking of aquatic resources within and adjacent to the construction work area, within CCL's property or areas of access, that were avoided during construction. These areas will be re-mapped upon Project completion to establish the limits of the monitoring area. All aquatic resource areas located within the limits of CCL's property or areas of access will be monitored for secondary or incidental impacts. Secondary or incidental impacts will be considered "impacts" if the area has a decrease in cover extent of more than 25 percent or a reduction in species diversity of more than 50 percent.

- The aquatic resources located outside the construction footprint of the CCL construction work area, but within the limits of CCL's property or areas of access, will be monitored and monitoring reports submitted for review and consideration by the resource and regulatory

agencies. This monitoring program will include:

- Monitoring assessments/inspections for health and area extent:
    - Extent mapping of the aquatic communities utilizing either DGPS equipment or standard survey techniques.
    - Quantitative measurements of species diversity and density will be conducted. Methods of assessments will include quadrates and line intercept/transects of various sizes and lengths depending on the area to be inspected/monitored. The location of the quadrates or transects will be recorded and will become the permanent monitoring locations throughout the duration of monitoring. Each transect will be marked with a permanent stake (preferably PVC) and will be numbered for monitoring station identification. In addition, the southwest corner of each quadrate will be permanently marked in the field to ensure consistent sampling of the area.
    - The number of transects and quadrates and their locations will be determined at the beginning of the monitoring effort, but prior to the first inspection event, based on safety around the CCL terminal facility, access to the adjacent areas, and general site conditions following construction. However, suitable quantities of sampling locations will be established to scientifically quantify and qualify the health and extent of the aquatic resources.

- The timing of monitoring will be as follows:
    - Inspection 1 – immediately following construction/restoration of the Project area.
    - Inspection 2 – six months post-construction
    - Inspection 3 – one year post-construction
    - Inspection 4 – two years post-construction
    - Inspection 5 – three years post-construction. (if after three years of monitoring, the cover extent of the avoided areas is 80 percent of the pre-construction extent and the diversity has not decreased by more than 50 percent, the monitoring will be determined complete. However, if the area does not meet the above criteria, additional mitigation or monitoring events will be agreed upon with the cooperating agencies identified below and implemented)

Preparation of monitoring status reports and submittal for analysis and review by the various resource and regulatory agencies, including TPWD, USFWS, USACE, TxGLO, and NOAA Fisheries. These reports will be submitted to the agencies within six weeks after the monitoring/inspection occurs. During the agency review, comments and aquatic resource mitigation solicitations will be requested as applicable. Upon additional impact identification and depending on the type of impact (reduction in cover extent or species diversity), supplemental mitigation will be identified and agreed upon with all cooperating agencies.

<u>CCL Mitigation and Monitoring Plan (Shamrock Island)</u>

The schedule of the Mitigation Activities at Shamrock Island will be as follows:

- The Shamrock Island mitigation project will be constructed prior to commencement of construction of the CCL Terminal.
- Construction of breakwaters will be completed within one year or less.

- A post-mitigation construction as-built drawing of the breakwaters and survey will be generated to document the final created mitigation areas.
- Annual habitat assessments will be conducted and compared with baseline data from January 2005 to estimate the rate of habitat change.

The Monitoring Plan at Shamrock Island will include robust methodology for monitoring vegetation; and, annual SAV monitoring.

- Monitoring Activities will be designed to confer with the success of the CBBEP monitoring plan. CCL plans to adopt the following points of the CBBEP monitoring plan:

    - The created SAV habitat will be allowed to naturally vegetate for two full growing seasons after the breakwaters are constructed. If after three years 50 percent of the required SAV mitigation has not naturally vegetated, CCL will consult with the agencies (TPWD, USFWS, USACE, TxGLO, and NOAA Fisheries) on whether to plant seagrass in areas that have not reached 50 percent coverage. If recommended by the agencies, CCL will plant seagrass in the areas designated by the agencies. Unless otherwise recommended by the agencies, the planting will be at a minimum of one sprig per 3-foot center.
    - If after five years 70 percent coverage of the required SAV mitigation has not be achieved; CCL will consult with the agencies on whether to plant seagrass in areas that have not yet reached 70 percent coverage. If recommended by the agencies, CCL will plant seagrass in the areas designated by the agencies. Unless otherwise recommended by the agencies, the planting will be at a minimum of one spring per 3-foot center.
    - CCL will submit annual reports beginning in year two to the agencies identified above indicating the percent coverage and acreage of SAV, and acreage and habitat of Shamrock Island. Monitoring reports will be generated and submitted to the agencies within six weeks of the monitoring event.
    - The Project will be determined to be a success when the breakwater(s) has been installed and approximately 27.8 acres of SAV have been created. There may be some changes in habitat type on Shamrock Island resulting from the reduction of wave energy reaching the island, and this will not cause the Project to be deemed unsuccessful.

- CCL will implement vegetation Monitoring Plan at Shamrock Island sufficiently sized to accurately measure the increase or decrease in acreage of habitat types within the mitigation area. This monitoring program will include utilizing a combination of the line intercept/transect method and the quadrat method. At a minimum, 30-meter transects (100-foot) will be spaced evenly and at intervals of no less than 62 meters (200 feet) will be established across the various wetland habitat types located in the mitigation area. In addition to the species composition (dominance and diversity) identified by the line intercept/transect, five 1-meter by 1-meter quadrats will be assessed along each transect (spaced every 6 meters or 20 feet) to determine density, dominance, and diversity. Each transect and quadrat will be permanently marked in the mitigation area for consistent monitoring of the area. Each transect will be marked with a permanent stake (preferably PVC) and will be numbered for monitoring station identification. In addition, the southwest corner of each quadrat will be permanently marked in the field to ensure consistent sampling of the mitigation area.

- Since access to Shamrock Island is restricted during the bird nesting season from March 15 to

August 31, the monitoring period will be conducted in September of each year to capture the previous growing season's SAV coverage.

- Within the created SAV habitat, if water clarity allows, boundaries of SAV communities will be visually mapped utilizing DGPS equipment or conventional survey techniques. If turbidity impedes visual mapping abilities, the "braille method" will be implemented to map seagrass communities. This method includes physically feeling the bay floor for SAVs. In water less than 3 feet deep, this can be accomplished by crawling, walking, or randomly feeling the bay floor with hands or feet to identify the presence of SAVs. In areas greater than 3 feet deep, snorkeling or scuba equipment is utilized to feel and map the extent of the SAVs. For each technique, the extents are mapped by a second person carrying a DGPS unit or the location is staked for follow-up survey utilizing conventional survey techniques.

- Once the boundary is identified, random 1-meter quadrate samples will be collected to sufficiently assess the area and to identify percent cover. An average of all percent cover will be tabulated to assess total percent cover of the seagrass community. In addition, three 6-inch Eckman grab samples within each 1-meter quadrate will be utilized to calculate density of seagrass stems. Lastly, during the SAV sampling effort, water depth and water quality parameters will be observed and recorded.

- For both SAV and the additional habitat types, photos will be taken at each sample location to document the conditions of the mitigation area during the monitoring period.

<u>CCL Mitigation and Monitoring Plan (BUS6)</u>

The schedule of the Mitigation Activities at BUS6 will be as follows:

- Construction of the BUS6 mitigation project will commence within six months of beginning work in jurisdictional areas at the CCL Terminal site.
- Construction of the mitigation site will be completed within one year or less.
- A post-mitigation construction as-built drawing and survey of the site will be generated to document the final created mitigation areas.
- Annual habitat assessments will be conducted and compared with baseline data collected prior to construction.

Monitoring and reporting will be conducted over a five-year period in accordance with USACE Regulatory Guidance Letter 08-03, *Minimum Monitoring Requirements for Compensatory Mitigation Projects*.

<u>CCL Mitigation and Monitoring Plan (Aransas Pass City Park)</u>

The schedule of the Mitigation Activities at the City park will be as follows:

- Construction of the City park mitigation project will commence within six months of beginning work in jurisdictional areas at the CCL Terminal site.
- Construction of the mitigation site will be completed within one year or less.
- A post-mitigation construction as-built drawing and survey of the site will be generated to document the final created mitigation areas.
- Annual habitat assessments will be conducted and compared with baseline data collected prior to construction.

Monitoring and reporting will be conducted over a five-year period in accordance with USACE Regulatory Guidance Letter 08-03, *Minimum Monitoring Requirements for Compensatory Mitigation Projects*.

4.1.5 Dredged Material Placement Plan

Approximately 4.8 mcy of material will be dredged from the berth and construction dock areas. Dredging will be accomplished by hydraulic and mechanical means.

During the dredging operation, potential effects on water quality may include a temporary decrease in water quality from increased turbidity surrounding the hydraulic cutterhead of the dredge as well as around the mixing zone where the water from the dredging activities reenters the Gulf. Although there will be a temporary increase in turbidity, the effects of this turbidity are expected to be short-term and will return to background levels a short distance from the point of disturbance. Other than turbidity surrounding the dredge, no other water quality impacts are anticipated.

Dredged Material Placement Area Plan

Dredged material will be placed in Dredged Material Placement Areas (DMPAs) 1 and 2 (approximately 90 acres and 385 acres respectively). DMPA 1 comprises a previously disturbed upland site and DMPA 2 comprises existing bauxite residue storage beds owned by Reynolds Metals Company, a subsidiary of Alcoa, Inc. Both sites are located immediately north of the proposed LNG terminal property. See Appendix A, Figure 5.

DMPA Plan Benefits

A primary benefit associated with the proposed Project results from the creation of new open bay habitat from uplands as a result of the proposed dredging activities. Additional open-water habitat will be converted from uplands during the excavation and dredging of the berth to a depth of - 45 feet MLT. This new habitat has the capacity to function as EFH for various marine species. DMPAs 1 and 2 are privately owned. Consequently, there is no need to use public dredged material placement areas, which could potential have a negative effect on available capacity for public projects. DMPAs 1 and 2 are within the immediate vicinity of the dredging activity within an industrial setting and will not require dredged material to be piped to a remote location, thus reducing any potential interference with marine traffic. In addition, the dredged material placed in DMPA 2 will provide a soil cover over the existing bauxite residue beds, allowing them to vegetate and thus eliminating the present nuisance dust problem from these beds. The vegetation will provide additional habitat for local wildlife and also enhance the property aesthetically.

Maintenance Dredging

In April 2003, the Environmental Impact Statement for the Corpus Christi Ship Channel widening and deepening project stated that the USACE estimates approximately 28 million cubic yards will be dredged during the 50-year maintenance life for the La Quinta Ship Channel (LQSC). This will require the USACE to perform maintenance dredging every five to seven years within the LQSC. Maintenance dredging of the CCL berth will be conducted on an as-needed basis, but will most likely take advantage of the dredge contracted by the USACE.

4.2 CORPUS CHRISTI PIPELINE

The regional ecosystem of South Texas is predominantly agricultural fields and upland scrub/shrub habitat. During the pipeline routing analysis, the pipeline was routed along existing pipeline corridors in an attempt to minimize impacts to wetlands or other waters of the U.S., and avoid residential areas, and other existing land uses to the greatest extent practicable.

During the routing analysis, CCP considered various ways to minimize impacts to wetlands, of which construction techniques, right-of-way width, and placement of the pipeline provided the greatest chance of minimizing impacts. As a result of evaluating various wetland construction techniques, CCP has proposed to utilize conventional open-cut technology. Soil properties in this region can support heavy equipment while still minimizing impacts to the environment. With this technique, the pipeline trench is excavated with backhoe equipment and the soil is temporarily sidecast to allow the pipe to be installed. During the trench excavation activities, the topsoil, or upper 12 inches, is separated from the subsoil to protect the seed source found in the topsoil. During the backfilling of the trench, the subsoil is placed first in the trench and the topsoil is placed back on top of the trench to facilitate increased restoration success of the pipeline right-of-way. If soils are saturated but still support construction equipment, wood mats are placed along the right-of-way to support the equipment and further minimize impacts to the soil.

Based on the results of the planning process, field surveys, and agency correspondence, CCP identified a route that will only impact five SF of wetlands.

During the field review and discussions with the agencies, CCP agreed to implement best management practices during construction and has agreed to the following aquatic resources mitigation plan to minimize unavoidable wetland impacts associated with the proposed pipeline:

- Segregate the topsoil or upper 12 inches of soil during construction and replace the soil in the order it was removed.
- Restore the Corpus Christi Pipeline Project area to its pre-construction contours and elevations.
- Chip or remove all woody vegetation within wetlands (or burn the debris in upland areas).
- Allow the Corpus Christi Pipeline Project area to revegetate naturally unless after tone year the Corpus Christi Pipeline Project area or portions of the Corpus Christi Pipeline Project area are not regrowing with at least 50 percent regrowth. If the Corpus Christi Pipeline Project area is not recovering, CCP will replant or seed the work area or portion of the work area until the Project area exhibits a minimum of 80 percent recovery as compared to an undisturbed area adjacent to the Corpus Christi Pipeline Project are.
- Submit monitoring reports beginning after the first year following restoration with subsequent report provided annually until 80 percent recovery is achieved.

4.3 TEMPORARILY AFFECTED WETLANDS

4.3.1 Wetland Restoration

Temporarily affected wetlands will be restored post-construction by:

- Removing any temporary fill from the wetlands

- Restoring the wetlands to their pre-construction elevations and contours

- Allowing the wetlands to naturally revegetate via the natural seed bank or vegetative propagation.

If after six months post construction the wetlands are not revegetating naturally to at least 25 percent aerial cover, the wetlands will be seeded or planted with native vegetation. If after one year the wetlands are still not reestablishing. CCL and CCP will notify the USACE and other appropriate resource agencies and develop an alternative mitigation or restoration plan. If the wetlands have at least 25 percent aerial cover after six months, the wetlands will not be planted but will be monitored for a minimum of three years. Restoration will be determined successful if the restored wetland areas have achieved at least 80 percent cover compared to an undisturbed or reference wetland in the Project vicinity.

4.3.2 Monitoring

The schedule of Wetland restoration activities for CCP is as follows:

- At completion of Project construction and during the final grading activities and stabilization of the pipeline – begin wetland restoration activities.

- Three months – complete wetland restoration activities

- Six months - complete first monitoring effort and report. Measure aerial cover extent. If the restored wetlands do not exhibit at least 25 percent cover, the wetlands will be seeded or planted with native vegetation.

- Year 1 – conduct second monitoring effort and report. Measure aerial cover extent. If the restored wetlands do not exhibit at least 25 percent cover, CCP will notify the USACE and other appropriate resource agencies and develop an alternative mitigation or restoration plan.

- Year 2 – conduct third monitoring effort and report. Measure aerial corer extent. If the wetland area has not achieved at least 50 percent aerial coverage, CCP will notify the USACE and other appropriate resource agencies and develop an alternative mitigation or restoration plan.

- Year 3 – conduct final monitoring effort and report (if wetland has achieved 80 percent vegetative cover). If 80 percent coverage has been achieved, the monitoring will be considered complete. If the wetlands have not achieved at least 80 percent aerial coverage, a fourth monitoring event will occur and additional mitigation and/or restoration activities will be implemented in consultation with the resource agencies. Once the restored wetlands have achieved 80 percent cover, the restoration will be considered complete. Monitoring reports will be conducted annually until at least 80 percent aerial coverage is achieved.

- Results of the restoration efforts will be included in mitigation monitoring reports generated specifically for the restored wetlands. These reports will be generated at six months and twelve months post-construction and then annually for two years or until the restored wetlands reach at least an 80 percent coverage success. Monitoring reports will be submitted to the appropriate agencies for review and comment upon completion within six weeks of conducting the monitoring.

- If after six months the restored wetlands are not revegetating naturally to at least 25 percent aerial

cover, the wetlands will be seed or planted with native vegetation. Prior to planting or seeding, CCP will consult with the appropriate agencies to identify an appropriate species composition. However, these wetlands will be considered successfully restored if after three years the wetlands have at least 80 percent aerial cover of hydrophytic vegetation.

- If after one year the wetlands are still not reestablishing, CCP will notify the USACE and other appropriate resource agencies and develop an alternative mitigation or restoration plan.

- If after the third-year monitoring effort in the restored wetlands plant coverage is less than 80 percent aerial coverage, CCP will re-coordinate with the USACE to refine the mitigation plan and replant or seed as necessary. In this event, a fourth-year monitoring effort and report will be completed. Monitoring will continue on an annual basis until at least 80 percent aerial cover is established. If 80 percent aerial plant coverage is achieved during the third-year monitoring effort, no fourth-year monitoring effort will take place.

- Photos will be taken at each restored wetland to document the conditions of the restored wetlands during the monitoring period. Permanent markers will be established to ensure that the same locations (and view direction) are monitored during each monitoring period.

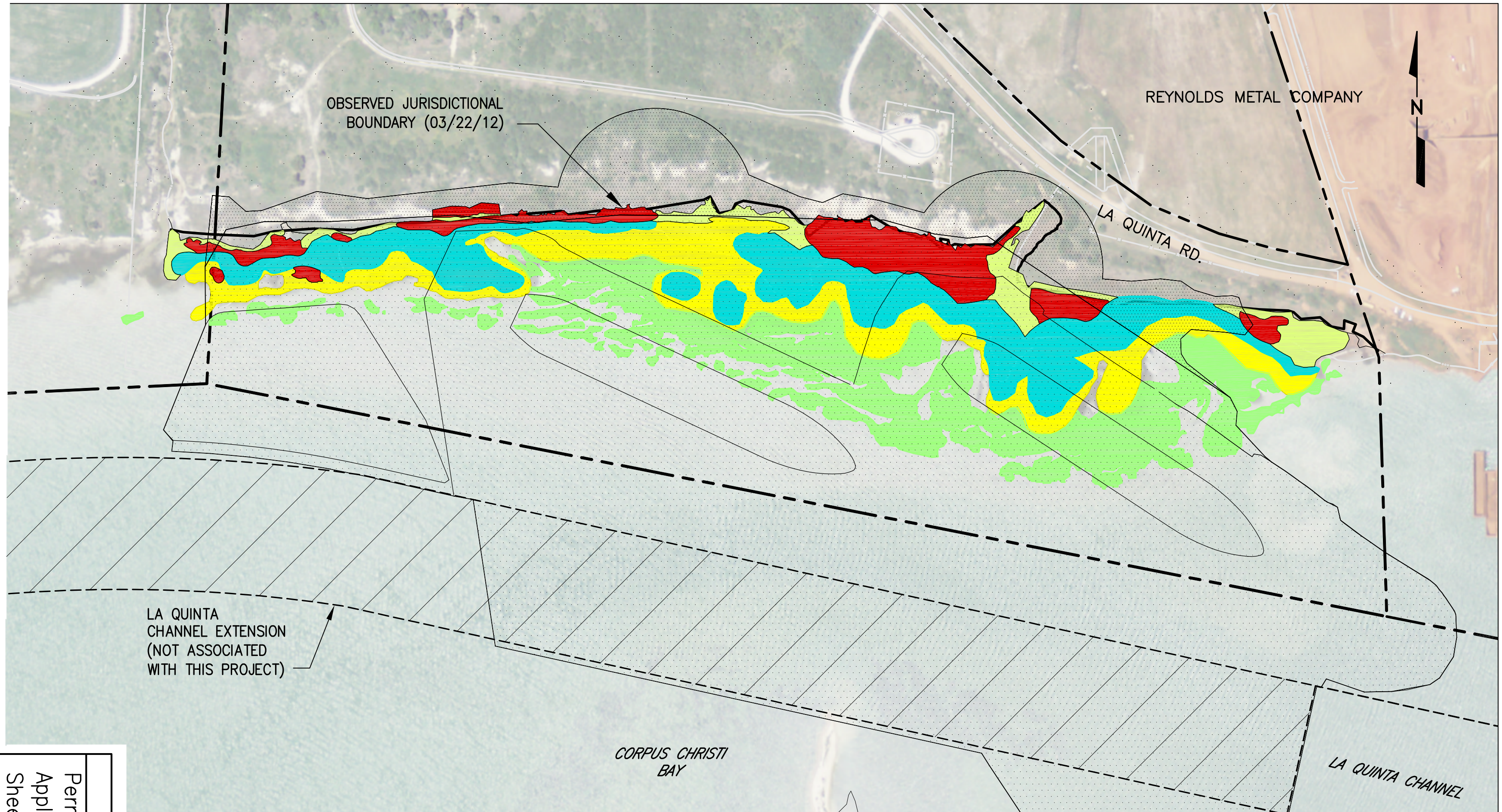
5.0 CONCLUSION

As a result of the alternatives analyses and field surveys, CCL and CCP believe that the terminal and pipeline facilities are located in a manner such that aquatic resource impacts are avoided and/or minimized to the maximum extent practicable. However, because the CCL Terminal and CCP Project facilities are located in the coastal zone of Texas, a region that is dominated by aquatic habitat, some impacts to these communities are unavoidable.

In order to compensate for the aquatic resource impacts associated with the CCL Terminal and Corpus CCP Project, CCL and CCP are proposing mitigation via preservation and enhancement of existing wetlands on Shamrock Island, restoration of temporarily impacted aquatic resources at CCL and Corpus Christi pipeline, and by creation of habitat at Shamrock Island, BUS6, and the City of Aransas Pass Park.

APPENDIX A

SITE FIGURES



PROPOSED IMPACTS

1 – 2

SCALE: 0 250' 500'

HABITAT TYPE	PREVIOUSLY PERMITTED IMPACTS (AC.)	PROPOSED IMPACTS (AC.) TEMPORARY	PERMANENT	TOTAL	TOTAL DIFF. (PERMANENT)
VEGETATED FLATS/HIGH MARSH	1.62	0.38	0.99	1.37	−0.63
AVICENNIA GERMINANS	2.01	0.63	6.72	7.35	4.71
UNVEGETATED SAND FLATS	0.45	0.49	2.76	3.25	2.31
SEAGRASS	6.04	0.12	9.17	9.29	3.13
SPARTINA ALTERNIFLORA	2.76	0.28	5.91	6.19	3.15
TEMPORARY IMPACT AREA – CONSTRUCTION				27.45	12.67
PERMANENT IMPACT AREA – OPERATIONS					

FOR COE USE ONLY

Permit Application No.:

Applicant Name:

Sheet ___ of ___

HDR Engineering, Inc.
TEXAS FIRM REGISTRATION NUMBER 754

ACTIVITY: DREDGE BASIN, CONSTRUCT DOCKS, SHORELINE PROTECTION, APPROACH, MOORING AND BREASTING STRUCTURES FOR EXPORTING OF LIQUID NATURAL GAS (LNG)

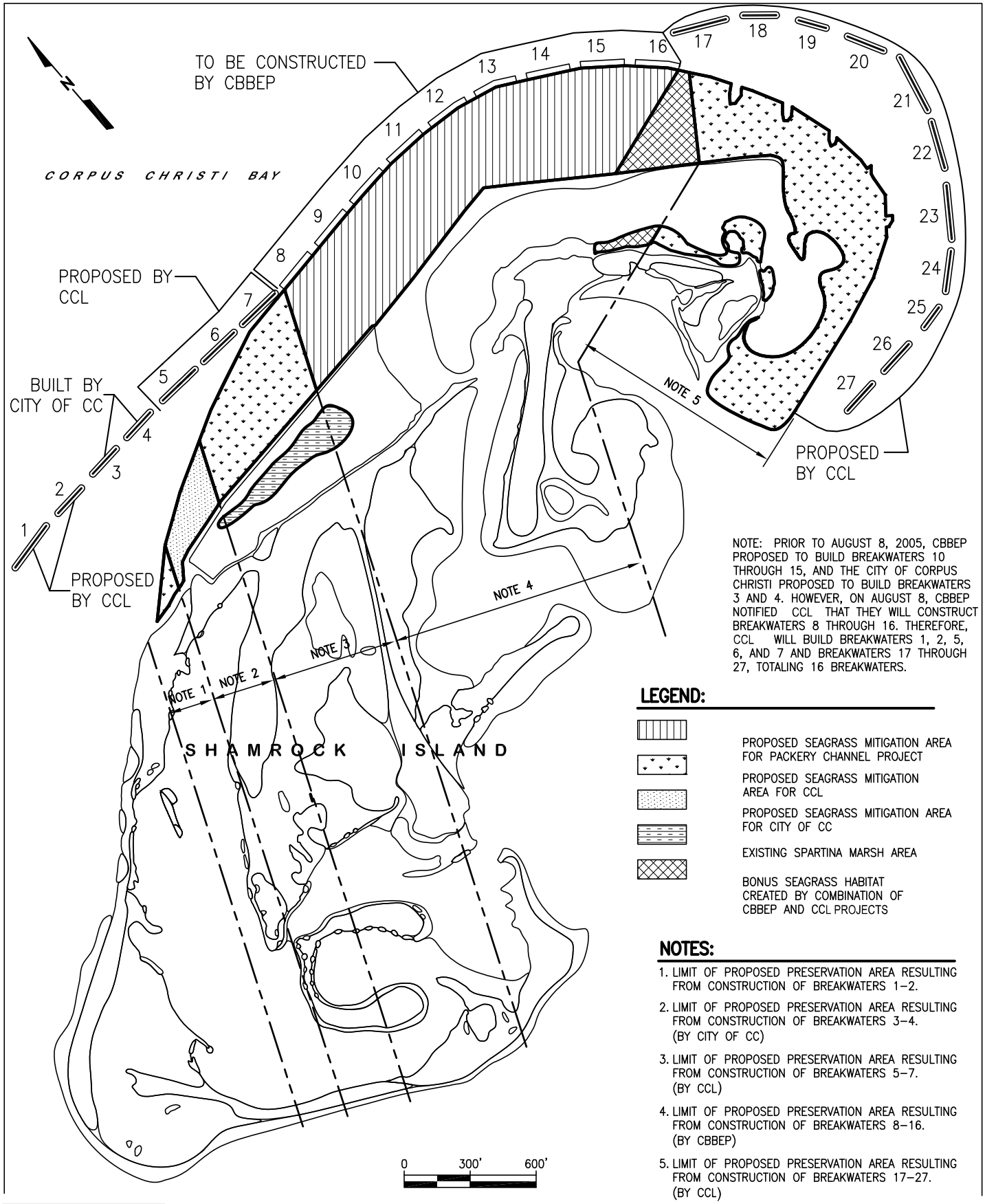
APPLICANT: CORPUS CHRISTI LIQUEFACTION, LLC AND CHENIERE CORPUS CHRISTI PIPELINE, L.P. DATUM: MLT

DATE: 08/20

REV. DATE:

HDR JOB NO: 180841

FIGURE 1



NOTE: PRIOR TO AUGUST 8, 2005, CBBEP PROPOSED TO BUILD BREAKWATERS 10 THROUGH 15, AND THE CITY OF CORPUS CHRISTI PROPOSED TO BUILD BREAKWATERS 3 AND 4. HOWEVER, ON AUGUST 8, CBBEP NOTIFIED CCL THAT THEY WILL CONSTRUCT BREAKWATERS 8 THROUGH 16. THEREFORE, CCL WILL BUILD BREAKWATERS 1, 2, 5, 6, AND 7 AND BREAKWATERS 17 THROUGH 27, TOTALING 16 BREAKWATERS.

LEGEND:

- PROPOSED SEAGRASS MITIGATION AREA FOR PACKERY CHANNEL PROJECT
- PROPOSED SEAGRASS MITIGATION AREA FOR CCL
- PROPOSED SEAGRASS MITIGATION AREA FOR CITY OF CC
- EXISTING SPARTINA MARSH AREA
- BONUS SEAGRASS HABITAT CREATED BY COMBINATION OF CBBEP AND CCL PROJECTS

NOTES:

1. LIMIT OF PROPOSED PRESERVATION AREA RESULTING FROM CONSTRUCTION OF BREAKWATERS 1–2.
2. LIMIT OF PROPOSED PRESERVATION AREA RESULTING FROM CONSTRUCTION OF BREAKWATERS 3–4. (BY CITY OF CC)
3. LIMIT OF PROPOSED PRESERVATION AREA RESULTING FROM CONSTRUCTION OF BREAKWATERS 5–7. (BY CCL)
4. LIMIT OF PROPOSED PRESERVATION AREA RESULTING FROM CONSTRUCTION OF BREAKWATERS 8–16. (BY CBBEP)
5. LIMIT OF PROPOSED PRESERVATION AREA RESULTING FROM CONSTRUCTION OF BREAKWATERS 17–27. (BY CCL)

HDR

HDR Engineering, Inc.

Texas P.E. Firm Registration No. 754

CORPUS CHRISTI LIQUEFACTION SHAMROCK ISLAND DESIGN

CONCEPTUAL MITIGATION PLAN

PROPOSED BREAKWATERS @ SHAMROCK ISLAND

DATE

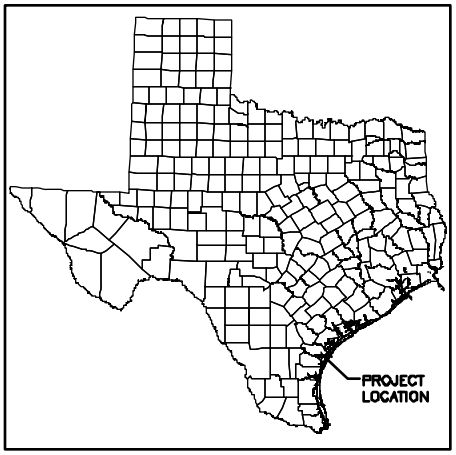
04–27–2012

FIGURE

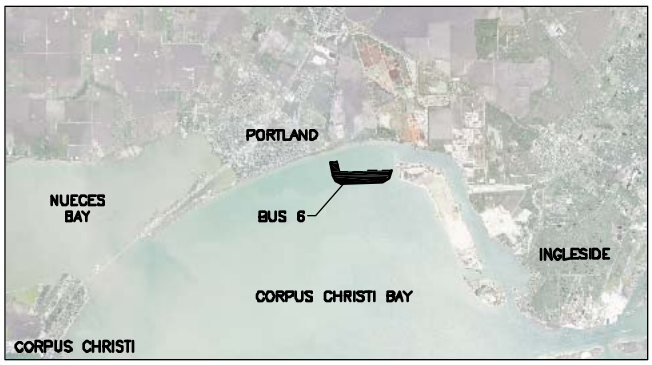
2

REVISED 04/27/12

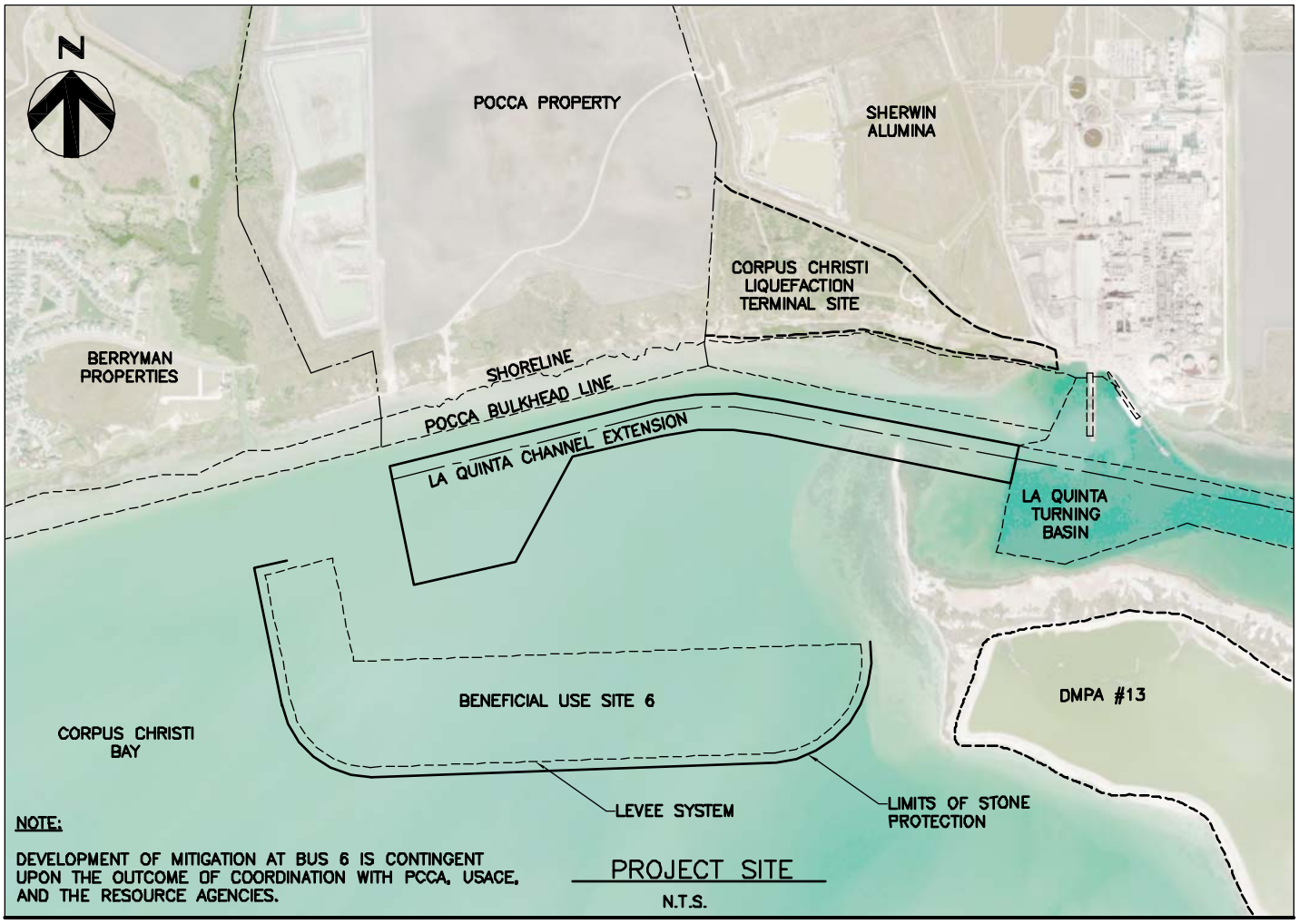
LOCATION MAP



VICINITY MAP
N.T.S.



LOCATION MAP
N.T.S.



NOTE:

DEVELOPMENT OF MITIGATION AT BUS 6 IS CONTINGENT UPON THE OUTCOME OF COORDINATION WITH PCCA, USACE, AND THE RESOURCE AGENCIES.

PROJECT SITE
N.T.S.

HDR

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Texas P.E. Firm Registration No.754

PROJECT TITLE: CORPUS CHRISTI LIQUEFACTION		PROJECT NUMBER	REFERENCE SHEET
SHEET TITLE: SEAGRASS MITIGATION @ BUS 6		PROJECT MANAGER	REFERENCE DOCUMENT
		DATE: 8-29-12	EXHIBIT NUMBER: FIGURE 3

HDR

HDR Engineering, Inc

Texas P.E. Firm
Registration No.754

CORPUS CHRISTI LIQUEFACTION

ARANSAS PASS CITY PARK MITIGATION SITE

DATE

8–29–12

FIGURE

4

HDR

HDR Engineering, Inc

Texas P.E. Firm
Registration No.754

CORPUS CHRISTI LIQUEFACTION
DREDGED MATERIAL PLACEMENT AREAS

DATE
8–29–12

FIGURE
5

Appendix 3C
Marine Threatened and Endangered Species Assessment

Corpus Christi Liquefaction
Nueces County, Texas

Marine Threatened and Endangered Species Assessment

August 2012

I. INTRODUCTION / BACKGROUND

The purpose of this report is to support the permitting process for the proposed natural gas liquefaction and export plant and import facilities with regasification capabilities ("CCL Terminal"), specifically with respect to Section 7(a) of the Endangered Species Act (ESA) of 1973 as amended. Section 7 of the ESA requires all federal agencies to consult with the National Marine Fisheries Service (NMFS) for marine species, and the United States Fish and Wildlife Service (FWS) for fresh-water and terrestrial species if the proposed action (an action is defined as any project that requires a federal permit or receives federal funding) may affect listed species or their designated habitat. A Biological Assessment (BA) is required to analyze the potential effects of the project on listed species and critical habitat in order to establish and justify an "effect determination".

In association with the previously permitted Corpus Christi LNG (CCLNG) import terminal at the same project site considered in this Assessment, Corpus Christi LNG now Corpus Christi Liquefaction, LLC (CCL) consulted with FWS and NMFS regarding the presence/absence of federally listed threatened or endangered species and their critical habitats in the project area. A Final Environmental Impact Statement (FEIS) prepared by the Federal Energy Regulatory Commission (FERC) under Docket CP04-37-000 dated March 2005 fully addressed potential effects on threatened and endangered species and includes documentation of coordination with FWS and NMFS. The FEIS served as the BA for the project and concluded that the import terminal would either have "no effect", or "may affect, but not likely to adversely affect" any listed threatened or endangered species. FWS and NMFS concurred with all of the species determinations, thereby concluding the endangered species consultation process.

This Assessment will rely on the findings for effects on marine species from the March 2005 FEIS for the CCLNG import terminal, as well as newly obtained species information to determine the applicability of the 2005 species determinations to the currently proposed CCL terminal at the same site. The result of this assessment will be new "effect determinations" for each marine species thought or known to be present in the project vicinity.

II. THREATENED AND ENDANGERED SPECIES ASSESSMENT

The following methodology was implemented for making species determinations for the proposed Corpus Christi Liquefaction terminal:

1) Review of the March 2005 FEIS for the CCLNG import terminal at the same site to identify listed species during the time of review, determinations for each species, and to develop an understanding of the rationale for each determination.
2) Obtain updated threatened and endangered species lists for the Nueces County (while the proposed project occurs in both Nueces and San Patricio Counties, marine environments are limited to Nueces County) for comparison with the 2005 FEIS, and contact NMFS and Texas Parks and Wildlife Department (TPWD) informally to confirm that no recent changes to federal or state listed threatened and endangered species lists have occurred.
3) Conduct an updated screening of habitats onsite to assess the suitability of habitat for the various listed species.
4) Based on the outcome of 1, 2, and 3 above, and the assumption that the Corpus Christi Liquefaction terminal will be very similar (in terms of potential risks to species) to the previously permitted import terminal, arrive at updated determinations for each species.

The 2005 FEIS concluded that the project would either have "no effect", or "may affect, but not likely to adversely affect" threatened and endangered species. Consultation of NMFS and TPWD's online threatened and endangered species databases resulted in confirmation that the lists have not changed since the time of the 2005 FEIS. NMFS and TPWD confirmed that the online information is the most current available data and is appropriate for use in making determinations for species effects associated with the proposed Corpus Christi Liquefaction terminal.

Since there is a possibility (although very slight) of potential effects from LNG vessels outside of the immediate project area, the Federal list was checked for pelagic species that may occur in the Gulf of Mexico. Five species of whales are listed and where considered in this Assessment.

Habitat surveys of the project area were conducted in June 2011 and March 2012. After reviewing the habitat requirements of listed species and documented areas of species occurrence, two listed species that have very low probabilities of occurrence in the project area have been eliminated from further discussion (Table 1). Based on areas of known occurrence and life histories of the species, it is concluded that the construction and operation of the proposed Corpus Christi Liquefaction terminal would have No Effect on these species.

Table 1. Federal and State Listed Endangered and Threatened Marine Species (Eliminated)

Species	Status*	Reason for Elimination	2005 Determination	2012 Determination
Fish				
Smalltooth Sawfish (*Pristis pecinata*)	F-E TX-E	Unlikely to occur in project vicinity.	No Effect	No Effect
Opossum Pipefish (*Microphis brachyurus*)	F-NL TX-T	Unlikely to occur in project vicinity.	No Effect	No Effect
* Status: F=Federal, TX = Texas. E = Endangered, T= Threatened, NL = Not listed				

The remaining 11 marine species that are thought to occur in Nueces County and its regional waters of the Gulf of Mexico are listed below in Table 2.

MARINE MAMMALS

WHALES

NMFS identifies five whale species that could potentially occur in the Gulf of Mexico. These are the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaingliae*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*). These species are generally restricted to off-shore waters; therefore it is unlikely that any of these five species would regularly occur in the study area.

Blue Whale

Blue whales (*Balaenoptera musculus)* occur in all oceans of the world. Blue whales inhabit sub-polar to sub-tropical oceans rarely occurring in the Gulf of Mexico off of Texas. There are only two records of Blue Whales from the Gulf of Mexico; one stranded near Sabine Pass, Louisiana in 1926 and one stranded near Freeport, Texas in 1940 (Texas Tech University 1997). Both identifications have been questioned. The approximate worldwide population of Blue whales is 11,000-12,000, with the current North Atlantic population between 100-1,500 animals.

Table 2. Federal and State Listed Endangered and Threatened Marine Species

Species	Status*	Preferred Habitat	2005 Determination	2012 Determination
Mammals				
Blue Whale (*Balaenoptera musculus*)	F-E TX-E	Inhabits deep waters off the continental shelf.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Fin Whale (*Balaenoptera physalus*)	F-E TX-E	Inhabits deep waters off the continental shelf.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Humpback Whale (*Megapetra novaeangliae*)	F-E TX-E	Inhabits deep waters off the continental shelf.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Sei Whale (*Balaenoptera borealis*)	F-E TX-E	Inhabits deep waters off the continental shelf.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Sperm Whale (*Physeter macrocephalus*)	F-E TX-E	Inhabits deep waters off the continental shelf.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
West Indian Manatee (*Trichechus manatus*)	F-E TX-E	Occasional visitor to Texas waters. Inhabits warm, shallow coastal waters, estuaries, bays, rivers and lakes.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Reptiles (sea turtles)				
Loggerhead Sea Turtle (*Caretta caretta*)	F-T TX-T	Juveniles are found in Gulf and bay systems. Adults are mostly pelagic.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Green Sea Turtle (*Chelonia mydas*)	F-T TX-T	Gulf and bay systems, shallow water seagrass beds, open water.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Leatherback Sea Turtle (*Dermochelys coriacea*)	F- E TX-E	Gulf and bay systems. Widest ranging open water reptile.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricate*)	F-E TX-E	Gulf and bay systems, warm shallow waters especially in rocky marine environments, jetties and coral reefs	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	F-E TX-E	Gulf and bay systems. Adults stay within the shallow waters of the Gulf of Mexico.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
* F = Federal, TX= Texas, E= Endangered, T= Threatened, NL = Not Listed				

Due to the species tendency to remain far offshore in very deep water and the high mobility of the species, this species is highly unlikely to come into contact with an LNG vessel associated with the proposed project. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Fin Whale

Fin whales (*Balaenoptera physalus*) are found in deep, offshore waters of all major oceans primarily in temperate to polar latitudes (NOAA 2011). While rare in Texas one young individual was stranded on the beach at Gilchrist, Chambers County on February 21, 1951 (Texas Tech University 1997). A highly migratory species the whales move to high latitude feeding grounds during the spring and summer and return to southerly temperate waters for mating and calving during fall and winter.

Due to the species tendency to remain far offshore in very deep water and the high mobility of the species, this species is highly unlikely to come into contact with an LNG vessel associated with the proposed project. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Humpback Whale

Humpback whales (*Megaptera novaingliae*) occur in all oceans of the world and are distributed in the western North Atlantic from north of Iceland, Disko Bay and west of Greenland south to Venezuela and the tropical islands of the West Indies (Texas Tech University 1997). The worldwide population estimate is between 5,200 – 5, 600 with about 800-1,000 individuals in the western North Atlantic. Humpback whales have been captured in the Florida Keys and northern Cuba with sightings occurring off the west coast of Florida and Alabama. There is only one documented observation along the Texas Coast, occurring near the Bolivar Jetty near Galveston on February 19, 1992 (Texas Tech University 1997).

Due to the species tendency to remain far offshore in very deep water and the high mobility of the species, this species is highly unlikely to come into contact with an LNG vessel associated with the proposed project. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Sei Whale

Sei whale (*Balaenoptera borealis*) is a medium sized baleen whale occurring mainly in offshore waters from the Gulf of Mexico and Caribbean Sea northward to Nova Scotia and Newfoundland. Sei whales, like other whales are a migratory species that tend to occur in groups of two to five individuals. Sei whales have been protected by the International Whaling Commission since the Mid-1980's (Encyclopedia of Life - Online). There are no known occurrences of Sei Whales in Texas (Schmidly 2004).

Due to the species tendency to remain far offshore in very deep water and the high mobility of the species, this species is highly unlikely to come into contact with an LNG vessel associated with the proposed project. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Sperm Whale

Sperm whales (*Physeter macrocephalus*) inhabit areas with a water depth of 600 meters or more and are uncommon in waters less than 300 meters (NOAA 2011). Sperm whales are found in all oceans of the world in deep waters between approximately 60^0 N and 60^0 S latitudes. Sperm whales are the most numerous of whales in the Gulf of Mexico and sightings in Texas near the coast are relatively common (Texas Tech University, 1997). Sightings of sperm whales in the Gulf of Mexico are common in depths of 655 feet or greater, along submarine canyons on the edge of the continental shelf (Texas A&M University Corpus Christi).

While sightings along the Texas Coast are relatively common, the species tendency to remain far offshore in very deep water and the high mobility of the species, makes it highly unlikely to come into contact with an LNG vessel associated with the proposed project. The determination for this species is May Affect, But Not Likely To Adversely Affect.

MANATEES

West Indian Manatee

The West Indian Manatee (*Trichechus manatus*) is federally and state listed as endangered. Manatees are found in rivers, estuaries, and coastal areas of the tropical and subtropical New World from the southeastern United States coast along Central America and the West Indies to the northern coastline of South America. They occur mainly in larger rivers and brackish water bays. They are extremely rare in Texas and have been sighted in Corpus Christi Bay, Laguna Madre, Cow Bayou, near Sabine Lake, Copano Bay, Bolivar Peninsula, and the mouth of the Rio Grande (Texas Tech University 1997).

Hunting of manatees was first responsible for the decline of their populations but manatees now face danger from collisions with power boats, entrapment in floodgates, navigation locks, fishing nets, and water pipes. Loss of warm water habitat along with ingestion of marine debris also is a threat to the continued survival of the West Indian Manatee.

While manatees have been observed in the project vicinity, sightings are very rare and typically involve only a single animal that vacates the region relatively quickly. Due to the scarcity of the species, the determination for this species is May Affect, But Not Likely To Adversely Affect.

SEA TURTLES

Five species of sea turtles inhabit the Gulf of Mexico with some species nesting on Gulf beaches and occupying Gulf inlets and shallow bays. While some species (green sea turtle and Kemp's ridley sea turtle) forage in bays, their occurrence in the project area would be short term. Impacts to foraging sea turtles will be minimized by utilizing mechanical and hydraulic cutterhead dredging methodologies, which are not know to take turtles (NMFS, 2003). Hopper dredging is not proposed.

Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) was listed as threatened throughout its range on July 28, 1978 (43 FR 32808). The decline of the loggerhead, like that of most sea turtles, can be attributed to over-exploitation 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, 2000).

The loggerhead is found 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 sub-tropical 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 3 to 5 years (NMFS and FWS, 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. Conch, shellfish, horseshoe crabs, prawns and other crustacean, squid, sponges, jellyfish, basket stars, fish (carrion or slow-moving species), and even hatchling loggerheads have all been recorded as loggerhead prey (Rebel, 1974; Hughes, 1974; Mortimer, 1982). Adults forage primarily on the bottom, but also take jellyfish from the surface. The young feed on prey concentrated at the surface, such as gastropods, fragments of crustaceans, and sargassum.

Nesting occurs usually on open, sandy beaches above the high-tide mark and seaward of well developed dunes. They nest primarily on high-energy beaches on barrier islands adjacent to continental land masses in warm-temperate and sub-tropical 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). No critical habitat has been designated for this species.

The loggerhead is widely distributed in tropical and subtropical seas, being found in the Atlantic Ocean from Nova Scotia to Argentina, Gulf of Mexico, Indian and Pacific oceans (although it is rare in the eastern and central Pacific), and the Mediterranean Sea (Rebel, 1974; Ross, 1982; Iverson, 1986). In the continental U.S., loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey (Musick, 1979) and sporadically along the Gulf coast. In recent years a few have nested on barrier islands along the Texas coast.

The loggerhead is considered to be the most abundant turtle in Texas marine waters, preferring shallow inner continental shelf waters and occurring only very infrequently in the bays. It is also the species most commonly sighted around offshore oil rig platforms and reefs and jetties. Loggerheads are probably present year-round but are most noticeable in the spring when one of their food items, the Portuguese man-of-war, is abundant. Loggerheads constitute a major portion of the dead or moribund turtles washed ashore (stranded) on the Texas coast each year. Many of these deaths are due to the activities of shrimp trawlers where turtles are accidentally caught in the nets and drown and their bodies dumped overboard.

Prior to 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, five were confirmed in 2000, three in 2001, one in 2002, two in 2006 and 5 in 2007(Shaver, 2000, 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.

The earliest confirmed loggerhead nest occurring in Texas was in 1977. Of the 516 sea turtle nests found on the Texas coast between 1979 and July 2007, 42 were loggerhead sea turtle nests, of which 32 were found on the Padre Island National Seashore, but it is possible some nests were undetected. During the last decade nesting has remained stable on the Texas coast, with 1-5 nests per year. In years past, the largest number along the Texas coast have been located at the Padre Island National Seashore, south of the project area (six recorded in 2007: four at PINS, two at South Padre Island; and two recorded in 2006: one at PINS, one at South Padre Island) (PINS, 2007).

Given that most loggerhead sightings in the northern Gulf of Mexico occur near jettied passes and in the open Gulf, this species is not likely to occur at the project site. The risk to a loggerhead sea turtle in this project area is considered very limited. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Green Sea Turtle

The green sea 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 exclusion device (TED)

requirements, the offshore commercial shrimp fleet captured about 925 green turtles a year, of which approximately 225 would die. Most turtles killed are juveniles and sub-adults. Various other fishing operations also negatively affect this species (NMFS, 1991b). 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.

The green sea 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. Food consumed includes seagrasses, macroalgae, and other marine plants, mollusks, sponges, crustaceans, and jellyfish (Mortimer, 1982; Green, D., 1984).

Terrestrial habitat is typically limited to nesting activities, although in some areas, such as Hawaii and the Galapagos Islands, they will bask on beaches (Balazs, 1980; Green, D. 1984). They prefer high-energy beaches with deep sand, which may be coarse to fine, with little organic content. At least in some regions, they generally nest consistently at the same beach, which is apparently their natal beach (Meylan et. al, 1990; Allard et al, 1994), although an individual might switch to a different nesting beach within a single nesting season (Green, D., 1984).

The green sea turtle is a circumglobal species in tropical and subtropical waters. In the U.S. Atlantic waters, it occurs around the U.S. Virgin Islands, Puerto Rico, and continental U.S. from Massachusetts to Texas. Major nesting activity occurs on Ascension Island, Aves Island (Venezuela), Costa Rica, and in Surinam. Relatively small numbers nest in Florida, with even smaller numbers in Georgia, North Carolina, and Texas (NMFS and FWS, 1991b; Hirth, 1997).

The green sea turtle in Texas inhabits shallow bays, rock passes and estuaries where its principal foods, the various marine grasses and other Submerged Aquatic Vegetation (SAV), 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 sea 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. They have also been documented in large numbers near passes at Packery, Mansfield and Brazos Santiago and observed at Fish Pass and at the Port Aransas Jetties. 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, with the last Texas turtle fisherman hanging up his nets in 1935. Incidental catches by fisherman and shrimpers were sometimes marked prior to 1963, when it became illegal to do so (Hildebrand, 1982).

Reduced numbers of green sea turtles can still be found in these same bays today (Hildebrand, 1982). Although numbers of green sea turtles are much reduced over historic figures their numbers are now starting to increase. While green sea turtles prefer to inhabit bays with SAV meadows, they may also be found in bays that are devoid of SAV. The green sea 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 sea turtle nests are rare in Texas. Of the 518 turtle nests found on the Texas coast between 1979 and July 2007, 21 were green sea turtle nests, all of which were found outside the project area on Padre Island National Seashore (PINS) and one on South Padre Island. This includes three in 2007 outside the

project area, two within PINS and one on South Padre Island. Also included (all within PINS) are two in 2006, four in 2005, one in 2004, two in 2003, two in 2002, and one in 2000. Observed juveniles are likely from Mexico and may return there to nest. There is a possibility that increased nesting of these juveniles in Texas could occur (FWS, 2008).

Adult Green sea turtles forage in bays that have extensive seagrass beds and could be impacted during dredging activities during construction of the project. With the exclusive use of mechanical methods and hydraulic dredges (which are known not to take sea turtles), the likelihood of a take is significantly reduced (NMFS, 2003). The determination for this species is May Affect, But Not Likely To Adversely Affect.

Leatherback Sea Turtle

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). Its decline is attributable to overexploitation by man and incidental mortality associated with commercial shrimping and fishing activities. Use of turtle meat for fish bait and the consumption of litter by turtles have also been mentioned as causes for mortality, the latter phenomenon apparently occurring when plastic is mistaken for jellyfish (Rebel, 1974).

Although nesting populations of leatherback sea turtles are especially difficult to discern because the females frequently change nesting beaches, current estimates are that 20,000 to 30,000 female leatherbacks exist worldwide. The major threat is egg collecting, although they are also jeopardized to some extent by destruction or degradation of nesting habitat (NatureServe, 2000). Egg collecting is not currently a problem in Florida, but remains a problem in Puerto Rico and the U.S. Virgin Islands (NMFS, 1992). This species is probably more susceptible than other turtles to drowning in shrimp trawlers equipped with turtle excluder devices (TEDs) because adult leatherbacks are too large to pass through the TED exit opening. While the TED exit opening size has been increased in the U.S., FWS is unsure whether it has been increased in other countries. 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, 1992).

The leatherback 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 when nesting or following concentrations of jellyfish (TPWD, 2000), during which it can be found in inshore waters, bays, and estuaries. It dives almost continuously, often to great depths.

Despite their large size, the diet of leatherbacks consists largely of jellyfish and sea squirts. They also consume sea urchins, squid, crustaceans, fish, blue-green algae, and floating seaweed (NFWL, 1980). The leatherback typically nests on beaches with a deepwater approach (Pritchard, 1971). No critical habitat has been designated within the project area.

The leatherback is probably the most wide-ranging of all sea turtle species. It is found in the Atlantic, Pacific and Indian oceans and occurs as far north as British Columbia, Newfoundland, Great Britain and Norway, as far south as Australia, Cape of Good Hope, and Argentina, and in other water bodies such as the Mediterranean Sea (NFWL, 1980). Leatherbacks nest primarily in tropical regions and 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 are found in the U.S. Virgin Islands, Puerto Rico, and Florida (NMFS, 2000).

The leatherback migrates further and ventures more 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 3,666 miles to Ghana, West Africa, after nesting in Surinam (NMFS, 1992). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to the middle of Florida.

Apart from occasional feeding aggregations such as a large occurrence of 100 turtles 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 of Mexico the leatherback is often associated with two species of jellyfish - the cabbagehead (*Stomolophus* sp.) and the moon jellyfish (*Aurelia* sp.) (NMFS, 1992). According to FWS (1981), leatherbacks have never been common in Texas waters. No nests of this species have been recorded on Texas beaches for over 60 years. The last two reported, one from the late 1920s and one from the mid-1930s, were both from Padre Island (Hildebrand, 1982, 1986). Stranding records report one leatherback on the Texas coast in 2006 and one in 2007 (Orms 2008).

The leatherback has been recorded from Nueces, Kenedy, and Cameron counties (Dixon, 2000). As previously stated, no nests of this species have been recorded on Texas beaches for 60 years. The last two reported, one from the late 1920s and one from the mid-1930s were both from Padre Island, well south of the project area (Hildebrand, 1982, 1986). A leatherback was caught by a relocation trawler in a shipping channel approximately 1.5 miles north of Aransas Pass in 2003 (NMFS, 1992). Stranding records report one leatherback on the Texas coast in 2006 and one in 2007 (Orms, 2008). Although highly unlikely, it is of potential occurrence in the project area.

Of the five species of sea turtles occurring in Texas waters, the leatherback is the species least likely to be affected by the proposed project because of its rare occurrence on the Texas coast. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Hawksbill Sea Turtle

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, 2006a).

Other threats include destruction of breeding locations by beach development, incidental take in lobster and Caribbean reef fish fisheries, pollution by petroleum products (especially oil tanker discharges), entanglement in persistent marine debris (Meylan, 1992), and predation on eggs and hatchlings. In American Samoa, most sea turtles and eggs encountered by villagers are harvested (Tuato ‘o-Bartley et al., 1993).

Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are typically found 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 8 to 10 inches. Coral reefs are widely recognized as the resident foraging habitat of juveniles, sub-adults, and

adults. This habitat association is undoubtedly related to their diet of sponges, which need solid substrate for attachment. Hawksbills are also found 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 2000).

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, fish, and plant material such as algae, SAV and mangroves, which also have been reported as food items for this turtle (Carr, 1952; Rebel, 1974; Pritchard, 1977; Musick, 1979; Mortimer, 1982). The young are reported to be somewhat more herbivorous than the adults (Ernst and Barbour 1972).

Terrestrial habitat use is typically limited to nesting activities. They nest on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls. Typically, these sand beaches are low energy with woody vegetation, such as sea grape (*Coccoloba uvifera*), near the waterline (NRC, 1990). The hawksbill is typically a solitary nester, which makes it harder to monitor nesting activity and success (NMFS, 2000).

The hawksbill is circum-tropical, 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 turtle is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas), south to Brazil (NMFS, 2000). In the continental U.S., the hawksbill nests only 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).

Texas is the only state outside of Florida where hawksbills are sighted with any regularity. Most of these sightings involve post-hatchlings and juveniles, and are primarily associated with stone jetties. These small turtles are believed to originate from nesting beaches in Mexico (NMFS, 2000).

One nest was documented at Padre Island in 1998 (Shaver, 1998). It contained 140 eggs of which 133 hatched and 132 were released into the Gulf (one weak hatchling was taken to a rehabilitation facility). This nest remains the only example documented on the Texas coast.

The majority of hawksbill sightings are related to stranded animals. Strandings from 1972−1989 were concentrated at Port Aransas, Mustang Island, and near the headquarters of the Padre Island National Seashore (Amos,1989). Live hawksbills are sometimes seen along the jetties at Aransas Pass Inlet. Other live sightings include a 24.7-cm juvenile captured in a net at Mansfield Channel in May 1991 (Shaver 1998), and periodic sightings of immature animals in the Flower Gardens National Marine Sanctuary, particularly at Stetson Bank.

The risk to a hawksbill sea turtle in this project area, while possible, is considered very limited because of a lack of their preferred habitat (rocky shores, reefs and passes) and a lack of there preferred food of sponges. With the exclusive use of mechanical methods and hydraulic dredges (which are known not to take sea turtles), the likelihood of a take is significantly reduced (NMFS, 2003). The determination for this species is May Affect, But Is Not Likely To Adversely Affect.

Kemp's Ridley Sea Turtle

Kemp's ridley (*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, to a total nesting population of approximately 1,000 in the mid-1980s. The decline of this species was primarily due to human activities including collection of eggs, fishing for juveniles and adults, killing adults for meat and other products, and direct take for indigenous use. In addition to these sources of mortality, Kemp's ridleys have been subject to high levels of incidental take by shrimp trawlers (FWS and NMFS, 1992; NMFS, 2000). The National Research Council's (NRC) Committee on Sea Turtle Conservation estimated in 1990 that 86% of the human-caused deaths of juvenile and adult loggerheads and Kemp's ridleys resulted from shrimp trawling (Campbell, 1995). It is estimated that before the implementation of Turtle Exclusion Devices (TEDs) the commercial shrimp fleet killed between 500 and 5,000 Kemp's ridleys each year (NMFS, 2000). Kemp's ridleys have also been taken by pound nets, gill nets, hook and line, crab traps, and long lines.

Another problem shared by adult and juvenile sea turtles is the ingestion of manmade debris and garbage. Postmortem examinations of sea turtles found stranded on the south Texas coast from 1986 through 1988 revealed 54% (60 of the 111 examined) of the sea turtles had eaten some type of marine debris. Plastic materials were most frequently ingested and included pieces of plastic bags, styrofoam, plastic pellets, balloons, rope, and fishing line. Non-plastic 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 of Mexico. 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 sea turtles through incidental take by hopper dredges (which will not be used for this project) and by degrading the habitat (USACE, 1990). In addition to direct take, channelization of the inshore and nearshore areas can degrade foraging and migratory habitat through open bay placement of dredged material, degraded water quality/clarity, and altered current flow (FWS and NMFS, 1992).

Sea turtles are especially subject to human impacts during the time the females come ashore for nesting. Modifications to nesting areas can have a devastating effect on sea turtle populations. In many cases, prime sea turtle nesting sites are also prime real estate. If a nesting site has been disturbed or destroyed, female turtles may nest in inferior locations where the hatchlings are less likely to survive, or they may not lay any eggs at all.

Today, under strict protection, the population appears to be in the early stages of recovery. Approximately 6,000 Kemp's ridley nests were recorded on Mexican beaches during the 2000 nesting season (Shaver, 2000). In 2001, 5,369 Kemp's ridley nests were recorded in Mexico, while in 2002 the number of nests rose to 6,326. As of mid-August 2003, 8,100 nests have been recorded in Mexico (Peña, 2003). More recent counts include approximately 10,000 nests in 2005 and 12,000 in 2006, and 15,000 nests in 2007 (Shaver, personal correspondence, 2007). In addition, nesting on Texas beaches also continues to increase with the 2007 count totaling 128 confirmed nests. The increase likely can be attributed to two primary factors: full protection of nesting females and their nests in Mexico, and the requirement to use TEDs in shrimp trawlers both in the U.S. and in Mexico (NMFS, 2000).

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 and associated infauna, and other epipelagic species of the Gulf of Mexico (FWS and NMFS, 1992). In some regions the blue crab *(Callinectes sapidus)* is the most common food item of adults and juveniles. Other food items include shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and occasional marine plants (Pritchard and Marquez, 1973; Shaver, 1991; Campbell, 1995).

Adults are primarily restricted to the Gulf of Mexico, although juveniles may range throughout the Atlantic Ocean since they have been observed as far north as Nova Scotia (Musick, 1979) and in coastal waters of Europe (Brongersma, 1972). Important foraging areas include Campeche Bay, Mexico, and Louisiana coastal waters.

The majority of Kemp's ridleys nest 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. Nesting has been documented from approximately 134 miles of the Tamaulipas coastline, and sporadic nesting has been reported from Bolivar Peninsula, Texas, southward to Isla Aquada, Campeche. There have been several isolated nesting attempts scattered from North Carolina to Colombia.

Kemp's ridley turtles occur in Texas in small numbers and in many cases may well be in transit between crustacean-rich feeding areas in the northern Gulf of Mexico and breeding grounds in Mexico. Additionally, there appears to be a population of Kemp's ridley turtles which remain in the northern gulf for longer periods of time. Females nesting on the Texas coast are remaining resident here offshore during the nesting season and to some extent later, according to turtles recently outfitted with radio receivers; one prior to 2006 and one in 2007 (Orms, 2008). Additionally, one of the males previously tracked in Mexican waters traveled to waters off the Texas coast. Studies also show that juvenile turtles use Texas areas extensively for foraging.

Kemp's ridley turtles have 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. From 1979 to 2007, 518 sea turtle nests were found on the Texas coast. Of the 518 nests, 454 were Kemp's ridley nests, 268 of which were found on PINS. The number of nestings has increased in recent years. In 1999, 16 confirmed Kemp's ridley nests were recorded in Texas, 12 nests were confirmed for 2000, 8 for 2001, 38 for 2002, 19 for 2003, 42 for 2004, 51 for 2005, and 102 for 2006 (PINS data). For the 2011 nesting season, there were a total of 199 confirmed nests. Several of the ridley nests were from head-started individuals. Such nestings, together with the proximity of the Rancho Nuevo breeding ground, probably accounts for the occurrence of hatchlings and sub-adults 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. Kemp's ridleys have been observed mating in the Mansfield Channel and, thus, could potentially mate in the nearby Laguna Madre and Gulf of Mexico.

The risk to a Kemp's ridley sea turtle in this project area is considered very limited. While Kemp's ridley sea turtles are presence in the bays and could be in the Project area, the exclusive use of mechanical methods and hydraulic dredges (which are known not to take sea turtles), the likelihood of a take is significantly reduced (NMFS, 2003). The determination for this species is May Affect, But Not Likely to Adversely Affect.

III. CONCLUSIONS

The 2005 FEIS for the LNG import terminal at this very same site determined that the project would not affect, or was unlikely to adversely affect threatened and endangered species. Listed species for the project area have gone unchanged since the time of the 2005 FEIS, as has species life history information and suitable habitat in the project vicinity. The proposed action (construction and operation of an LNG export facility) poses very similar risks (dredging and operation of large vessels), although very small, to marine species in the project area. The best management practices and conservation measures adopted during the permitting process for the import terminal will be adopted by the export terminal project. Marine mammals typically are present in the Project vicinity ranging from April though October when water temperatures exceed 20 degrees Celsius. Therefore, CCL will defer pile driving activities during these months to avoid any potential impacts to the sea turtles. If pile driving activities do occur during the months when sea turtles or marine mammals could be present within 250 meters of the terminal, CCL will implement the monitoring protocol identified by NOAA Fisheries in the 2005 Final Environmental Impact Statement and supplemental comments.

The monitoring plan includes:

a. An observer dedicated for sea turtle and marine mammal observations, responsible to monitor for species presence prior to pile driving activities.

b. A 250 m radius zone would be established and monitored for 60 minutes prior to engaging the pile driving hammer during construction. If a sea turtle or marine mammal is observed within the zone, pile driving would be delayed until the animal is observed to have left or is heading away from the established zone. If an animal dives and cannot be re-sighted, pile driving may not begin until 20 minutes after the last sighting or until the 60 minute observation is complete, whichever is longer.

c. If pile driving activity ceases for any reason, observations for sea turtles and marine mammals would resume until pile driving begins, or the 60 minute survey of the area will be repeated (see b. above).

d. All animals must be allowed to exit the established zone of their own free will.

e. Pile driving will not be started during night-time hours (sunset to sunrise). Pile driving begun during the day that continues into the night, may continue through the night until the hammer activity ceases.

CCL will keep records of all observations, including the date of each survey, the start and end time of each survey, the species and number of animals sighted, behavior of the animals, and how long the animals were observed before leaving the established 250 meter zone. All records will be available upon request.

Therefore, taking the above in account, the conclusion of this assessment is that the proposed project will either have No Effect, or May Affect, But Not Likely to Adversely Affect threatened and/or endangered species in the marine environment.

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Appendix 3D
Terrestrial and Freshwater Aquatic Threatened and Endangered Species Assessment

CORPUS CHRISTI LIQUEFACTION
SAN PATRICIO COUNTY, TEXAS

TERRESTRIAL AND FRESHWATER AQUATIC THREATENED AND ENDANGERED SPECIES ASSESSMENT

AUGUST 2012

I. INTRODUCTION / BACKGROUND

The purpose of this report is to support the permitting process for proposed natural gas liquefaction and export plant and import facilities with regasification capabilities ("CCL Terminal"), specifically with respect to Section 7(a) of the Endangered Species Act (ESA) of 1973 as amended. Section 7 of the ESA requires all federal agencies to consult with the United States Fish and Wildlife Service (FWS) for fresh-water and terrestrial species if the proposed action (an action is defined as any project that requires a federal permit or receives federal funding) may affect listed species or their designated habitat. A Biological Assessment (BA) is required to analyze the potential effects of the project on listed species and critical habitat in order to establish and justify an "effect determination".

In association with a previously permitted Corpus Christi LNG (CCLNG) import terminal at the same project site considered in this Assessment, Corpus Christi LNG consulted with FWS regarding the presence/absence of federally listed threatened or endangered species and their critical habitats in the project area. A Final Environmental Impact Statement (FEIS) prepared by the Federal Energy Regulatory Commission (FERC) under Docket CP04-37-000 dated March 2005 fully addressed potential effects on threatened and endangered species and includes documentation of coordination with FWS. The FEIS served as the BA for the project and concluded that the import terminal would either have "no effect", or "may affect, but not likely to adversely affect" any listed threatened or endangered species. FWS concurred with all of the species determinations, thereby concluding the endangered species consultation process.

This Assessment will rely on the findings for effects on terrestrial and freshwater aquatic species from the March 2005 FEIS for the CCLNG now (Corpus Christi Liquefaction , LLC [CCL]) import terminal, as well as newly obtained species information to determine the applicability of the 2005 species determinations to the currently proposed CCL terminal at the same site. The result of this assessment will be new "effect determinations" for each terrestrial and freshwater aquatic species thought or known to be present in the project vicinity.

II. THREATENED AND ENDANGERED SPECIES ASSESSMENT

The following methodology was implemented for making species determinations for the proposed CCL export terminal:

1) Review of March 2005 FEIS for an CCLNG import terminal at the same site to identify listed species during the time of review, determinations for each species, and develop an understanding of the rationale for each determination.
2) Obtain updated threatened and endangered species lists for the Nueces and San Patricio Counties for comparison with the 2005 FEIS, and contact FWS and Texas Parks and Wildlife Department (TPWD) informally to confirm that no recent changes to federal or state listed endangered species lists have occurred.
3) Conduct an updated screening of habitats onsite to assess the suitability of habitat for the various listed species.
4) Based on the outcome of 1, 2, and 3 above, and the assumption that the export terminal will be very similar (in terms of potential risks to species) to the previously permitted import terminal, arrive at updated determinations for each species.

The 2005 FEIS concluded that the project would either have "no effect", or "may affect, but not likely to adversely affect" threatened and endangered species. Consultation of FWS and TPWD's online threatened and endangered species databases resulted in confirmation that the lists have not changed since the time of the 2005 FEIS. FWS and TPWD confirmed that the online information is the most current available data and is

appropriate for use in making determinations for species effects associated with the proposed LNG export terminal.

Habitat surveys of the project area were conducted in June 2011 and March 2012. After reviewing the habitat requirements of listed species and documented areas of species occurrence, seven listed species that have very low probabilities of occurrence in the project area have been eliminated from further discussion (Table 1). Based on areas of known occurrence and life histories of the species, it is concluded that the construction and operation of the proposed export terminal would have No Effect on these species.

Table 1. Federal and State Listed Endangered and Threatened Species Eliminated From Further Consideration

Species	Status*	Reason for Elimination from Further Consideration	2005 Determination	2012 Determination
Mammals				
Ocelot (*Leopardus pardalis*)	F-E TX-E	Surveys of the site in 2012 found semi-suitable habitat for the ocelot, however the habitat is small and isolated. The ocelot is not known to inhabit this part of San Patricio County.	No Effect	No Effect
Gulf Coast Jaguarundi (*Herpailurus yagouaroundi*)	F- E TX-E	The 2012 survey of the property found semi-suitable habitat for the jaguarondi. However, San Patricio County is out of this species known range.	No Effect	No Effect
Red Wolf (*Canus rufus*)	F- E TX- E	Declared Extinct in the wild in 1980.	No Effect	No Effect
Birds				
Eskimo Curlew (*Numenius borealis*)	F- E TX- E	Thought to be Extinct.	No Effect	No Effect
Plants				
South Texas Ambrosia (*Ambrosia cheiranthifolia*)	F-E TX-E	Project is outside of known range.	No Effect	No Effect
Slender Rush Pea (*Hoffmanseggia tenelle*)	F-E TX-E	Project is outside of known range.	No Effect	No Effect
Mollusks				
Golden Orb (*Quadrula aurea*)	F=C TX-T	Habitat is restricted to lentic and lotic areas of river basins. There is no habitat on the project site.	No Determination	No Effect
* Status: F=Federal, TX = Texas, E = Endangered C= Canidate				

The remaining terrestrial and freshwater aquatic species could potentially occur in the project vicinity are listed below in Table 2.

Table 2. Federal and State Listed Endangered and Threatened Species

Species	Status*	Preferred Habitat	2005 Determination	2012 Determination
Birds				
Brown Pelican *(Pelecanus occidentalis)*	F-DL, TX-E	Shallow coastal waters and nearshore areas.	Not Likely to Adversely Affect	Not Likely to Adversely Affect

Species	Status*	Preferred Habitat	2005 Determination	2012 Determination
Bald Eagle (*Haliaeetus leucocephalus)*	F-DL, TX- NL	Coastal area, rivers, and large bodies of water	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Whooping Crane *(Grus americana)*	F-E, TX-E	Winter habitat in Texas comprises brackish marshes, bays, flats.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
Piping Plover *(Charadrius melodus)*	F-T, TX-T	Beaches, mudflats, sandflats.	Not Likely to Adversely Affect	Not Likely to Adversely Affect
American Peregrine Falcon *(Falco peregrines anatum)*	F-NL, TX-T	Transpecos.	No Determination Made	No Effect
Arctic Peregrine Falcon *(Falco peregrines tundris)*	F-NL, TX-T	Migration through Texas Coastal Bend.	No Determination Made	No Effect
Northern Aplomado Falcon *(Falco femoralis spetenrionalis)*	F-E, TX-E	South Texas grasslands and coastal prairies.	No Determination Made	No Effect
Reddish Egret *(Egretta refescens)*	F-NL, TX-T	Coastal marshes, shell beaches, sandflats, and mudflats.	No Determination Made	Not Likely to Adversely Affect
Sooty Tern *(Onychoprio fuscata)*	F-NL, TX-T	Islands and coastal beaches, very uncommon in coastal Texas.	No Determination Made	No Effect
White-faced Ibis *(Plegadis chihi)*	F-NL, TX-T	Freshwater marshes, swamps, and ponds.	No Determination Made	No Effect
White-tailed Hawk *(Buteo albicaudatus)*	F-NL, TX-T	Coastal grasslands.	No Determination Made	Not Likely to Adversely Affect
Wood Stork *(Myceteria americana)*	F-NL, TX-T	Prairie ponds, flooded pastures, and fields.	No Determination Made	Not Likely to Adversely Affect
Mammals				
Southern Yellow Bat *(Lasiurus ega)*	F-NL, TX-T	Roosts in tress of far south Texas.	No Determination Made	Not Likely to Adversely Affect
White-nosed Coati *(Nasua narica)*	F-NL, TX-T	Transpecos and thorny woodlands within Texas Coastal Bend.	No Determination Made	No Effect
Reptiles				
Texas Horned Lizard *(Phrynosoma cornutum)*	F-NL, TX-T	Loose sand and loamy soils throughout Texas.	No Determination Made	Not Likely to Adversely Affect
Texas Indigo Snake (*Drymarchon melanurus erebennus*)	F-NL, TX-T	Sparsely vegetated areas of south Texas.	No Determination Made	Not Likely to Adversely Affect

Species	Status*	Preferred Habitat	2005 Determination	2012 Determination
Texas Scarlet Snake (*Cemophora coccinea lineri*)	F-NL, TX-T	Sandy thickets of the Texas Coastal Bend.	No Determination Made	Not Likely to Adversely Affect
Timber/Canebrake Rattlesnake (*Crotalus horridus*)	F-NL, TX-T	Hilly woodlands and thickets near freshwater.	No Determination Made	No Effect
Texas Tortoise (*Gopherus berlandieri*)	F-NL, TX-T	Cactus rich areas of south Texas.	No Determination Made	Not Likely to Adversely Affect
Amphibians				
Black-spotted Newt (Notophthalmus meridionalis)	F-NL, TX-T	Freshwater ponds, canals, and ditches.	No Determination Made	No Effect
Sheep Frog (Hypopachus variolosus)	F-NL, TX-T	Tropical humid forests.	No Determination Made	No Effect
South Texas siren (Siren sp)	F-NL, TX-T	Freshwater ponds, ditches, and swamps.	No Determination Made	No Effect
*Status: F=Federal, TX=Texas, E=Endangered, T=Threatened, NL=Not Listed				

BIRDS

Brown Pelican

The brown pelican (*Pelecanus occidentalis*) was listed as endangered throughout its foreign range on June 2, 1970 (35 FR 8495), and throughout its U.S. range on October 13, 1970 (35 FR 16047). Population declines were attributed largely to chlorinated hydrocarbon residues from the use of pesticides, such as DDT compounds (DDE, DDD, and DDT), polychlorinated biphenyls (PCBs), dieldrin, and endrin, which caused eggshell thinning; thus, eggs became desiccated and were more easily broken during incubation (NFWL, 1980). Other factors included human disturbance and loss of habitat due to commercial and residential development (FWS, 1995a). Pelicans are large, heavy birds and easily flushed from the nest. Flushing exposes the eggs and young to predation, temperature stress and permanent abandonment by the parents.

A ban on the use of DDT in the U.S. in 1972, together with efforts to conserve and improve remaining populations, has led to increased numbers of brown pelicans. Populations in some areas have increased to historical breeding levels or above, with stable population numbers and productivity. The brown pelican has been delisted along the U.S. Atlantic coast and, in Florida and Alabama, along the Gulf coast. In May 1998, the FWS announced its intention to either delist or downlist to threatened status numerous species, including the brown pelican (63 FR 25502—25512; May 8, 1998). Delisting for the Brown pelican was finalized on November 7, 2009.

Brown pelicans inhabit shallow coastal waters with water depths up to 80 feet (Palmer, 1962; NFWL, 1980; Fritts et al., 1983). They are rarely found inland and do not venture more than 20 miles out to sea except to take advantage of particularly favorable feeding conditions (FWS, 1980). Distances of 61 miles from shore have been recorded (Fritts et al., 1983). Brown pelicans, which are colonial nesters, usually nest on undisturbed offshore islands in small bushes and trees, including mangroves, and in humid forests (NFWL, 1980; Guzman and Schreiber, 1987). Occasionally they nest on the ground and preferred sites are those free from human

disturbance, flooding, and terrestrial predators, such as raccoons and coyotes. Brown pelicans utilize beaches, sandbars, sandspits, mud flats and even manmade structures such as piers, wharves, pilings, oil/gas platforms, and docks for loafing (NFWL, 1980). No critical habitat has been designated for this species.

Brown Pelicans occur along the Pacific coast of the Americas from southern British Columbia south to Cape Horn and throughout the Atlantic, Gulf and Caribbean coastal areas from New Jersey south to eastern Venezuela. In North America, it occasionally ventures inland north to North Dakota, Ontario and Nova Scotia. Its breeding range is more restricted: along the Pacific coast from central California south to Chile, including the Galapagos Islands; and from North Carolina, south to eastern Venezuela, the West Indies, Greater Antilles, and Virgin Islands (American Ornithologists' Union (AOU), 1998).

In North America, two subspecies are recognized: the eastern brown pelican (*P.o. carolinensis*) ranging from North Carolina south through Florida and west to Texas, and the California brown pelican (*P.o. californicus*) in California (NFWL, 1980). For the eastern subspecies, the present range is the same as the historical one, but in reduced numbers. It became extirpated in Louisiana in 1966, but has since (beginning in 1968) been reintroduced from Florida. It has never been known to nest in Mississippi or Georgia (FWS, 1980; 50 FR 4938, February 9, 1985). Brown pelican colonies are known to occur on the east coast of Mexico off the eastern tip of the Yucatan Peninsula (Mabie, 1986, 1988).

While some migration occurs after nesting in both subspecies, many individuals overwinter close to their breeding grounds (FWS, 1980). Atlantic coast populations move southward in the fall, with most birds wintering in the U.S., particularly in Florida. Some birds, however, disperse to the Cuban coast (Clapp et al., 1982). Gulf coast birds tend to remain on the Gulf coast, although Texas and Louisiana birds have been recovered in Mexico and Cuba (Palmer, 1962; Clapp et al., 1982).

Historically, the brown pelican was a common bird of the Texas Gulf coast with an estimated breeding population of 5,000 pairs residing in 17 colonies in 1918 (Mabie, 1990). By the 1960s, however, it was almost extirpated. In 1963, only 14 breeding pairs were recorded along the Texas coast and in 1964 no known nesting occurred (Mabie, 1986). The decline started during the 1920s and 1930s due to human disturbance (Oberholser, 1974), and continued due to pesticide contamination (King et al., 1977; Mabie, 1986). Since the 1960s, the brown pelican has made a gradual comeback in Texas with an estimated 2,400 breeding pairs in 1995 (Campbell, 1995). Most of the breeding birds have traditionally been found on Pelican Island in Corpus Christi Bay, Nueces County, and Sundown Island near Port O'Connor in Matagorda County. Smaller groups or colonies occasionally nest on Bird Island in Matagorda Bay, a series of older dredged material islands in West Matagorda Bay, Dressing Point Island in East Matagorda Bay, and islands in Aransas Bay (Campbell, 1995).

Although brown pelican colonies are not monitored every year, 1,900 and 750 pairs nested on Pelican Island in 2003 and 2004 respectively, and on Sundown Island, 1,714 pairs nested in 2005 and 987 pairs nested in 2004 (FWS, 2005a). Recent predation on Pelican Island resulted in no observed 2005 breeding pairs, which has possibly led displaced breeding pairs to use Shamrock Island with 340 pairs, and Sunfish Island with 30 pairs (both islands which are located in Corpus Christi Bay). Further to the south, 100 breeding pairs were observed on a Laguna Vista island in 2004 (FWS, 2005a).

In Texas, the brown pelican occurs from Chambers County to Cameron County (Campbell, 1995), primarily along the lower and middle coasts. Occasional sightings are reported on the upper coast and inland to central, north-central, and eastern Texas (Texas Ornithological Society (TOS, 1995), usually on large freshwater lakes. Such occurrences are relatively uncommon. The species is an uncommon resident in the general area, but likely occurs in the open water and barrier island habitats in the study area. Brown pelicans are unlikely to nest in the study area, but are likely to be present throughout most of the year.

This species is expected to forage in the project area or general vicinity on occasion, and it could potentially be temporarily affected from noise and activity from the proposed project. Direct impacts to loafing and feeding birds may result from activity associated with construction activities. Construction activities may disturb brown pelicans causing them to take flight and relocate to other feeding and loafing areas. This type of displacement is typically temporary since birds disturbed by traffic or human activities generally move a short distance away and continue to conduct their pre-disturbance behavior. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) first received legal protection under the Eagle Protection Act on June 8, 1940 (amended October 23, 1972). FWS listed the bald eagle (below the 40th parallel) as endangered on March 11, 1967 (32 FR 4001). Later it received protection under the ESA of 1973. The legal status of the species was changed on February 14, 1978 (43 FR 6233) to endangered in the conterminous U.S. except for Washington, Oregon, Minnesota, Wisconsin, and Michigan, where it was designated as threatened (FWS, 1984). FWS down-listed the species to threatened on July 12, 1995 (60 FR 35999 36010). The Bald Eagle was removed from the Federal list on July 9, 2007.

Several factors contributed to the decline of the bald eagle, including loss of habitat, mortality from shooting and trapping, and environmental contaminants (FWS, 1984). Human factors include direct mortality resulting from hunting, trapping, and poisoning, as well as indirect mortality resulting collisions with power lines, structures, vehicles, and electrocution (Buehler, 2000). Mortality through shooting, however, is on the decline. Between 1975 and 1981, 18% of the total reported mortalities were due to shooting, compared to 62% between 1961 and 1965 (FWS, 1984).

Historically, increases in human population have resulted in extensive alterations in land use. Because eagles nest near water, increased recreation and other human uses of water resources have had negative effects on the bald eagle. The greater use of boats, off-road vehicles, snowmobiles, and increased development of waterfront property have severely altered eagle habitat (Snow, 1981). The construction of reservoirs has created new wintering and non-nesting habitat and nesting bald eagles may use these areas in the future, potentially resulting in major redistribution of nesting (FWS, 1984).

Environmental contaminants are responsible for the greatest decline in eagle populations. Organochloride pesticides inhibit calcium metabolism, resulting in thin eggshells and thus, reproductive failure. Since banning of the use of DDT and other organochloride pesticides in the U.S., the eagles have slowly recovered. Most populations of bald eagles appear to be producing young at a normal rate (FWS, 1984).

The bald eagle inhabits coastal areas, rivers, and large bodies of water. Water is the common feature of its nesting habitat. Because fish and waterfowl comprise the bulk of the bald eagles' diet, nests are seldom far from a river, lake, bay, or other waterbody. Bald eagles generally build nests in the largest trees available, which provide adequate flight access and visibility of the surrounding area (Buehler, 2000). Nest trees may be in woodlands, woodland edges, or open areas, and are frequently the dominant or co-dominant trees in the area (Green, 1985). Bald eagles also nest on cliffs and rock pinnacles, particularly in the southwestern U.S. and occasionally on the ground and on man-made structures (Buehler, 2000).

Water is also an important element of the winter habitat, with eagles usually frequenting lakes and major river systems. Wintering bald eagles also use habitats with little or no open water, if rabbits, carrion, or other food items are readily available (Green, 1985; Buehler 2000).

The bald eagle ranges throughout North America. Two subspecies are currently recognized based on size and weight: the northern bald eagle (*H. l. alascanus*) and the southern bald eagle (*H. l. leucocephalus*), the former

being larger and heavier than the latter. This delineation, however, is of questionable merit due to a continuous size gradient from north to south throughout the range; eagles in the central part of the U.S. are intermediate in size. The northern population nests from central Alaska and the Aleutian Islands, east through Canada, and in the northern states of the U.S. the southern population nests primarily in the estuarine areas of the Atlantic and Gulf coasts from New Jersey to Texas and the lower Mississippi Valley, northern California to Baja California (both coasts), Arizona and New Mexico (Snow, 1981). Wintering ranges of the two populations overlap. Many of the northern bald eagles migrate south for the winter and can occur as far south as Texas. The southern eagles tend to be more sedentary although there is some northward movement during the summer (Snow, 1981). The largest wintering group is in Alaska, where over 3,000 have congregated in the Chilkat Valley during the fall and winter months (Steenhof, 1978).

The southern subspecies nests in Texas along the Gulf Coast and on major inland lakes during the winter months, and migrates to more-northern latitudes during the summer. The northern bald eagle nests in the northern U.S. and Canada during spring and summer, and migrates to the southern U.S., including Texas, during the fall and winter. Concentrations of wintering northern eagles are often present around the shores of reservoirs in Texas, with most wintering concentrations occurring in the eastern part of the state. In Texas, wintering bald eagles have occurred as far south as Cameron County (Oberholser, 1974). In Louisiana, bald eagles nest primarily along the Gulf Coast (Buehler, 2000); in winter, they are occasionally observed on large lakes in northern and central parishes (Buehler, 2000).

This species while is likely present in the general area at some time during the year; however, no suitable nesting habitat is present in the study area. The Bald Eagle has been delisted under the endangered species act but is still protected under the Bald and Golden Eagle Protection Act of 1940, prohibiting take of any kind. Based on the preceding analysis, the determination for this species is No Effect.

Whooping Crane

The whooping crane (*Grus americanus*) was listed as endangered on March 11, 1967 (F.R. Doc. 67-2721). The whooping crane population, estimated at 500 to 700 individuals in 1870 declined to only 16 individuals in the migratory population by 1941 as a consequence of hunting and specimen collection, human disturbance, and conversion of the primary nesting habitat to hay, pastureland, and grain production. The main threat to whooping cranes in the wild is the potential of a hurricane or contaminant spill destroying their wintering habitat on the Texas coast. Collisions with power lines and fences are known hazards to wild whooping cranes. The primary threats to captive birds are disease and parasites. Bobcat predation has been the main cause of mortality in the Florida experimental population (FWS, 2001).

The nesting area in Wood Buffalo National Park is a poorly drained region interspersed with numerous potholes. Bulrush is the dominant emergent in the potholes used for nesting. On the wintering grounds at Aransas National Wildlife Refuge in Texas, whooping cranes use the salt marshes that are dominated by salt grass, saltwort, smooth cordgrass, glasswort, and sea ox-eye. They also forage in the interior portions of the refuge, which are gently rolling, sandy, and are characterized by oak brush, grassland, swales, and ponds. Typical plants include live oak, redbay, Bermuda grass, and bluestem. The non-migratory, Florida release site at Kissimmee Prairie includes flat, open palmetto prairie interspersed with shallow wetlands and lakes. The primary release site has shallow wetlands characterized by pickerel weed, nupher, and maiden cane. Other habitats include dry prairie and flatwoods with saw palmetto, various grasses, scattered slash pine, and scattered strands of cypress. Areas selected for the proposed eastern migratory experimental population closely mimic habitat of the naturally occurring wild population in Canada and Texas (FWS, 2001).

The current nesting range of the self-sustaining natural wild population is restricted to Wood Buffalo National Park in Saskatchewan, Canada and the current wintering grounds of this population are restricted to the Texas Gulf Coast at Aransas National Wildlife Refuge and vicinity. It is experiencing a gradual positive population

trend overall, although some years exhibit stationary or negative results. In January, 2000, there were 187 individuals in the flock, including 51 nesting pairs (FWS, 2001).

An aerial whooping crane census was conducted March 4-5, 2008 at the Aransas National Wildlife Refuge and surrounding areas. The estimated size of the flock is listed at 266 birds, consisting of an estimated 144 adults, 83 subadults, and 39 juveniles. The total number of whooping cranes located on the census was actually 268, with presumably at least 3 cranes that moved and were counted twice. With the flight conducted on two consecutive afternoons, it is expected that a few cranes moved between portions of the census area and were counted on both days (Stehn, 2008).

The Aransas-Wood Buffalo population of cranes migrates southeasterly through Alberta, Saskatchewan and eastern Manitoba, stops-over in southern Saskatchewan, and continues through the Great Plains states of eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas (FWS, 2007). About 9,000 hectares of salt flats on Aransas National Wildlife Refuge and adjacent islands comprise the principal wintering grounds of the whooping crane. Marshes are dominated by salt grass (*Distichlis spicata*), saltwort (*Batis maritima*), smooth cordgrass (*Spartina alterniflora*), glasswort (*Salicornia* sp.), and sea ox-eye (*Borrichia frutescens*). Inland margins of the flats are dominated by Gulf cordgrass (*Spartina spartinae*). Interior portions of the refuge are gently rolling and sandy and are characterized by oak brush, grassland, swales, and ponds. Typical plants include live oak (*Quercus virginiana*), redbay (*Persea borbonia*), and bluestem (*Andropogon* spp.). In the last 30 years, many upland sites have been grazed, mowed, or burned under controlled conditions to maintain oak savannah habitat. The refuge maintains as many as 3,300 ha of grassland for cranes, waterfowl, and other wildlife. Human visitation is carefully controlled, and other potentially conflicting uses of the refuge, such as activities associated with oil and gas exploration, are reduced when whooping cranes are present (FWS, 2007).

The whooping crane has been recorded in San Patricio County, and may potentially access waters on the bay side and interior of Mustang and Padre Islands, which is outside the project area.

While the whooping crane has been recently sighted in San Patricio County, such occurrences are rare. Given its rarity and suitable habitat only in waters on the leeward side of nearby barrier islands, this project is unlikely to adversely affect the species. The determination for the species is May Affect, But Not Likely to Adversely Affect.

Piping Plover

FWS 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 (FWS, 1995a). Additional threats include human disturbances through recreational use of habitat, and predation of eggs by feral pets (FWS, 1995a).

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 Elliot-Smith, 2004). On the wintering grounds, these birds use beaches, mudflats, sandflats, dunes, and off-shore spoil islands (FWS, 1995a; AOU, 1998).

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.

Approximately 35% of the known global population of piping plovers winters along the Texas Gulf Coast, where they spend 60 to 70% of the year (Campbell, 1995; Haig and Elliot-Smith, 2004). The species is a common migrant and rare to uncommon winter resident on the upper Texas coast (Richardson et al., 1998; Lockwood and Freeman, 2004). Piping plover concentrations in Texas occur in the following counties: Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kleberg, Matagorda, Nueces, San Patricio, and Willacy (FWS, 1988). In Louisiana, the piping plover is a rare migrant statewide and uncommon winter resident along the Gulf Coast in Cameron and Jefferson parishes (FWS, 1994). Piping plovers may occur in the study area, but suitable habitat is of limited extent.

The piping plover begins arriving at its post-breeding and wintering grounds in Texas in mid to late July. Haig and Oring (1985) found that early in the post-breeding season, piping plovers frequented beaches, but later tended to inhabit ephemeral sand flats along the backside of barrier islands. Observations of wintering piping plovers in Alabama did not indicate a seasonal preference between habitats, although wintering plovers spent more than 85% of their time on sand flats or mud flats each month (Johnson and Baldassarre, 1988). Along the Texas coast, a correlation appears to exist between tidal height and habitat selection, with piping plovers actively feeding on tidal flats during periods of low tides, and on the Gulf beaches during high tides (Eubanks, 1991; Zonick, et al., 1998; Drake et al., 2000).

Winter distribution studies along the Atlantic and Gulf coasts found piping plovers usually occurring in small, unevenly distributed groups along the coast; however, the sites with largest concentrations of plovers consisted of expansive sand flats or mud flats with sandy beach in close proximity (Nicholls and Baldassarre, 1990). Plovers on the wintering grounds suggest that they show some site fidelity, returning to the same stretch of beach year after year. On the lower Texas coast, individual plovers are known to use areas about 3,000 acres in size, moving two miles or more between foraging sites as tidal movements shift the availability of productive tidal flats (TPWD, 2000). Recent studies show significantly more stringent site fidelity with individual birds returning to more precise locations (+/-400 feet in lateral distance on the beach) each year (Amos, 1989). Piping plover concentrations in Texas occur in Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kleberg, Matagorda, Nueces, San Patricio and Willacy counties (FWS, 1988). FWS (1995a) estimates that approximately 1,900 piping plovers, or approximately 35%, wintered along the Texas Gulf coast.

Several areas along the Texas coast have been identified by the FWS as essential wintering habitat for the piping plover. Essential wintering habitat for the piping plover provides the space and requisite resources necessary for the continued existence and growth of piping plover populations and consist of coastal beach, sand flat and mud flat habitats. Critical Habitat for the wintering grounds (as opposed to breeding population Critical Habitat) has recently been designated in Texas by the FWS (66 FR 36074—36078). The closest critical habitat to the Project area is Unit TX13 Sunset Lake, located approximately four miles southwest of the Project site.

This unit is triangle shaped, with State Highway 181 as the northwest boundary, and the limits of the City of Portland as the northeast boundary. The shore on Corpus Christi Bay is the third side of the triangle, with the actual boundary being Mean Low Low Water (MLLW) off this shore. This unit is a large basin with a series of tidal ponds, sand spits and wind tidal flats. This unit is owned and managed by the City of Portland within a system of city parks. Some of the described area falls within the jurisdiction of the TGLO.

It includes two city park units referred to as Indian Point and Sunset Lake. Much of the unit is a recent acquisition by the city, and management considerations for the park include the area's importance as a site for wintering and resident shorebirds. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds. In studies along the Laguna Madre, Drake et al. (2000) found that overall usage of relatively undisturbed beach habitats by wintering piping plovers, including both foraging and roosting activities, was minimal (2.8%). Piping plovers were found primarily to use beach habitats when other preferred habitats were unavailable, such as when algal and sand flats were inundated. This is considered to be partly due to the prime availability of forage species on tidal flats but also possibly due to the high level of disturbance on beach habitats (Drake et al., 2000).

The piping plover habitat on the Project location is relatively small when compared to the abundance of habitat in the immediate vicinity. Construction activities on the project site could result in piping plovers seeking refuge on nearby area habitats. The determination for this species is May Affect, But Not Likely to Adversely Affect.

American Peregrine Falcon and Arctic Peregrine Falcon

These two falcon subspecies have been delisted by the FWS but are listed as threatened in Texas. The decline of peregrine falcon populations was the result of the use of DDT. Since DDT was banned in 1972, populations have been recovering resulting in the subsequent Federal delisting and the States reclassification to threatened. The American peregrine is a resident of the Trans-Pecos region, including the Chisos, Davis, and Guadalupe mountains. The Arctic peregrine migrates through Texas on its way to wintering areas in South America, stopping to feed along the Texas coast before continuing south (TPWD 2012). The Arctic peregrine could occur in the Project area during their migrations during the spring and fall. The determination for this species is No Effect.

Northern Aplomado Falcon

The northern aplomado falcon (*Falco femoralis sptenrionalis*) ranges from southern Argentina northward through Mexico to south western United States. In Texas, the northern aplomado falcon occurred in two distinctly different habitats. In western Texas they are associated with open desert grassland with scattered yuccas, mesquite and other shrubs or oak woodlands surrounded by or intermingled with desert grasslands, and in south Texas, coastal prairie and marsh habitats that supported small islands of trees and shrubs or that interfaced with woodlands along freshwater drainages and estuaries were used (FWS 2004). Reasons for the decline of the falcon are not well known but over grazing of grasslands leading to habitat destruction are probable causes. Northern aplomado falcons primarily prey on birds and insects but will also take small rodents.

While the project site is within historical ranges of the northern aplomado falcon most recent sightings in Texas have been from the Rio Grande Valley or the Trans-Pecos area. Since habitat in the Project area is not optimal for the northern aplomado falcon, the determination for this species is No Effect.

Reddish Egret

The reddish egret (*Egretta refescens*) is a permanent resident along the Texas middle and lower coasts. The reddish egrets mating season if from early March through late July. In Texas, the nests are built mostly on the

ground near a bush or prickly pear cactus or on an oyster shell beach. Reddish egrets are most often found in salt and brackish water wetlands (TPWD 2012).

The proposed project area is located within the reddish egrets breeding range. Nesting habitat exists in the Project area. The wetlands located in the Project area could be used for foraging, however, abundant foraging grounds near the Project area could also be used by the species. Reddish egrets were not observed in the project area during field surveys in June 2011 or March 2012. The determination for this species is May Affect, But Not Likely to Adversely Affect.

Sooty Tern

The sooty tern (*Onychoprion fuscatus*) is an uncommon to rare visitor to pelagic waters off the Texas Coast. Breeding occurs from April to July and is mostly in equatorial regions with nests on spoil islands and coastal beaches. While sooty terns have been sighted in Texas it is unlikely to be present on the Project site because of its pelagic nature. The determination for this species is No Effect.

White-faced Ibis

The white-faced ibis (*Plegadis chichi*) inhabits marshes, swamps, ponds and rivers, preferring freshwater where it feeds on insects, newts, leeches, earthworms, snails and crayfish. Breeding occurs between April and June. The American population is in decline, with continuing threats including draining of wetlands and widespread use of pesticides (TPWD 2003).

Occurrence of the white-faced ibis on the project site is highly unlikely due to lack of preferred freshwater marsh habitat in the Project area. The determination for this species is No Effect.

White-tailed Hawk

The White-tailed hawk (*Buteo albicaudatus*) is a tropical and sub-tropical species ranging from southern Texas to central Argentina and some of the islands of the southern Caribbean. Its preferred habitats include open, semi-open or thinly forested country, whether flat of hilly. In Texas, it resides in coastal grasslands, preferring saltgrass flats near the Gulf to Mexico and dry grassy mesquite-live oak savannahs farther inland (USGS, 2004). The white-tailed hawk feeds primarily on rabbits, rats, snakes, lizards, frogs, grasshoppers, beetles and occasionally birds (Planetofbirds.com, 2012). Breeding season runs from March to May in Texas (TPWD, 2003).

White-tailed hawks are uncommon in the project area and were not observed during field surveys in June 2011 or March 2012. There is however the potential for this species to occur in the project vicinity. The determination for this species is May Affect, But Not Likely To Adversely Affect.

Wood Stork

Wood storks (*Mycteria ameicana*) are the largest wading birds that breed in North America. The species prefers freshwater and brackish wetlands, and nests in cypress or mangrove swamps. In Texas, the wood stork forages in prairie ponds, flooded pastures or fields, ditches and other shallow standing water including salt-water. The birds move into Gulf States in search of mudflats and other wetlands. They formerly nested in Texas but there have been no breeding records since 1960 (TPWD 2003). The decline of wood storks is attributed to loss of wetlands with associated reduction in the food base (primarily small fish) necessary to support breeding colonies (FWS, 2003).

While wood storks could potentially occur in the project vicinity, they were not observed during field surveys conducted in June 2011 and March 2012. The determination for this species is May Affect, But Not Likely to Adversely Affect.

MAMMALS

Southern Yellow Bat

The southern yellow bat (*Lasiurus pardalis*) is a neotropical species that ranges in the United States from southern California to south Texas where it has been recorded from Cameron, Kleberg, and Nueces Counties. The southern yellow bat requires trees which can provide them with a daytime roost. The Southern yellow bat has been recorded roosting in palm trees in the Rio Grande Valley. They forage at night and feed primarily on insects.

There is potential for the southern yellow bats to roost in palm trees in the project vicinity and forage for insects over the grasslands and coastal wetlands at night. However, due to the lack of contiguous habitat, the determination for this species is May Affect, But Not Likely to Adversely Affect.

White-Nosed Coati

White-nosed coatis **(***Nasua narica*) inhabit warmer parts of Central America, Mexico and the extreme southern United States including south Texas. In Texas they are rarely seen in a range from Brownsville to the Big Bend region of the Trans-Pecos. They have been reported from Aransas, Brewster, Cameron, Hidalgo, Kerr, Maverick, Starr, Uvalde and Webb Counties (Texas Tech University 1997). White-nosed coatis are a raccoon like carnivore that feed on insects and other ground dwelling arthropods, lizards, snakes, carrion and rodents.

The white-nosed coati is highly unlikely to occur in the Project area. The determination for this species is No Effect.

REPTILES

Texas Horned Lizard

The Texas horned lizard (*Phrynosoma cornutum*) or "horny toad" are found in arid and semiarid habitats in open areas with sparse plant cover. The horned lizard is commonly found in loose sand or loamy soils. They range from south-central United States to northern Mexico, and throughout most of Texas, Oklahoma, Kansas and New Mexico (TPWD 2003). They feed primarily on harvest (red) ants. The decline of the Texas horned lizard is due multiple reasons including collection for the pet trade, spread of red imported fire ants, changes in land use and environmental contaminants.

The Texas horned lizard could occur in the Project area. However, due to the small amount of suitable habitat onsite and the large expanses of high quality habitat in nearby areas, the determination is May Affect, But Not Likely To Adversely Affect.

Texas Indigo Snake

The Texas indigo snake (*Drymarchon melanurus erebennus*) is a large nonvenomous snake found from southern Texas south to Mexico. They prefer lightly vegetated areas not far from permanent water sources, but are also found in mesquite savannah, open grassland area, and coastal sand dunes. They den in burrows left by other animals (TPWD 2003). Texas indigo snakes will eat a wide range of animals including mammals, birds, lizards, frog, turtles, eggs and other snakes, including rattlesnakes. The decline of the Texas indigo snake is due primarily to habitat loss resulting from human development.

The Project area is within the far northern range of the Texas indigo snake. Indigo snake sightings in San Patricio County are rare. The probability of occurrence onsite is very low. The determination for this species is May Affect, But Not Likely to Adversely Affect.

Texas Scarlet Snake

The Texas scarlet snake (*Cemphora coccinea lineri*) is a nonvenomous snake native to the United States. The Texas scarlet snake's range includes counties of the Texas Coastal Bend. They prefer sandy thicket habitats along the Gulf of Mexico coastline. The Texas scarlet snake feeds on eggs of other reptiles but also eats small rodents and lizards. The Texas scarlet snake is nocturnal, spending most of the daylight hours in burrows or under leaf litter.

Habitat for this snake is present in San Patricio County but not on the Project site making the potential for the project affecting this species low. The determination for this species is May Affect, But Not Likely to Adversely Affect.

Timber/Canebrake Rattlesnake

Timber/Canebrake rattlesnakes (*Crotalus horridus*) are the second largest venomous snake in Texas and third largest in the United States. Timber rattlesnakes feed on rabbits, squirrels, rats, mice, birds, other snakes, lizards and frogs. They prefer moist lowland forests and hilly woodlands or thickets near permanent water sources such as rivers, lakes, ponds, and swamps. Loss of habitat by human development is the single most reason for their decline (TPWD 2003).

Suitable habitat for the timber/canebrake rattlesnake is not present on the project site. The determination for this species is No Effect.

Texas Tortoise

The Texas tortoise (*Gopherus berlandieri*) is a primarily vegetarian tortoise, feeding heavily on the fruit of the common prickly pear and other succulent plants. Collection of tortoises for pets led to its listing in 1977 as a protected nongame (threatened) species (TPWD 2003). The species breeds from April to September and lays it eggs deep in a hollow on the ground.

While there is marginal habitat for the Texas Tortoise on the Project site the probability of occurrence is very low due to past land disturbances including industrial and agricultural practices. The determination for this species is May Affect, But Not Likely to Adversely Affect.

AMPHIBIANS

Black-spotted Newt

The black–spotted newt (*Notophthalmus meridionalis*) is found in freshwater permanent or temporary ponds, canals, ditches, or even shallow depressions along the Gulf Coast, south of the San Antonio River to northern Veracruz, Mexico. If the water source dries up, young and adult black-spotted newts will seek shelter on land under rocks or rocky ledges. The black-spotted newt is in decline and has high sensitivity to herbicides and pesticides (Amphibia Web 2012).

Black-spotted newts are unlikely to occur on the project site due to a lack of suitable habitat. The determination for this species is No Effect.

Sheep Frog

The sheep frog (*Hypopachus variolosus*) inhabits low and moderate elevations in tropical humid forests as well as disturbed and opened habitats. It can also be found in moist sites in arid areas such as the margin of ponds, marshes, under leaf-litter, in underground burrows, under rocks and other surface cover (IUCN 2010). The American population is limited to southern Texas.

Sheep frogs are unlikely to occur on the project site due to a lack of suitable habitat. The determination for this species is No Effect.

South Texas Siren

South Texas sirens (*Siren sp*) are found in the Mississippi Valley east to Alabama and west to Texas. The south Texas siren ranges in Texas in the eastern third of the state from the lower Rio Grande Valley northward along the Gulf Coast to Louisiana. Sirens prefer warm, shallow waters with vegetative cover, such as ponds, ditches and swamps.

South Texas sirens are unlikely to occur on the project site due to a lack of suitable habitat. The determination for this species is No Effect.

III. CONCLUSIONS

The 2005 FEIS for the LNG import terminal at this very same site determined that the project would not affect, or was unlikely to adversely affect threatened and endangered species. Listed species for the project area have gone unchanged since the time of the 2005 FEIS, as has species life history information and suitable habitat in the project vicinity. The proposed action (construction and operation of an LNG export facility) poses very similar risks terrestrial and freshwater aquatic species in the project area. Best management practices and conservation measures adopted during the permitting process for the import terminal will be adopted by the export terminal project. Taking the above in account, the conclusion of this assessment is that the proposed project will either have No Effect; or May Affect, But Not Likely to Adversely Affect threatened and/or endangered species.

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Appendix 3E
Corpus Christi Liquefaction Project Threatened and Endangered Species Report for the Corpus Christi Pipeline

Corpus Christi Liquefaction Project
Threatened and Endangered Species Report for the Corpus Christi Pipeline
San Patricio County, Texas

Prepared for

Cheniere Corpus Christi Pipeline, L.P.

Prepared by

August 2012

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ACRONYMS AND ABBREVIATIONS

Corpus Christi Pipeline	Cheniere Corpus Christi Pipeline, L.P.
Commission	Federal Energy Regulatory Commission
FERC	Federal Energy Regulatory Commission
HDD	horizontal directional drill
M&R	meter and regulation
Pipeline	Cheniere Corpus Christi Pipeline, L.P. pipeline
Terminal	Corpus Christi Liquefaction Project Terminal
TPWD	Texas Parks and Wildlife Department
USFWS	United States Fish and Wildlife Service

1.0 INTRODUCTION

Cheniere Corpus Christi Pipeline, L.P. ("Corpus Christi Pipeline") plans to construct and operate a bi-directional, 48-inch-diameter pipeline ("Pipeline") and appurtenant facilities. The 23-mile Pipeline will originate at the Corpus Christi Liquefaction, LLC natural gas liquefaction and export plant and import facilities with regasification capabilities ("Terminal") and will terminate north of the City of Sinton at an interconnect with Tennessee Gas Pipeline in San Patricio County, Texas.

The previously authorized, but not constructed, Pipeline route received concurrence on the determination of "no adverse impact" from the United States Fish and Wildlife Service ("USFWS") (Consultation No. 2-11-04-I-0060) on May 13, 2004. The Pipeline will be located within areas that have also been evaluated and assessed in conjunction with the Federal Energy Regulatory Commission's ("FERC" or "Commission") review and approval of the CCLNG Import Terminal in Docket Nos.CP04-44-000, CP04-45-000, and CP04-46-000 (April 18, 2005 Order authorizing Cheniere Corpus Christi Pipeline Company[1] to construct and operate a 23-mile long natural gas pipeline).

The purpose of the current field study was to re-evaluate the habitat that will be crossed by the Pipeline and appurtenant facilities, assess any changes since the previous evaluation and agency clearances, and determine if the habitat is currently suitable for threatened and endangered species with the potential to occur in San Patricio County.

This report provides a description of the Pipeline and appurtenant facilities, methods used for the re-evaluation, a description of the habitats along the Pipeline, life history information, and a determination for each species listed in San Patricio County.

2.0 FACILITY DESCRIPTIONS AND LOCATION

Corpus Christi Pipeline will construct approximately 23.0 miles of new 48-inch-diameter natural gas pipeline, originating at the Terminal and routed in a northwest direction largely along existing rights-of-way, and terminating north of the City of Sinton at an interconnect with Tennessee Gas Pipeline. Two new compressor stations will be constructed and six meter and regulation ("M&R") stations will be installed along the Pipeline route. These compressor stations and M&R stations are described in Table 2-1.

[1] Now Cheniere Corpus Christi Pipeline, L.P. ("Corpus Christi Pipeline")

TABLE 2-1

Summary of Proposed Corpus Christi Pipeline and Appurtenant Facilities

Facility	Length (miles)	Diameter (inches)	Location (MP)	Horsepower	Description
Pipeline					
Corpus Christi Pipeline	23.0	48	N/A	N/A	New bi-directional pipeline to connect Terminal to natural gas pipeline supply and delivery points
Compressor Stations					
Taft Compressor Station	N/A	N/A	7.5	12,260	New compressor station site with two Centaur 50 turbines/compressors
Sinton Compressor Station	N/A	N/A	21.5	41,000	New compressor station site with two Titan 130 turbines/compressors
Meter and Regulation Stations					
Liquefaction M&R Station	N/A	N/A	0.0	N/A	Install bi-directional M&R station to feed gas into the LNG terminal
Texas Eastern M&R Station	N/A	N/A	7.5	N/A	Install bi-directional M&R station at interconnect with Texas Eastern pipeline
Tejas M&R Station	N/A	N/A	21.0	N/A	Install bi-directional M&R station at interconnects with two Tejas pipelines
NGPL M&R Station	N/A	N/A	22.4	N/A	Install bi-directional M&R station at interconnects with two NGPL pipelines
Transco M&R Station	N/A	N/A	22.8	N/A	Install bi-directional M&R station at interconnect with Transco pipeline
Tennessee Gas M&R Station	N/A	N/A	23.0	N/A	Install bi-directional M&R station at interconnects with two Tennessee Gas pipelines
Appurtenant Facilities					
Pig Launcher	N/A	48	0.0	N/A	Pig launcher at Liquefaction M&R Station
Mainline Valve	N/A	N/A	0.0	N/A	Mainline valve at Liquefaction M&R Station
Mainline Valve	N/A	N/A	7.5	N/A	Mainline valve at Taft Compressor Station
Mainline Valve	N/A	N/A	14.5	N/A	Mainline valve on Pipeline
Mainline Valve	N/A	N/A	21.5	N/A	Mainline valve at Sinton Compressor Station
Pig Receiver	N/A	48	23.0	N/A	Pig receiver at Tennessee Gas M&R Station
Mainline Valve	N/A	N/A	23.0	N/A	Mainline valve at Tennessee Gas M&R Station

Land use along the Pipeline consists primarily of rural agricultural land planted with cotton, sorghum, corn, and soybeans. The Pipeline will cross through a portion of a wind energy facility, the Papalote Creek Wind Farm. The wind turbines are located on agricultural land near the communities of Taft and Gregory. The remaining land uses that will be affected consist of open lands and industrial lands.

3.0 METHODS

Field biologists reviewed the *Terrestrial Threatened and Endangered Species Report Corpus Christi Pipeline Project* (PBS&J 2004) report prior to initiating field activities. Biologists also reviewed USFWS and Texas Parks and Wildlife Department ("TPWD") county lists for threatened and endangered species prior to field surveys. Habitat evaluations were performed in conjunction with the wetland surveys conducted May 8-10, 2012. The purpose of the field study was to re-evaluate the areas that were previously reviewed, asses any changes since the previous review and agency clearance, and determine if the habitat is suitable for threatened and endangered species. Biologists surveyed the entire length of the 23-mile Pipeline and appurtenant facilities. The survey corridor was 300 feet in width, or 150 feet on each side of the centerline. Biologists evaluated the survey corridor for habitat changes from the 2004 evaluation. The biologists also evaluated the survey corridor for habitat for species that have been listed since 2004. During the evaluation, biologists noted plant community types, conditions of the habitats and surrounding area, and potential for competition with similar habitat-use species to make their determination.

4.0 HABITAT

In general, habitat along the Pipeline route and appurtenant facilities was found to be similar to that presented in the 2004 report. The Pipeline will cross areas of open land, agricultural land, wetland, and industrial lands.

Open land along the Pipeline route contains many of the same vegetative communities identified in 2004. Biologists observed king ranch bluestem (*Bothriochloa ischaemum*), hooded windmill grass (*Chloris cucullata*), mesquite (*Prosopis glandulosa*), gordo bluestem (*Dicanthium aristatum*), and Texas prickly pear (*Opuntia lindheimeiri*) during the May 2012 field survey. Many of the open land areas identified during the survey consisted of fallow fields, some of which were being utilized as pasture land.

Agricultural land was planted in cotton (*Gossypium hirsutum*) and *Sorghum*. This was the primary land use along the Pipeline route.

Four wetlands were identified along the Pipeline route. Common vegetation found in wetlands along the Pipeline route include river birch (*Betula nigra*), mesquite, deciduous holly (*Ilex decidua*), locust (*Gleditsia triacanthos*), *Carex* spp., softstem bulrush (*Schoenoplectus tabernaemontani*), curly dock (*Rumex crispus*), common cattail (*Typha latifolia*), common spikerush (*Eleocharis palustris*), *Eleocharis* spp., and red fescue (*Festuca rubra*).

Nine streams will be crossed by the Pipeline. The majority of streams that will be crossed by the Pipeline are drainage ditches associated with pasture and agricultural lands. Only three streams are perennial, including Chiltipin Creek and Oliver Creek. These streams have higher quality riparian areas; however, none are left in their natural state and all have been manipulated in the past for agricultural purposes.

Industrial lands were highly disturbed and contained little vegetative cover. Since 2004, the Papalote Creek Wind Farm has been constructed in the vicinity of Taft. The wind farm was constructed largely on

agricultural land; however, the construction of turbine pads and access roads has disturbed large areas of agricultural land. Wind turbines at this facility range in height up to approximately 130 meters, detracting avian species from the area.

5.0 THREATENED AND ENDANGERED SPECIES

The following species (Table 5-1) are only found in marine environments. Due to the fact that the Pipeline will not cross any marine environments, these species are not discussed further. The Pipeline will have no effect on any of these species.

TABLE 5-1

Federal and State Threatened and Endangered Species Potentially Occurring in San Patricio County, Texas that have been Eliminated from Further Discussion

Common Name	Scientific Name	USFWS Status	TPWD Status
Loggerhead sea turtle	*Caretta caretta*	T	T
Green sea turtle	*Chelonia mydas*	T	T
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	E
Smalltooth sawfish	*Pristis pectinata*	E*	E
West Indian manatee	*Trichechus manatus*	E	E

* = Species that appears on the TPWD species list, but does not appear on the USFWS list as occurring in San Patricio County, TX.

Source: USFWS 2012; http://www.fws.gov/southwest/es/EndangeredSpecies/EndangeredSpecies_Lists/Endangered Species_Lists_Main.
TPWD 2011; http://gis.tpwd.state.tx.us/TpwEndangeredSpecies/DesktopDefault.aspx.

PBS&J (2004) identified 28 species listed as threatened or endangered in San Patricio County, Texas. Since 2004, five additional species have been listed by the USFWS and/or the TPWD. These species include the white-nosed coati (*Nasua narica*), opossum pipefish (*Microphis brachyurus*), golden orb (*Quadrula aurea*), peregrine falcon (*Falco peregrinus*), and northern aplomado falcon (*Falco femoralis septentrionalis*). Also since 2004, six species have been delisted including the American alligator (*Alligator mississippiensis*), smooth green snake (*Liochlorophis vernalis*), least tern (*Sterna antillarum athalassos*), mountain plover (*Charadrius montanus*), bald eagle (*Haliaeetus leucocephalus*), and arctic peregrine falcon (*Falco peregrinus tundrius*), and two species; brown pelican (*Pelecanus occidentalis*) and American peregrine falcon (*Falco peregrinus anatum*), have had status changes. Table 5-2 provides a current list of non-marine threatened and endangered species that potentially occur in San Patricio County, Texa,s as well as those that were listed in 2004 for comparison.

TABLE 5-2

Federal and State Listed Threatened and Endangered Species in San Patricio County, Texas for 2004 and 2012

Common Name	Scientific Name	2004 Status [1]		2012 Status[1]	
		USFWS	TPWD	USFWS	TPWD
Fish					
Opossum pipefish	*Microphis brachyurus*	---	---	---	T
Amphibians					
Sheep frog	*Hypopachus variolosus*	---	T	---	T
Black-spotted newt	*Notophthalmus meridionalis*	---	T	---	T
South Texas siren	*Siren* sp.	---	T	---	T
Reptiles					
Texas tortoise	*Gopherus berlandieri*	---	T	---	T
Timber/canebrake rattlesnake	*Crotalus horridus*	---	T	---	T
Texas horned lizard	*Phrynosoma cornutum*	---	T	---	T
Texas scarlet snake	*Cemophora coccinea lineri*	---	T	---	T
Texas indigo snake	*Drymarchon melanurus erebennus*	---	T	---	T
Smooth green snake	*Liochlorophis vernalis*	---	E	---	---
American alligator	*Alligator mississippiensis*	T/SA	---	---	---
Birds					
Brown pelican	*Pelecanus occidentalis*	E	E	---	E
Reddish egret	*Egretta rufescens*	---	T	---	T
White-faced ibis	*Plegadis chihi*	---	T	---	T
White-tailed hawk	*Buteo albicaudatus*	---	T	---	T
Peregrine falcon	*Falco peregrinus*	---	---	---	T
American peregrine falcon	*Falco peregrinus anatum*	---	E	---	T
Arctic peregrine falcon	*Falco peregrinus tundrius*	---	T	---	---
Northern aplomado falcon	*Falco femoralis septentrionalis*	---	---	E*	E
Bald eagle	*Haliaeetus leucocephalus*	T	---	---	---
Whooping crane	*Grus Americana*	E	E	E/CH	E
Piping plover	*Charadrius melodus*	T	T	T/CH	T
Mountain plover	*Charadrius montanus*	PT	---	---	---
Eskimo curlew	*Numenius borealis*	E	E	E*	E
Sooty tern	*Sterna fuscata*	---	T	---	T
Least tern	*Sterna antillarum athalassos*	E	~E	---	---
Wood stork	*Mycteria americana*	---	T	---	T
Mollusks					
Golden orb	*Quadrula aurea*	---	---	---	T
Mammals					
Southern yellow bat	*Lasiurus ega*	---	T	---	T
White-nosed coati	*Nasua narica*	---	---	---	T
Red wolf	*Canus rufus*	E	E	E*	E

TABLE 5-2

Federal and State Listed Threatened and Endangered Species in San Patricio County, Texas for 2004 and 2012

Common Name	Scientific Name	2004 Status [1]		2012 Status[1]	
		USFWS	TPWD	USFWS	TPWD
Ocelot	*Leopardus pardalis*	E	E	E	E
Gulf Coast Jaguarundi	*Herpailurus yagouaroundi cacomitli*	E	E	E	E

[1] E = Endangered: species in danger of extinction throughout all or a significant portion of its range.

T = Threatened: species, which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

CH = Critical habitat. No critical habitats have been identified within the Pipeline route. Critical habitat is present to the west of the CCL Terminal site for piping plover (14 FR 23476 23600; 5/19/09)

* = Species that appear on the TPWD species list, but do not appear on the USFWS list as occurring in San Patricio County, TX.

~ = Protections restricted to populations found in the "interior" of the United States.

Source: USFWS 2012; http://www.fws.gov/southwest/es/EndangeredSpecies/EndangeredSpecies_Lists/Endangered Species_Lists_Main.

TPWD 2011; http://gis.tpwd.state.tx.us/TpwEndangeredSpecies/DesktopDefault.aspx.

6.0 SPECIES DESCRIPTIONS

The species descriptions presented in *Terrestrial Threatened and Endangered Species Report Corpus Christi Pipeline Project* (PBS&J 2004) are still valid. Therefore, only the five species not listed as threatened and endangered in 2004 are discussed below.

White-nosed coati (*Nasua narica*)

The white-nosed coati is listed as threatened by the TPWD. This species prefers conifer, hardwood, and mixed forest habitats and often travel in troops. White-nosed coatis forage for fruits and berries, bulbs, roots, leaves, insects, small mammals, lizards, and bird eggs. They will also forage for cultivated crops if available (NatureServe 2012). Corpus Christi is near the northern limits of the white-nosed coati's range, which extends west to Arizona and south through Mexico. Though the white-nosed coati has been recorded as close as Aransas County, the Pipeline route does not contain large tracts of forested habitat suitable for the white-nosed coati. Therefore, construction and operation of the Pipeline is not likely to adversely affect the white nosed coati.

Opossum pipefish (*Microphis brachyurus*)

The opossum pipefish is an anadromous species, spending the majority of their time in the open ocean and returning to freshwater to breed. The opossum pipefish can be found in low gradient creeks and medium to large rivers with dense, emergent vegetation (NatureServe 2012). The opossum pipefish is not a strong swimmer and reasons for decline include disease, water quality, unnatural flow, and water control structures (NOAA Fisheries 2009). These are the primary reasons for the TPWD listing of threatened for this species. The only drainage that may provide suitable breeding and/or feeding habitat (low gradient, w/emergent vegetation within 30 miles of the coast) is Chiltipin Creek. However, it

supports a population of longnose gar and the gars ability to thrive in the turbid warm water would be an indicator that the water quality/dissolved oxygen levels of the drainage are too poor and/or low to support the opossum pipefish. Additionally, downstream channel constrictions would prohibit the upstream migration. Due to the above mentioned reasons and the fact that Corpus Christi Pipeline will cross Chiltipin Creek via the horizontal directional drill ("HDD") method to avoid direct impacts to Chiltipin Creek, the construction and operation of the Pipeline is not likely to adversely affect the opossum pipefish.

Golden orb (*Quadrula aurea*)

The golden orb is a freshwater mussel that can be found in shallow waters in medium to large rivers and is listed as threatened by the TPWD. This species appears to be restricted to flowing waters with sand, gravel, and cobble bottoms at depths from a few centimeters to over three meters and is intolerant of scouring floods producing excess silt and mud deposition. The golden orb is also intolerant of impoundment in most instances (NatureServe 2012). The remaining known populations in Texas are centralized around the Corpus Christi area, with one of the nine known populations occurring in Lake Corpus Christi. Live Oak County, Texas is the nearest county the USFWS lists the golden orb as potentially occurring (USFWS 2012). The nine known populations appear to be restricted to four rivers in Texas. It appears that the golden orb has been extirpated from the Aransas River Basin, of which Chiltipin Creek is located. The remaining drainages crossed by the Pipeline are too prone to drying up in drought times to support a long-term population of mussels. Therefore, construction and operation of the Pipeline is not likely to adversely affect the golden orb.

Peregrine falcon (*Falco peregrinus*)

The peregrine falcon is listed as threatened by the TPWD and can be found nesting on ledges with an overhang for protection or in holes on the face of rocky cliffs. They have also been observed nesting on manmade structures (NatureServe 2012). This species hunts in open areas with cliffs or other high vantage points above rivers and coasts and have been observed hunting above the dunes at Padre Island National Seashore. The open grassland / scrub / coastal savannah habitats along the Pipeline route is too heavily grazed to provide nesting habitat for this species and its preferred hunting grounds are not found along the Pipeline. Although this species has the potential to fly in the vicinity of the Pipeline, there is no nesting habitat for this species and therefore construction and operation of the Pipeline is not likely to adversely affect this species.

Northern aplomado falcon (*Falco femoralis septentrionalis*)

The northern aplomado falcon is listed as endangered by both the USFWS and the TPWD. It prefers open rangeland and savanna, semiarid grasslands with scattered trees and shrubs as habitat (NatureServe 2012). Severe overgrazing by domestic livestock has been one of the primary reasons for the decline of this species (TPWD 2012). The open grassland / scrub / coastal savannah habitats along the Pipeline route is too heavily grazed to provide nesting habitat for this species, though it may be observed hunting in the vicinity of the Pipeline route. Due to the lack of suitable nesting habitat for this species along the Pipeline route, construction and operation of the Pipeline is not likely to adversely affect this species.

7.0 CONCLUSIONS

The Pipeline and appurtenant facilities will not be located in areas that contain high quality habitat for any federal or state listed threatened or endangered species with the potential to occur in San Patricio County, Texas. Table 5-3 provides impact determinations from the 2004 evaluation and for the 2012 re-evaluation.

TABLE 5-3

Impact Determinations for Terrestrial Federal and State Listed Threatened and Endangered Species in San Patricio County, Texas for 2004 and 2012

Common Name	Scientific Name	2004 Determination[1]	2012 Determination[2]
Fish			
Opossum pipefish	*Microphis brachyurus*	NA	Not Likely to Adversely Affect
Amphibians			
Sheep frog	*Hypopachus variolosus*	No Adverse Impact	Not Likely to Adversely Affect
Black-spotted newt	*Notophthalmus meridionalis*	No Adverse Impact	Not Likely to Adversely Affect
South Texas siren	*Siren* sp.	No Adverse Impact	Not Likely to Adversely Affect
Reptiles			
Texas tortoise	*Gopherus berlandieri*	No Adverse Impact	Not Likely to Adversely Affect
Timber/canebrake rattlesnake	*Crotalus horridus*	No Adverse Impact	Not Likely to Adversely Affect
Texas horned lizard	*Phrynosoma cornutum*	No Adverse Impact	Not Likely to Adversely Affect
Texas scarlet snake	*Cemophora coccinea lineri*	No Adverse Impact	Not Likely to Adversely Affect
Texas indigo snake	*Drymarchon melanurus erebennus*	No Adverse Impact	Not Likely to Adversely Affect
Smooth green snake	*Liochlorophis vernalis*	No Adverse Impact	NA
American alligator	*Alligator mississippiensis*	No Adverse Impact	NA
Birds			
Brown pelican	*Pelecanus occidentalis*	No Adverse Impact	Not Likely to Adversely Affect
Reddish egret	*Egretta rufescens*	No Adverse Impact	Not Likely to Adversely Affect
White-faced ibis	*Plegadis chihi*	No Adverse Impact	Not Likely to Adversely Affect
White-tailed hawk	*Buteo albicaudatus*	No Adverse Impact	Not Likely to Adversely Affect
Peregrine falcon	*Falco peregrinus*	NA	Not Likely to Adversely Affect
American peregrine falcon	*Falco peregrinus anatum*	No Adverse Impact	Not Likely to Adversely Affect
Arctic peregrine falcon	*Falco peregrinus tundrius*	No Adverse Impact	NA
Northern aplomado falcon	*Falco femoralis septentrionalis*	NA	Not Likely to Adversely Affect
Bald eagle	*Haliaeetus leucocephalus*	No Adverse Impact	NA
Whooping crane	*Grus Americana*	No Adverse Impact	Not Likely to Adversely Affect
Piping plover	*Charadrius melodus*	No Adverse Impact	Not Likely to Adversely Affect
Mountain plover	*Charadrius montanus*	No Adverse Impact	NA
Eskimo curlew	*Numenius borealis*	No Adverse Impact	Not Likely to Adversely Affect
Sooty tern	*Sterna fuscata*	No Adverse Impact	Not Likely to Adversely Affect

TABLE 5-3

Impact Determinations for Terrestrial Federal and State Listed Threatened and Endangered Species in San Patricio County, Texas for 2004 and 2012

Common Name	Scientific Name	2004 Determination[1]	2012 Determination[2]
Least tern	*Sterna antillarum athalassos*	No Adverse Impact	NA
Wood stork	*Mycteria americana*	No Adverse Impact	Not Likely to Adversely Affect
Mollusks			
Golden orb	*Quadrula aurea*	NA	Not Likely to Adversely Affect
Mammals			
Southern yellow bat	*Lasiurus ega*	No Adverse Impact	Not Likely to Adversely Affect
White-nosed coati	*Nasua narica*	NA	Not Likely to Adversely Affect
Red wolf	*Canus rufus*	No Adverse Impact	Not Likely to Adversely Affect
Ocelot	*Leopardus pardalis*	No Adverse Impact	Not Likely to Adversely Affect
Gulf Coast Jaguarundi	*Herpailurus yagouaroundi cacomitli*	No Adverse Impact	Not Likely to Adversely Affect

[1] Determination from *Terrestrial Threatened and Endangered Species Report Corpus Christi Pipeline Project* (PBS&J 2004)

[2] Determination based on amount of habitat present in the vicinity of the Pipeline ROW, quality of the habitat, and known recent occurrences within the vicinity of the Pipeline ROW.

NA = No determination made for this species at that time.

The Pipeline and appurtenant facilities will be constructed and operated in areas that are highly disturbed. The majority of the area is in active agriculture or used for industrial purposes. Corpus Christi Pipeline has designed the Pipeline to utilize existing rights-of-way to the extent practicable. The Pipeline will parallel existing road and gas and electric transmission lines for approximately 19.7 miles, or approximately 86 percent of the route. Moreover, Corpus Christi Pipeline will utilize the HDD method to cross two perennial streams, Chiltipin Creek and Oliver Creek, and associated wetlands, thereby reducing impacts to areas of potential habitat for listed species.

Since the initial evaluation in 2004, the Papalote Creek Wind Farm was constructed near the communities of Taft and Gregory. This project consists of 196 wind turbines, extending to a maximum blade tip height of approximately 130 meters. This development likely detracts large numbers of avian species. Moreover, the installations of turbine pads, access roads, and underground electrical collection lines have caused large amounts of ground disturbance. In addition to the Papalote Creek Wind Farm, the Pipeline route traverses areas that have been highly disturbed from the installation of oil and gas pipelines and electric transmission lines. The large amount of industry in the vicinity of the Pipeline route also contributes to higher traffic areas with continual activity.

It is likely, for the reasons described above, that many species not well suited for disturbed habitats would use habitats in the surrounding area and avoid areas crossed by the Pipeline. The surrounding areas such as Aransas National Wildlife Refuge, Mustang Island State Park, Lake Corpus Christi State Park, and

Padre Island National Seashore provide suitable, high quality habitat for a variety of species. For the reasons listed above, in conjunction with the general low quality of habitat along the Pipeline route, the Pipeline is not likely to adversely affect federal and state listed threatened and endangered species with the potential to occur in San Patricio County Texas.

8.0 REFERENCES

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