4.0 ENVIRONMENTAL ANALYSIS

4.1 GEOLOGIC RESOURCES

This section describes the geologic resources associated with the Ingleside Energy Center LNG Project and the potential geologic hazards that may be encountered at the LNG site or along the proposed pipeline route.

4.1.1 Geologic Setting

The proposed Ingleside Energy Center LNG Project would be located in the West Gulf Coast subdivision of the Atlantic and Gulf Coastal Plains geomorphic province. The region is characterized by a series of increasing depositional plains that range from the shoreline to about 200 miles inland and range in elevation from sea level to about 600 feet. The upper sediments consist of the Pleistocene Beaumont Formation that is underlain by the Pleistocene Lissie Formation.

The Beaumont Formation consists of interbedded layers of clay, sandy clays, and silty and clayey sands that were deposited on the back bay of an ancient barrier island. In the Central Gulf Coast region this formation is composed of up to 90 percent clay with medium to fine grained sands. The Lissie Formation consists of alluvial deposits of sand, silt, clay and small amounts of gravel. About 60 percent of this formation is composed of fine to coarse-grained sand while the remaining 40 percent consists of sandy clay (20 percent) and gravel and clay (10 percent each). The Lissie Formation typically contains very stiff to hard clays, dense to very dense sands, and thin weakly cemented layers of sandstone.

The LNG terminal would be located within a bay-estuary system that formed upon the Pleistocene Nueces River fluvial deltaic system. Large sediment loads were deposited towards the coast during interglacial periods, and broad deltas and large floodplain areas were formed. The Nueces River valley filled with fluvial and marine sediments as the shoreline receded to its present position. Holocene alluvial and floodplain deposits that are underlain by the Beaumont Formation occur at the LNG terminal site. The Lissie Formation occurs at a depth of about 90 feet. The proposed pipeline would also be located on recent Holocene alluvial deposits that are underlain by deep Pleistocene deltaic and alluvial deposits. From MP 0.0 to MP 21.0 the pipeline would be underlain by the Beaumont Formation and from MP 21.0 to MP 26.4 it would be underlain by the Lissie Formation.

4.1.2 Extractive Resources

There are three primary types of resources potentially occurring on or beneath the Project area: oil and gas, lignite and coal, and mineral and gravel.

4.1.2.1 Oil and Gas

Oil and gas production in the Project area occurs within the Frio Formation. Five Frio Formation reservoirs occur in San Patricio County and four occur in Nueces County. Oil and gas fields in the vicinity of the pipeline include Midway, Triple A, East Taft, Taft, West Taft, Ewing, Plymouth, Portillo, Sinton, Sinton North, and North Pasture. Ingleside San Patricio reviewed

TRRC maps and found five wells within 150 feet of the pipeline construction right-of-way. There is one operating oil well, near MP 16.3, that would be about 96 feet from the pipeline; the other four wells are not in operation. Construction of the proposed pipeline would not affect these wells. Ingleside San Patricio would conduct a detailed survey of the pipeline route prior to construction and the pipeline would be adjusted within the permanent easement, in order to avoid any obstacles encountered, including existing oil and gas wells.

4.1.2.2 Lignite and Coal

Commercial deposits of lignite, or brown coal, occur as sedimentary deposits in the Cockfield-Yegua Formation and Wilcox Group whereas commercial deposits of bituminous coal are found in Late Cretaceous beds of Maverick County, Texas, about 200 miles northwest of the Corpus Christi area. Both lignite and coal are extracted by strip mining methods. No lignite or coal extraction operations have been identified in the Project area.

4.1.2.3 Mineral and Gravel

Sand, clay, salt, and gravel are mined in the Gulf Coast region; however, no mineral or gravel extraction operations have been identified in the Project area.

4.1.3 Paleontological Resources

No sensitive paleontological resources have been identified in the Project area.

4.1.4 Geologic Hazards

The following section provides a summary of the site conditions with respect to seismicity and faulting, soil liquefaction, diapiric structures, subsidence, karst terrain, slope stability, and flooding/storm damage.

4.1.4.1 Seismicity and Faulting

The proposed Project is located within the Gulf Coastal Plains geomorphic province, which is characterized by a low seismic hazard potential. According to the Seismic Risk Map for the Uniform Building Code, the Gulf Coast region, including the Project area, is within Seismic Zone 0, the lowest risk zone.

Ingleside San Patricio conducted a site-specific seismic hazard analysis to further assess seismic hazards at the LNG terminal site. This analysis included development of a seismotectonic model in order to evaluate seismic hazards with respect to the NFPA guidelines for stationary LNG storage containers. Results of this study indicate that due to very low level of ground motion predicted at the site, earthquake hazards were not considered a controlling factor in facility design (ABS Consulting, 2004).

Although numerous faults exist in the Gulf Coast region, review of the physiographic and historical data for the Project indicates that movement along these faults in modern times is the result of subsidence due to petroleum production and groundwater pumping (see section 4.1.4.4, below). A low risk of seismic activity and faulting effects can be reasonably anticipated for the

Project area. Therefore, we conclude that the potential for large-magnitude seismic activity in the vicinity of the Project is low.

4.1.4.2 Soil Liquefaction

Soil liquefaction occurs in saturated soils; that is, soils in which the space between individual particles is completely filled with water and the soils are subject to intense and prolonged ground shaking from seismic events. When liquefaction occurs, the strength of the soil decreases and the ability of a soil deposit to support foundations for structures is reduced. Soils that are composed of particles that are about the same size, such as water or wind-deposited sediments, are more susceptible to liquefaction than soils with a wide range of particle sizes.

Ingleside San Patricio conducted an assessment of factors that could create conditions conducive to liquefaction (*i.e.,* presence of saturated sand and the potential for shock such as an earthquake, explosion, or vibration) and determined that there is minimal risk of liquefaction at the LNG tank site and process area and a slightly greater risk at the marine terminal site. To mitigate potential liquefaction risks at its LNG terminal site Ingleside San Patricio would construct the LNG storage tanks on reinforced concrete slab foundations, the process area on a drilled-and-underreamed pier foundation system, and the marine terminal with deep pile foundations (Tolunay-Wong, 2004a, b, c).

While sediments and landforms present in the Project area have soil liquefaction potential under seismic shaking events, our analysis indicates that the low risk of seismic activity in this area minimizes the potential hazard to the Project from soil liquefaction. In addition, Ingleside San Patricio's measures to reinforce underlying soils at its LNG terminal site would further minimize the risk of liquefaction. Therefore, we conclude that soil liquefaction would not be a significant hazard for the Ingleside Energy Center LNG Project.

4.1.4.3 Diapiric Structures

Diapiric structures, or salt domes, could cause faulting, fault scarps, slumping, and the formation of shallow gas pockets, seeps, and vents. In the Gulf Coastal Plain, salt domes are primarily concentrated in two bands with the largest band extending from southeastern Texas through Louisiana and a smaller band extending from northeastern Texas across northern Louisiana and south-central Mississippi. No diapiric structures have been identified in the Project area. Therefore, we conclude that the hazards associated with these diapiric structures would not be a significant hazard for the Project.

4.1.4.4 Subsidence

Subsidence is defined as sudden sinking or gradual downward settling of land with little or no horizontal motion, caused by surface faults, and intensified or accelerated by subsurface mining or the pumping of oil, natural gas, or groundwater. There are several oil and gas fields in San Patricio County and groundwater extraction in the county is primarily for irrigation. Various degrees of subsidence have been documented along the entire Texas coast, with the most significant subsidence in the Houston-Galveston area. Subsidence is typically a concern when designing LNG storage tank foundations. However, consolidated stiff to hard clays and medium to dense sands underlie the Project area. In addition, there is no significant oil and groundwater

extraction in the vicinity of the proposed LNG terminal. We believe that subsidence would not be a significant hazard to the proposed LNG terminal or pipeline facilities.

4.1.4.5 Karst Terrain

Karst terrain develops in areas that are underlain by carbonate rocks and evaporites. Groundwater dissolution of near-surface carbonate rocks and evaporites, combined with surface weathering and erosion produces karst topography. The potential for karst is greatest where surficial deposits are less than 30 feet thick and the underlying carbonate rocks occur at a depth at or just above the water table. These conditions do not exist in the Project area; therefore, we conclude that subsidence related to karst terrain would not be a hazard for the Ingleside Energy Center LNG Project.

4.1.4.6 Slope Stability

The proposed marine basin at the LNG terminal would have a 2:1 slope and would be dredged to a minimum depth of 43 feet below MLT and a maximum depth of 44 feet below MLT. The lower portion of the slopes, between 30 and 43 feet below MLT, would be in sandy layers that would be susceptible to erosion from wheel wash and bow thrusters from the LNG ship. To minimize impacts on slope stability, Ingleside San Patricio would install erosion protection (*i.e.,* articulated concrete blocks) on the lower portion of the north slope from 5 feet below MLT to the bottom of the slope. Erosion protection would not be required on the south side of the LNG ship berth; however, if needed, other measures to protect side slopes would include installation of riprap, fabriforms, or other slope stabilization materials.

Following construction, slopes in upland portions of the LNG terminal site would be graded, seeded, and maintained in a grassy condition as part of terminal operations. The proposed pipeline would cross land that is relatively flat, with elevations ranging from 15 to 75 feet above mean sea level (msl). We conclude that slope stability would not be a significant hazard for the Ingleside Energy Center LNG Project.

4.1.4.7 Flooding/Storm Damage

The Ingleside Energy Center LNG Project would be located along the Gulf of Mexico shoreline and would be subject to coastal storms, hurricanes, flooding, and other coastal processes. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), a majority of the proposed LNG terminal site would lie within Coastal Flood Zone C; however, shoreline areas would be located in Zones V22, A16, and B. The majority of the proposed pipeline (89.4 percent) would lie within the Minimal Flood Hazard Zone (Zone C), 10.5 percent would lie within the Moderate Flood Hazard Zone (Zone B), and 0.1 percent would lie within the Special Flood Hazard Zone (Zone A or V). Table 4.1.4.7-1 includes definitions of FEMA flood hazard zone designations in the Project area.

Ingleside San Patricio designed its LNG terminal to mitigate the potential effects of flooding/storm damage. The highest forecast storm surge water level for the Ingleside area is about 11.5 ft above msl, which would be attained with a 10 mph westerly moving, Category 4 hurricane passing 30 nautical miles south of Port Aransas. Other hurricane scenarios may produce 10 to 11 ft water levels (U.S. Navy, 2005). The shoreline facilities would be designed to

withstand storm surge and flooding. The top of the dock, main processing equipment, storage tanks, and support buildings would be located in the upland areas, at an elevation 20 feet above msl.

TABLE 4.1.4.7-1

Federal Emergency Management Agency Flood Hazard Zone Designations in the Ingleside Energy Center LNG Project Area

Zone Designation	Description
Zone A	Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.
Zone A1-A30	Zones A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.
Zones B and C	Zones B and C are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No Base Flood Elevations or depths are shown within this zone.
Zone V	Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

4.2 SOILS AND SEDIMENTS

4.2.1 Soil Composition and Limitations

The Ingleside Energy Center LNG Terminal would be within the Victoria-Raymondville-Orelia soil association while the San Patricio Pipeline would cross the Victoria-Raymondville-Orelia and Orelia-Papalote soil associations. These soil associations include clay, loam, clay loam, sandy clay loam, fine sandy loam, and loamy fine sand.

Table 4.2.1-1 provides a summary of soil characteristics associated with the proposed LNG terminal and table 4.2.1-2 summarizes soil limitations associated with the proposed pipeline. Major soil characteristics and limitations are discussed below.

Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion as determined by the U.S. Secretary of Agriculture. In addition, prime farmland includes land that possesses the above characteristics but is being used currently to produce livestock and timber. Urbanized land and open water are excluded from prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (*e.g.*, using artificial drainage or irrigation).

TABLE 4.2.1-1

Soil Series Impacted by the Ingleside Energy Center LNG Terminal

Soil Series	Prime Farmland a/	Hydric Characteristics
Orelia Fine Sandy Loam	No	Not Hydric
Orelia Sandy Clay Loam	No	Not Hydric
Papalote Fine Sandy Loam, 0 - 1 % Slopes	Yes	Not Hydric
Papalote Fine Sandy Loam, 1 - 3% Slopes	Yes	Not Hydric
Raymondville Clay Loam, 0 - 1 % Slopes	Yes	Not Hydric
Raymondville Clay Loam, 1 - 3 % Slopes	Yes	Not Hydric
Victoria Clay, 0 - 1 % Slopes	Yes	Not Hydric
Victoria Clay, 1 - 3 % Slopes	Yes	Not Hydric
Victoria Clay, Depressional	No	Not Hydric

a/ Total acres of prime farmland soils affected by the LNG terminal is 60.7 (Papalote series = 2.2 acres, Raymondville series = 20.0 acres, and Victoria series 38.5 acres).

TABLE 4.2.1-2

Soils Crossed by the San Patricio Pipeline

Milepost	Soil Association	Area Affected by Construction (acres) a/	Erosion Potential	Revegetation Potential	Severe Compaction Potential	Drainage	Flooding
0.0-20.1	Victoria-Raymondville-Orelia	243.6	Medium	High to medium	Low to high	Poorly to moderately well drained	Moderate
20.1-26.4	Orelia-Papalote	76.4	Medium	High to medium	Low to high	Poorly to moderately well drained	Moderate

a/ Includes area within 100-foot-wide construction right-of-way, additional temporary workspace, and aboveground facilities.

We evaluated prime farmland where proposed permanent aboveground facilities would result in the loss of significant amounts of prime farmland. About 82 percent (60.7 acres) of the soils found on the LNG terminal site are classified as prime farmland. The San Patricio meter station would be at MP 0.0, within the LNG terminal site, and located on prime farmland soil. However, the soils at the proposed LNG terminal site are currently in industrial use, therefore loss of this acreage would not be a significant impact on prime farmland.

Three meter stations associated with the proposed pipeline would be located on prime farmland soil: the Tetco meter station at MP 12.5, the GulfTerra/CrossTex meter stations at MP 19.7, and the Kinder Morgan-Tejas meter station at MP 24.3. Operation of these aboveground facilities would result in the permanent removal of a total of 0.4 acre of prime farmland soils from agricultural use. Because the majority of soils crossed by the pipeline are considered prime farmland, there is little opportunity to avoid placement of aboveground facilities on prime farmland. Since each of the meter stations would require only from 0.1 to 0.2 acre for operation, impact at each site would be minimal. We believe the loss of 0.4 acre of prime farmland as a result of operation of the proposed meter stations would not be a significant impact.

Construction of the pipeline would impact about 234.8 acres of prime farmland soil. These impacts could include interference with agricultural drainage, mixing of topsoil and subsoil, and soil rutting and compaction. These impacts would result primarily from trench excavation and backfilling, and vehicular traffic along the construction right-of-way. Most impacts would be short-term and would not affect the potential use of prime farmland for agricultural purposes. Ingleside San Patricio would adhere to the measures contained in our Plan which are designed to minimize impact on agricultural soils.

To further mitigate potential impacts on prime farmland, Ingleside San Patricio consulted with the NRCS and has agreed to segregate and replace the top 20 inches of topsoil as a means of avoiding mixing the topsoil with subsoil with a high sodium content (high salinity). In a letter dated January 24, 2005, the NRCS indicated that it did not consider the construction of the pipeline to represent a permanent conversion of farmland, because the land could still be used. The NRCS indicated that it had reviewed the LNG terminal and aboveground interconnects along the pipeline, and completed an AD-1006 (Farmland Conversion Impact Rating) form for each. The NRCS stated that the Farmland Protection Policy Act law states that sites with a score of less than 160 will require no further consideration. All sites scored less than 160. In a March 15, 2005 letter to the FERC, commenting on the draft EIS for this Project, the NRCS indicated that it believed the pipeline and agricultural production could co-exist if the above mitigation actions are implemented. We agree.

Hydric Soils

Hydric soils are defined as "soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (FR, July 13, 1994). Soils that are artificially drained or protected from flooding (*e.g.,* by levees) are still considered hydric if the soil in its undistributed state would meet the definition of a hydric soil. These soils are typically associated with wetlands.

Hydric soils do not occur on the LNG terminal site. The San Patricio Pipeline would affect about 23 acres of soils (Edroy clay) that have hydric characteristics. Edroy clays are deep, poorly drained, nearly level soils that are generally associated with waterbodies. They have a high clay content, medium available water capacity, and very slow permeability. Ingleside San Patricio would construct the Project in accordance with our Procedures, which include provisions for wetland and waterbody crossings and special construction measures in areas of saturated soils. We believe that Ingleside San Patricio's implementation of these measures, as well as use of Best Management Practices (BMPs) during construction (*e.g.*, use of appropriate erosion and sedimentation control measures), would minimize impacts on hydric soils.

Erosion Potential

Erosion is a continuing natural process that can be accelerated by human disturbance. Factors that influence soil erosion include soil texture, structure, length and percent of slope, vegetative cover, and rainfall or wind intensity. Soils most susceptible to erosion by water are typified by bare or sparse vegetative cover, noncohesive soil particles with low infiltration rates, and moderate to steep slopes. Wind erosion processes are less affected by slope angles. Clearing, grading, and equipment movement could accelerate the erosion process, and without adequate protection could result in discharge of sediment to waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility and impair revegetation.

The LNG terminal site is currently well vegetated and nearly level and the potential for erosion of soils and discharge of sediments off site would be relatively low during construction. Since Ingleside San Patricio has adopted our Plan and Procedures for erosion and sedimentation control during construction, these concerns would be minimal.

Along the San Patricio Pipeline, soils with a slope of two percent or more may exhibit erosion potential. During pipeline construction, Ingleside San Patricio would use erosion control structures, temporary seeding and revegetation, and erosion control fabric in accordance with our Plan and Procedures. For waterbody crossings, Ingleside San Patricio would use the waterbody crossing methods contained in our Procedures and erosion and sedimentation control practices specified in our Plan. These erosion control measures include the installation of slope breakers and sediment barriers such as silt fence or hay bales, the use of mulch and erosion control fabrics, and restoration within 20 days of backfilling the trench, weather permitting. We conclude that implementation of these measures would minimize overall soil erosion that could result from construction of the Project.

Revegetation Potential

Successful restoration and revegetation in areas that are not permanently developed is important to maintain ecosystem productivity and to protect underlying soil from potential damage, such as erosion. Soils on the LNG terminal site are currently well vegetated and no soils along the pipeline route were identified which have a low potential for revegetation. None of these areas are predicted to have a low revegetation potential following construction of the Ingleside Energy Center LNG Project. Areas where aboveground facilities would be built would not be revegetated. This would encompass about 74 acres at the LNG terminal, including roads. The aboveground facilities along the pipeline would cover about 1.0 acre.

Ingleside San Patricio would implement the requirements in our Plan for revegetation of disturbed areas. These measures include compensation or restoration of all turf, ornamental shrubs, and specialized landscaping at the landowners request and addition of fertilizers and soil pH modifiers and seedbed preparation or seeding at the local soil conservation authority, land management agency, or landowners request. Ingleside San Patricio indicated it would seed disturbed areas using mixtures recommended in the NRCS soil survey for San Patricio County. We conclude that if revegetation is conducted in accordance with these measures, areas disturbed by construction would be successfully revegetated. See section 4.4.2 of this EIS for further information on revegetation.

Compaction Potential

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of the soil. The degree of compaction is dependent on moisture content and soil texture. Fine-textured soils with poor internal drainage are the most susceptible to compaction. Construction equipment traveling over wet soils could disrupt soil structure, reduce pore space, increase runoff potential, and cause rutting. Compaction and rutting impacts would be more likely to occur when soils are moist or saturated.

The LNG terminal may have the potential to experience some level of compaction; however, the potential impacts associated with compaction on the LNG terminal site would be minimal given that the site would be highly developed. The San Patricio Pipeline would cross about 0.7 mile of

soils with high compaction potential; however, based on soil texture and drainage characteristic, essentially all of the soils that would be disturbed by pipeline construction activities have the potential to experience some level of compaction.

Ingleside San Patricio would mitigate for potential compaction in agricultural areas by following measures contained in our Plan. Mitigation for soil compaction would include topsoil segregation and deep tillage operations using a paraplow or similar implement. In addition, Ingleside San Patricio intends to construct the pipeline during the dry season thereby minimizing the potential to compact moist or saturated soils. We believe that use of these measures during construction would minimize soil compaction resulting from construction of the proposed Project.

4.2.2 Contaminated Soils

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination would typically be minor because of the low frequency of spills and leaks. Ingleside San Patricio would develop and implement a SPCC Plan. The SPCC Plan would describe spill prevention practices, spill handling and emergency notification procedures, and training requirements and address steps that would be taken should soil contamination be encountered, cleanup procedures, and reporting guidelines.

Ingleside San Patricio conducted a hazardous material environmental data search of the TCEQ and EPA Superfund databases and identified no known hazardous sites within 0.25 mile of the proposed pipeline. The LNG terminal site would be adjacent to the Occidental Chemical manufacturing facility. Ingleside San Patricio sampled five upland locations at the site and tested the soils for total organic carbon, metals, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), pesticides, and polycyclic biphenyls. An additional six composite samples were collected from the maneuvering basin and Occidental Chemical's existing loading dock. The results of the analyses revealed that few compounds were detected and did not exceed regulatory limits set by the state. However, in the event that a hazardous waste site is encountered during project construction, Ingleside San Patricio would stop work in the immediate area and implement the emergency procedures identified in its SPCC Plan and per TCEQ rules and regulations. Ingleside San Patricio would not allow construction to continue in the area until the issues have been resolved in compliance with applicable TCEQ and/or EPA rules and regulations.

4.2.3 Shoreline Erosion

The shoreline along the Gulf Coast exists in various states of erosion, accretion, or equilibrium. These processes are dynamic and vary with time as well as location. In 1976, Brown *et al.* found that in the Corpus Christi area, most of the shoreline along the gulf side of the barrier islands was in depositional-erosional equilibrium; however, the shoreline on either side of Aransas Pass was in depositional mode. Protected from the Gulf of Mexico waves and currents by barrier islands, Corpus Christi Bay itself was undergoing moderate deposition.

A portion of the shoreline within the proposed LNG terminal site would be modified by excavating and dredging of the proposed LNG ship berth. The shoreline of the berth area would be protected from erosion by constructing the side slopes at a 2:1 slope and installing erosion

controls such as articulated concrete blocks or other slope stabilization materials. In addition, Ingleside San Patricio would monitor shoreline erosion by using bathymetric and side scan surveys.

The EIS prepared for the Channel Improvements Project (COE, 2003) evaluated the potential for ship traffic resulting from the channel improvements to contribute to shoreline erosion in Corpus Christi Bay. The report concluded that the main factors currently contributing to shoreline erosion in this area were wind-generated waves and sea level rise. While the additional ship traffic resulting from ship channel improvements would slightly increase shoreline erosion, these effects would probably not be detectable compared with the existing erosion. The EIS also concluded that the greatest impacts would occur at the shorelines that support little to no vegetation.

The City of Port Aransas, in its comments on Ingleside San Patricio's Project, and the proposed Vista del Sol LNG Project, indicated that LNG ships passing through the channel within its city limits could contribute to its ongoing problem of shoreline erosion. The City of Port Aransas also stated that the LNG companies proposing facilities in the Corpus Christi Bay area "are aware of this problem and are willing to look at ways they can participate in the solution."

In our recent analysis of the Cheniere Corpus Christi LNG Project, we recognized that there is a potential for LNG ship movements to cause shoreline erosion and that this impact is dependant on a number of factors, including number of ships; ship size, hull shape, speed, and draft; propeller action; and proximity to shore (FERC, 2004).

LNG ship traffic and frequency of passage is discussed in detail in section 4.9.2 of this EIS. Up to 140 ships would call on the proposed LNG terminal per year, which on average would be a frequency of one vessel movement inward and one vessel movement outward through the Corpus Christi and La Quinta Channels two to three times per week. This would represent a 3.5 percent increase over existing large vessel traffic in the channels. Given the current volume of large ship traffic in the channels, the additional incremental ship traffic resulting from operation of the Ingleside Energy Center LNG Terminal is not expected to substantially increase shoreline erosion.

The City of Port Aransas has partnered with the TGLO and the PCCA to construct concrete bulkheads that would protect about up to 6,000 linear feet of shoreline along the Corpus Christi Ship Channel. The City of Port Aransas intends to seek additional funding over the next five to 10 years to address shoreline erosion issues. Ingleside San Patricio has stated that it would participate in this endeavor through the Port Industries of Corpus Christi, of which it is a member. **We recommend that:**

- **Prior to construction of the LNG terminal, Ingleside San Patricio should file with the Secretary details of its coordination with the City of Port Aransas, or other entities, regarding its planned or potential assistance with ongoing or future shoreline protection efforts.**

4.2.4 Sediments

The sediments that would be affected by the Ingleside Energy Center LNG Project are located within the proposed marine terminal basin. Dredging to an elevation of -43 feet MLT would remove about 3,084,700 cubic yards of material. Of this amount, about 1,719,400 cubic yards of material would be removed for the LNG ship berth and 1,365,300 cubic yards of material would be dredged for the maneuvering area. An additional 550,300 cubic yards of material would be removed for the relocation of Occidental Chemical's existing loading dock (see section 2.10.1 of this EIS).

Ingleside San Patricio conducted a geotechnical investigation of the sediments that would be dredged using a continuous Cone Penetration Test (CPT) (Tolunay-Wong, 2004c). The sampling and physical testing was done in accordance with standard methods published by the American Society of Testing Materials (ASTM). The characteristics of subsurface stratigraphy within the LNG ship berth and maneuvering area are summarized below.

<u>LNG Ship Berth</u>

Field investigations of the upland location for the proposed LNG ship berth area revealed that one to 10 feet of compacted fill has been placed in this area, with deepest fill thickness near the shoreline. The fill material consists of cohesive fat clays, fat clays with sand and lean clays. Sandy lean clay samples recovered from 6 to 8 feet depth interval showed a liquid limit of 39 percent, and plasticity index of 24. In situ moisture content was three percentage points wet of corresponding plastic limit and the total unit weight was 128 pounds per cubic foot. The undrained shear strengths are generally in increasing trend with depth, typical of the Beaumont Formation soils. The undrained shear strength values were in a range of 1,000 pounds per square foot (psf) to 4,500 psf within the upper 10 feet, 1,500 psf to 3,000 psf at depths of 10 to 20 feet, and 2,500 psf and higher below 20 feet. The clay sediment is over-consolidated, which is typical for clays in the Beaumont Formation, and is formed by cyclical moisture content changes after deposition and cementing of the minerals along grain contacts.

The subsurface stratigraphy of the LNG ship berth consists of about one to 10 feet of compacted clay fill, with most fill thickness between 1 to 2 feet. Layers of natural stiff to hard clays interbedded with medium dense to very dense clayey sands, and to a lesser extent poorly graded sands with silt, occur to depths of 60 to 160 feet. The soils exposed at the bottom of the proposed dredging elevation of -43 feet MLT, are predominately sands and silts. The CPT records show frequent interbedded partings and thin layers within the cohesive soil layers typically below 30 to 35 feet depths. Several of the recovered cohesive samples were slicken sided with shell fragments, and calcareous and ferrous nodules which are the features of typical Beaumont clays.

<u>Maneuvering Area</u>

The proposed maneuvering area contains predominately stiff to very stiff fat and lean clays and sandy clays with zones of medium dense to dense silty and clayey sands. The proposed dredge slope would be predominately in lean clays, sandy clays and fat clays, which are stiff to hard in characteristics. More sandy zones including clayey sands and silty sands are expected at or slightly below the toe of the dredge slope at elevation -43 feet MLT.

Sediments near the surface in urban environments may be contaminated by release of various chemicals from human activities along the shoreline. 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. In addition, three sediment cores were taken and analyzed for metals. In the COE's EIS, the data were compared to one type of Sediment Quality Guidelines, known as the effects range low (ERL), as provided in the NOAA Screening Quick Reference Tables (Buchman, 1999). The chemical concentrations ranking in the lowest 10 percent were defined as the ERL, and it represents an estimate of chemical concentration below which no effects on the marine ecology have been observed. These are conservative levels used to identify sediment that may require additional evaluations before decisions on disposal or beneficial re-use are made.

The COE tested sediments of La Quinta Channel in 1985, 1990, and 2000. In the 1985 samples, 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. Samples from the same stations were tested in 1990 and 2000, and all metals were below the ERL levels. The samples taken in 1985 were analyzed for polychlorinated biphenyls (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.

4.3 WATER RESOURCES

4.3.1 Groundwater

The Ingleside Energy Center LNG Project area is underlain by the Gulf Coast aquifer, characterized as an unconfined aquifer with unconsolidated sand, silt, and clay deposits. The lithology of the Gulf Coast aquifer system reflects three depositional environments: continental (alluvial plan), transitional (delta, lagoon, and beach), and marine (continental shelf). Numerous retreats and advances of ancient shorelines have resulted in a complex, overlapping mixture of sand, silt, and clay (Ryder, 1996). The sequence is generally wedge-shaped and thickens towards the Gulf of Mexico, where it is thousands of feet thick. In San Patricio and Nueces Counties, the primary water-bearing stratigraphic units are the Pliocene Goliad Sand, the Pleistocene Lissie and Beaumont Formations, and Holocene alluvial and beach sands in the Nueces River valley (Shafer, 1968).

The Chicot and Evangeline aquifers are commonly used hydrogeologic unit designations for subdivisions of the upper, mostly sandy portion of the Gulf Coast deposits. Water supply wells in southeastern San Patricio County are completed in the Chicot aquifer at depths typically less than 50 feet deep. Groundwater in the county is mainly used for irrigation. However, its use is limited by high chloride, salinity, and alkalinity in the groundwater.

The EPA has not designated the Gulf Coast aquifer as a sole source aquifer. The Project crosses no locally zoned aquifer protection areas.

Blasting is not anticipated by Ingleside San Patricio. No public or private water supply wells are located within 150 feet of the proposed Project and no wellhead protection areas (also known as source water protection areas) would be crossed by the Project. Most municipal water systems in

San Patricio and Nueces Counties obtain water from Lake Corpus Christi and the Nueces River/Choke Canyon Reservoir (about 40 and 75 miles northwest of the Project area, respectively) and Lake Texana (about 88 miles northeast of the Project area) (TCEQ, 2003).

Some dewatering may occur in areas of the LNG terminal during construction; however, relatively small volumes would be expected and effects on the overall groundwater system would be small and temporary. Ingleside San Patricio's geotechnical consultant reported that static groundwater in its subsurface borings at the LNG storage tank locations was between 5.2 and 6.5 feet below existing grade. Groundwater at the process and pipe rack area was between 13 and 30 feet below existing grade (Tolunay-Wong, 2004a, b).

Shallow aquifers with a water table less than 10 feet in depth may be encountered along the San Patricio Pipeline. If shallow groundwater is encountered during excavations, it may be necessary to dewater during construction. Trench dewatering operations would be brief, typically lasting several days or less. Potential impacts on the groundwater would include minor fluctuations in groundwater levels and/or increased turbidity within the aquifer adjacent to the activity. Because of the relatively small amount of water removed, the short duration of the activity, and the local discharge of the water, groundwater levels would quickly recover after pumping stops. Ingleside San Patricio would follow our Plan and Procedures that provide guidance on the location of dewatering structures so that there would be no deposition of sediments into wetlands and waterbodies, and no impacts on cultural resources or habitat for sensitive species. We believe that effects of dewatering on groundwater and other environmental resources would be localized, temporary, and insignificant.

The greatest potential for impacts on groundwater would be an accidental release of a hazardous substance, such as fuels, lubricants, and coolants, during construction or operation. Ingleside San Patricio has agreed to implement our Procedures, which include the preparation and implementation of Spill Prevention and Response Procedures that meet state and federal requirements. Ingleside San Patricio would be required to develop an SPCC Plan that would be implemented during construction of the facilities. The SPCC Plan must address potential spills of fuel, lubricants, and other hazardous materials and describe spill prevention practices, spill handling and emergency notification procedures, and training requirements. It must also describe mitigation measures, including containment and cleanup, to minimize potential impacts should a spill occur. Prior to construction, Ingleside San Patricio would file this plan with the Secretary for the review and approval of the Director of OEP. Implementation of Ingleside San Patricio's SPCC Plans would minimize or eliminate the potential for adverse impacts on groundwater resources.

Although Ingleside San Patricio's SPCC Plan would include measures that would be taken should a spill occur in onshore areas within the LNG terminal site, there are no procedures specified for spills that could occur in waters of Corpus Christi Bay during construction of the marine terminal. Therefore, **we recommend that:**

- **Ingleside San Patricio develop an Offshore SPCC Plan to include procedures that would be implemented should spills of oil, gas, lubricants, or other hazardous materials occur during construction and operation of the marine terminal. In addition to addressing emergency spill response and clean-up procedures, this plan should include a description of general spill prevention measures such as material**

handling practices, personnel training, and inspection. The offshore SPCC Plan should be filed with the Secretary for review and approval by the Director of OEP prior to the start of site preparation at the LNG terminal.

4.3.2 Surface Water

4.3.2.1 Marine Water

The LNG terminal would be located on the northeast shoreline of Corpus Christi Bay along the La Quinta Channel, west of Ingleside. Corpus Christi Bay is included in the National Estuary Program, with a designation as an estuary of "national significance." The entire estuary system encompasses more than 25 smaller bays, including Nueces Bay north of the City of Corpus Christi and Redfish Bay east of the City of Ingleside, and numerous saltwater bayous. Corpus Christi Bay is approximately 75-miles-long and covers about 600 square miles, extending from the brackish Aransas and Copano Bays at its northern boundary to Baffin Bay and the hypersaline Upper Laguna Madre at its southern boundary. Barrier islands, such as Mustang Island and Padre Island, separate Corpus Christi Bay from the Gulf of Mexico. The entire Corpus Christi Bay system covers 124,796 acres, with 127 miles of shoreline. The average depth of the bays within the system ranges from three to 11 feet (American Oceans Campaign, 1996).

The Corpus Christi Ship Channel extends for 36 miles from Port Aransas to the Port of Corpus Christi. The Corpus Christi and La Quinta Ship Channels have been dredged to a depth of 45 feet. In addition, the Gulf Intracoastal Water Way (GIWW) through Corpus Christi Bay has been dredged to a depth of 12 feet.

Corpus Christi Bay drains a semi-arid watershed encompassing about 11,000 square miles of land. The average annual rainfall on the bay varies from 24 to 36 inches; and its annual surface evaporation rate is 60 inches. The system's primary sources of freshwater are the San Antonio, Mission, Aransas, and Nueces Rivers. It is estimated that the Nueces River and Oso Creek contribute about 314,000-acre feet of fresh water into Corpus Christi Bay in an average year. In recent years, freshwater inflows have declined due to increasing diversions and demands by municipalities, industries, farmers, and other residents, resulting in increased water salinity levels in the bay.

Wind speeds in the bay are high, while tidal currents are relatively weak. As a result, the bay can have high ambient suspended solid concentrations. A COE seagrass study in Laguna Madre (just south of Corpus Christi Bay) modeled the relative contribution of dredging and wind in resuspending sediments. The study concluded that wind-caused waves are the most important factor for sediment resuspension in that part of Corpus Christi Bay (COE, 2000).

All designated uses of the Corpus Christi Bay are fully supported (TCEQ, 2002). Nevertheless, water quality issues affecting the bay include reduced inflow of fresh water; wetland habitat loss; chemical, heavy metal, and nutrient increases; brown tide; and floating debris (American Oceans Campaign, 1996).

The primary impacts on Corpus Christi Bay from construction and operation of the Project would be from dredging for the LNG terminal marine basin and from stormwater runoff. There is also the potential for impacts on the bay from accidental spills of hazardous materials during

construction, or LNG spills during operation. In addition, Ingleside San Patricio would withdraw about 420,000 gallons of seawater weekly during its testing of the firewater system. The water would be discharged back into the pump suction area adjacent to suction screens at a rate of 14,000 gpm.

Approximately 40 acres would be affected by the proposed dredging of the maneuvering area while 19 acres would be affected by proposed excavation and dredging of the LNG ship berth. Ingleside San Patricio would use hydraulic dredging to remove sediment to create the necessary depth at the maneuvering area and marine terminal basin. In order for a hydraulic dredge to move sediment, a large volume of water must be added to make a slurry that can be pumped. The volume of water is typically four to eight times the in-place volume of sediment removed, so that about 800 to 1,600 gallons of water are added for each cubic yard of sediment dredged. The dredged material slurry would be pumped into Alcoa tailing ponds, Ingleside San Patricio's preferred DMPA. The dredged material would be pumped via submerged disposal lines approximately 3.8 miles long. The sediment particles would settle by gravity to the bottom of the disposal areas and be separated from the overlying water (called return water). This return water would then flow back to Corpus Christi Bay via existing DMPA drainage ways or county drainage canals. Further details on Ingleside San Patricio's proposed dredging are described in section 2.2.1.1 of this EIS.

The primary impact on water quality from dredging would be a temporary increase in suspended solids in the water around the dredged area. Although cutterhead suction dredges capture the majority of sediment loosened by the dredge, there are some sediment particles that become suspended in the water.

The water that is separated from the sediment would contain some fine-grained sediment particles that would not settle out but would remain in suspension. Ingleside San Patricio indicates that most of the material at the proposed maneuvering basin between elevation 0.0 and -37 feet consists of fat and lean clays, lean sandy clays, and stiff lean and fat sandy clays (62 percent of sandy clay passes through a -200 sieve at -35.0 feet). Below -37 feet, most of the material consists of silty sand and clayey sand (41 and 39 percent of silty sand passes through a -200 sieve at -38.5 and -43.0 feet, respectively while 70 percent of clayey sand passes through a -200 sieve at -37.0 feet) (Tolunay-Wong, 2004d). At the LNG ship berth most of the material above elevation -10.0 feet consists of compacted clay fill. Below -10 feet most of the material consists of fat clays with sand, lean clay, sandy lean clay, and silty clays interbedded with clayey and silty sands and some poorly graded sand with silt (37, 47, and 39 percent of clayey sand passes through a -200 sieve at -43.0, -18.0, and -63.0, respectively; 52 percent of sandy lean clay passes through a -200 sieve at -18.0 feet, and 14 percent of silty san passes through a -200 sieve at -27.0 feet) (Tolunay-Wong, 2004c).

Ingleside San Patricio indicated that turbidity caused by a cutterhead dredge would be relatively minor and limited to the lower portion of the water column. The fine silt and clay particles that would be resuspended as a result of dredging would wash out of the channel before settling. Ingleside San Patricio would use BMPs during dredging, including adjusting cutterhead rotational speed and hydraulic pump operating parameters, and the use of turbidity curtains to entrain the maximum amount of material and minimize turbidity. See section 4.41 for further information on potential turbidity and its impacts on adjacent seagrass beds.

Ingleside San Patricio would be required to obtain several permits that would address dredging and dredged material management, including permits from the COE under Section 404 of the CWA and Section 10 of the Rivers and Harbor Act. Permits for water discharges into the bay from the LNG terminal would be obtained from the EPA and/or the TRRC under Section 401 of the CWA. A National Pollutant Discharge Elimination System (NPDES) permit under Section 402 of the CWA issued by the TRRC would be necessary to regulate return water emanating from the DMPAs. Typically, such permits would establish limits on the concentration and area of suspended solids during dredging, and would likely require monitoring during dredging and establish criteria for maximum suspended sediment concentrations allowed in the return water.

The COE's EIS for its proposed Corpus Christi ship channel improvements addressed potential impacts on water quality from dredging an extension of La Quinta Channel. The EIS evaluated historical data on a number of contaminants found in sediments, dredge maintenance material, and water quality samples. The COE concluded that, overall, there is no indication of current water quality problems in the La Quinta Channel, or problems that would result from dredging to extend the La Quinta Channel (COE, 2003). Ingleside San Patricio reported that lab analysis of composite soil and groundwater samples collected from several geotechnical boring locations did not identify any issues or exceedance of COE dredge parameter levels and therefore meet the COE definition of "clean" dredge material. Ingleside San Patricio would submit the sampling information and lab results as part of its COE permit application for review and approval.

Operational impacts of the LNG terminal on marine waters would include periodic maintenance dredging of the maneuvering area and marine terminal basin, as well as propeller wash from the LNG ship traffic in La Quinta Channel. Based on the operating history of Occidental Chemical existing loading dock, Ingleside San Patricio expects maintenance dredging to be required about every 10 to 12 years. Comparatively, COE performs maintenance dredging of La Quinta Channel every three to five years. Both maintenance dredging and propeller could result in increased turbidity in the bay from the resuspension of bottom sediments. The marine terminal basin would include erosion protection (*i.e.,* articulated concrete blocks) placed on the lower portion of the north slope from 5 feet below MLT to the bottom of the slope to stabilize the shoreline and prevent erosion from wave action and wheel wash and bow thrusters from the LNG ship wash. We believe that turbidity caused by maintenance dredging using a hydraulic cutterhead dredge would be short-term, localized, and not significant. Maintenance dredging should not add appreciably to on-going maintenance dredging activities in La Quinta Channel. Ingleside San Patricio anticipates that materials generated during maintenance dredging would be pumped to Alcoa's tailing ponds, if they are still available, or another permitted disposal area.

During site preparation and construction at the LNG terminal site, disturbed soils would be exposed to erosion. To minimize erosion impacts on surface waters, Ingleside San Patricio would comply with the Texas Pollutant Discharge Elimination System, Construction General Permit for stormwater discharges during construction. This would include preparation and implementation of a Stormwater Pollution Prevention Plan and Erosion and Sedimentation Control Plan. Stormwater collected at the LNG terminal site would be discharged through Occidental Chemical's existing stormwater system. Stormwater removal from within the LNG storage tank dikes must conform to 49 CFR 193.2173, requiring water to be pumped out at 25 percent of the maximum predictable collection rate from a storm of 10-year frequency and

1-hour duration. Water removed would be discharged in the vicinity of the removal area via overland flow to reduce sedimentation. Ingleside San Patricio would implement our Procedures in addition to its Stormwater Pollution Prevention Plan. Ingleside San Patricio indicated it would consult with the EPA and TCEQ to determine if amendments to Occidental Chemical's existing stormwater permits would be required for stormwater discharges from its LNG terminal.

Occidental Chemical would provide potable water supplies to the LNG terminal site and sanitary wastewater would be pumped and treated at its existing sewage treatment system.

In the event of an accidental spill of oil, gas, lubricants, or other hazardous materials during construction or operation, Ingleside San Patricio would follow the measures outlined in its SPCC Plan. In addition, LNG vessels calling at the LNG terminal would be required to have a vessel response plan that satisfies Coast Guard requirements and applicable international standards.

Ingleside San Patricio has designed its LNG terminal to account for an accidental spill of LNG during operation of the facility, and prevent the LNG from entering Corpus Christi Bay. The LNG facilities would include safety and hazard detection systems, two LNG impoundment sumps and associated LNG spill collection system. In the unlikely event that LNG is spilled into the water, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water. Being less dense than water, LNG would float on the surface prior to vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water.

4.3.2.2 Fresh Water

No natural fresh water ponds, lakes, or streams occur on or adjacent to the LNG terminal site. Twelve constructed storm drainage ditches and an approximate 2-acre fire water make-up pond are located on the LNG terminal site (see table 4.3.2.2-1). Only one drainage ditch would be temporarily impacted due to construction activities for the LNG storage tanks, but would be restored to pre-construction conditions. All remaining waterbodies are located outside of proposed construction areas and would not be affected by the Project.

Fresh water for this project would be obtained from the Occidental Chemical manufacturing complex via above- and below- ground piping. The San Patricio Water District supplies a majority of the fresh water used at this facility.

Ingleside San Patricio would use the STV technology to vaporize the LNG. Heated wastewater from Occidental Chemical's and/or ICLP's cooling water system would provide a source of heat for the LNG vaporization process. As the heated wastewater circulates over the STV, it would be cooled by the LNG and returned to the Occidental Chemical and/or Ingleside Cogeneration facility for reuse. This process would conserve about two million gallons of water per day (see section 2.2.1.5).

TABLE 4.3.2.2-1 **Waterbodies Near the Ingleside Energy Center LNG Terminal**				
Waterbody	**Waterbody Type**	**State Water Quality Classification**	**Fishery Type**	**Width (feet)**
SF-1A-SP-001	On-site Ditch	Not Applicable	Not Applicable	15
SF-1A-SP-002	On-site Ditch	Not Applicable	Not Applicable	8
SF-1A-SP-003	On-site Ditch	Not Applicable	Not Applicable	10
SF-1A-SP-004	On-site Ditch	Not Applicable	Not Applicable	Pond
SF-1A-SP-005	On-site Ditch	Not Applicable	Not Applicable	2
SF-1A-SP-006	On-site Ditch	Not Applicable	Not Applicable	1
SF-1A-SP-007	On-site Ditch	Not Applicable	Not Applicable	1
SF-1A-SP-008	On-site Ditch	Not Applicable	Not Applicable	2
SF-1A-SP-009	On-site Ditch	Not Applicable	Not Applicable	9
SF-1A-SP-0010	On-site Ditch	Not Applicable	Not Applicable	15
SF-1A-SP-0011	On-site Ditch	Not Applicable	Not Applicable	2
SF-1A-SP-0012	On-site Ditch	Not Applicable	Not Applicable	2
SF-Pond-001	Freshwater Pond	Not Applicable	Not Applicable	Not Applicable
La Quinta Channel	Estuary	CR, AL, FC, OW, GU a/	Estuarine and Saltwater	2,100

a/ CR = Contact Recreation, AL = Aquatic Life, FC = Fish Consumption, OW = Oyster Waters, GU = General Use.

The proposed San Patricio Pipeline would cross 12 surface waterbodies. No waterbody segments that would be crossed by the pipeline are included on the list of impaired waterbodies under Section 303(d) of the CWA or have concerns resulting from contaminated sediments. Table 4.3.2.2-2 provides a list of the waterbodies crossed by the proposed pipeline, including location by MP, waterbody name, type, crossing width, water quality classification, fishery type, and proposed crossing method. Only two natural, permanently flowing streams would be crossed by the pipeline: Oliver Creek (MP 20.0) and Chiltipin Creek (MP 21.2).

Ingleside San Patricio would cross 9 of the 12 waterbodies using the HDD crossing method. The HDD method involves boring a pilot hole beneath the waterbody to the opposite bank and then enlarging the hole with one or more passes of a reamer until the hole is the necessary diameter. A prefabricated pipe segment is then pulled through the hole to complete the crossing.

We received a comment from Naismith Engineering, Inc., on behalf of the San Patricio County Drainage District (SPCDD) regarding concerns about its ability to construct and maintain future drainage and flood control projects in the county following pipeline installation across drainage canals. Ingleside San Patricio met with Naismith Engineering, Inc. to discuss SPCDD concerns. Given Ingleside San Patricio's plans to HDD all the drainage canals and bury the pipeline a minimum of 10 feet below the bottom of the ditch, no impacts are expected to existing county drainage and flood control structures. Naismith Engineering, Inc, indicated that the depth of the pipeline would provide sufficient clearance for maintenance and future expansion of the drainages.

TABLE 4.3.2.2-2

Waterbodies Crossed by the Ingleside San Patricio Pipeline

Milepost a/	Waterbody	Type b/	Crossing Width (feet)	State Water Quality Classification	Fishery Type	Crossing Method
8.9	Canal c/	P	<50	Not Available	Warmwater	HDD
9.2	Canal c/	P	<50	Not Available	Warmwater	HDD
10.0	Roadside Drainage Ditch	I	<10	Not Available	Warmwater	Bore/Open Cut
11.1	Canal	P	6	Not Available	Warmwater	Bore/HDD
12.9	Canal	P	8	Not Available	Warmwater	HDD
13.3	Canal	P	8	Not Available	Warmwater	HDD
14.2	Roadside Drainage Ditch	I	<10	Not Available	Warmwater	Bore/Open Cut
15.6	Roadside Drainage Ditch	I	<10	Not Available	Warmwater	Bore/Open Cut
16.3	Canal	P	30	Not Available	Warmwater	HDD
17.7	Canal	P	30	Not Available	Warmwater	HDD
20.0	Oliver Creek	P	30	Aquatic Life	Warmwater	HDD
21.2	Chiltipin Creek	P	35	Aquatic Life	Warmwater	HDD

a/ Milepost at canal/creek centerline.
b/ Waterbody type: P=Perennial, I = Intermittent.
c/ Canal identified from aerial photographs; field verification has not been completed.

A successful drill generally results in no impact on the waterbody being crossed. For this reason, directional drilling is considered to be a preferred crossing method for waterbodies, especially those that are sensitive. However, there are certain impacts that could occur as a result of the drilling, such as inadvertent release of drilling mud. This could occur in the area of the mud pits or tanks, or along the path of the drill due to unfavorable ground conditions. Drilling mud is most often comprised of naturally occurring materials, such as bentonite, which in small quantities would not be detrimental to vegetation, fish, or wildlife. In larger quantities, the release of drilling mud into a waterbody could affect fisheries and vegetation; although impacts would be significantly less than those associated with an open-cut crossing. Ingleside San Patricio would submit a project-specific HDD contingency plan that addresses the inadvertent release of drilling mud into the waterbody, how the abandoned drill hole would be sealed, notification of downstream users, and cleanup measures for inadvertent releases.

Ingleside San Patricio has not yet conducted geotechnical investigations of all of the waterbodies that would by directionally drilled. These investigations must be conducted to determine the feasibility of completing directional drills at these waterbody crossings. Once survey permission has been granted by the landowners, and the geotechnical investigations are completed, Ingleside San Patricio would prepare final site-specific drilling plans. In the event that an HDD of a waterbody is unsuccessful, Ingleside San Patricio would install the crossings using the open-cut method. Ingleside San Patricio would file its final SPCC and HDD Contingency Plan approximately one year prior to commencement of construction of the pipeline.

The three waterbodies that would be affected by the proposed project are intermittent roadside ditches. These waterbodies would be crossed by the bore/open cut method. It is possible that no

flow would be present during construction across these waterbodies, in which case crossing by the bore/open cut method would have minimal impact on the waterbody. If flow were present in these waterbodies, Ingleside San Patricio would complete most instream work within 24 hours (for streams less than 10 feet across) or within 48 hours (for streams greater than 10 feet across). Trench spoils would be stored at least 10 feet from the water's edge and would have erosion and sedimentation controls installed. Stream banks would be stabilized and temporary sedimentation barriers installed across the right-of-way within 24 hours of completing instream construction. Therefore, most impacts would be temporary and suspended sediment concentrations and turbidity levels would be expected to return to preconstruction levels soon after construction in each stream was completed.

Stormwater from areas disturbed during construction would be discharged under a General Construction Permit, which Ingleside San Patricio would obtain from the EPA under the NPDES program. In addition, Ingleside San Patricio would obtain a Section 10 permit from the COE for work in navigable waterways and a Section 404 permit for placement of dredged or fill material into all waters of the U.S., including wetlands. A wastewater discharge permit would be obtained from the TCEQ.

In response to past concerns raised by federal, state, and local agencies regarding the potential impact of construction of pipeline projects in general, we developed our Procedures to provide guidelines for an acceptable level of protection for wetlands and waterbodies affected by pipeline projects. Our Procedures include requirements for pre-construction planning, environmental inspection, construction methods, sediment and erosion control, restoration, and post-construction maintenance. It includes provisions to handle stormwater and protection of waterbodies and wetlands from accidental spills of fuels or hazardous materials. Ingleside San Patricio proposes to cross all waterbodies in accordance with our Procedures. We believe that using the measures detailed in our Procedures would minimize impacts on water resources.

Lubricant, hydraulic fluid, and fuel spills from refueling construction equipment, fuel storage, or equipment failure in or near a waterbody could flow or migrate to the waterbody and immediately affect aquatic resources and contaminate the waterbody downstream of the release point. Ingleside San Patricio would follow the measures that would be outlined in its SPCC Plan to minimize the potential impacts of spills of hazardous materials during construction in waterbodies.

4.3.2.3 Hydrostatic Testing

Prior to being placed into service, the proposed LNG storage tanks and pipeline would be hydrostatically tested to ensure structural integrity. Hydrostatic testing procedures for the LNG storage tanks and pipeline are discussed below.

LNG Storage Tanks

Once construction is completed, the inner tanks of the two LNG storage tanks would be hydrostatically tested, in accordance with API 620, Appendix Q.8 (see section 2.4.1.4). Hydrostatic testing of each tank would involve filling the inner tank with approximately 28 million gallons of water. At the maximum level calculated, the water would be maintained for at least 48 hours for inspection. After testing, the tanks would be cleaned with fresh water

and dried. Test water would be obtained either from the local water district and provided through the Occidental Chemical manufacturing complex or from the La Quinta channel. No chemicals would be added to the hydrostatic test water before or after testing. Prior to discharge, all test water would be analyzed for chemical composition and dissolved oxygen would be restored.

Pumps in each tank would control the discharge rate of the test water. Fresh water would be discharged at a rate of approximately 2,000 to 3,000 gpm into the existing surface drainage system, through the DuPont outfall in compliance with DuPont's Stormwater Discharge Permit. If salt water is used, the water would be discharged back into the La Quinta channel. Energy dissipation devices, such as a splash plate or hay bale structure, would be used during discharge of hydrostatic water in accordance with our Procedures to prevent scouring and erosion.

Pipeline

Prior to being placed into service, the LNG transfer lines and the 26-inch-diameter pipeline would also be hydrostatically tested to DOT standards, as listed in 49 CFR 192. The pipeline would be tested in one segment, using approximately 3.5 million gallons of water for the entire pipeline. The sections of pipe that were installed using the HDD method would be tested separately to ensure the integrity of the HDD segment. Of the 3.5 million gallons, about 246,784 gallons would be used to test the HDD segments. Temporary manifolds and pumping systems would be used to withdraw water. Water would be pushed from one segment to another by connecting piping at the manifold sites as each test segment is filled sequentially. The pipeline segments would be pressurized to the design test pressure and the pressure would be maintained for a minimum of eight hours. If during the test period any leaks are detected, the leaks would be repaired and the test section re-pressurized until the DOT specifications are met. The test water would be obtained from Occidental Chemical's existing firewater system. After testing is completed, the water would be discharged to either an upland area or directly to a waterbody in accordance with the FERC Procedures and permits issued by the EPA and appropriate state agencies. Ingleside San Patricio may also discharge water into Occidental Chemical's existing stormwater system.

Ingleside San Patricio would uses appropriate energy dissipation and erosion control measures to prevent scouring during dewatering.

Discharge of hydrostatic test water used to test the integrity of oil and gas facilities requires permitting from the TRRC, as regulated by the Texas Administrative Code (TAC) Title 16, Part 1, Chapter 3, Rule 3.30 Memorandum of Understanding Between the TRRC and the TCEQ under Section (e)(6)(A). In addition, hydrostatic test waters that fall under the jurisdiction of the TRRC and that would be discharged into waters of the state would require a permit from the EPA under the NPDES, as regulated by the CWA. The appropriate Section 401 Water Quality Certification and Section 404 permit must also be obtained prior to discharge of hydrostatic test water into surface waterbodies. Compliance with requirements of our Plan and Procedures, and with permitting requirements from EPA and state and local agencies would minimize impacts resulting from the discharge of hydrostatic test water.

4.4 VEGETATION

4.4.1 Wetlands and Submerged Aquatic Vegetation

The COE defines wetlands as areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The proposed Project would affect both coastal and freshwater wetlands, generally classified as estuarine and palustrine. Estuarine wetlands are associated with the ocean but usually are located in areas that are semi-enclosed by land. These wetlands are located in intertidal areas where ocean waters are, at least occasionally, diluted by freshwater runoff from the land. Palustrine wetlands are nontidally influenced freshwater wetlands that are generally dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. Seagrasses or submerged aquatic vegetation found in subtidal areas are not always considered wetlands as defined above. However, seagrasses are a near shore habitat that occur in some estuarine systems and are also considered in this discussion. Ingleside San Patricio identified wetlands within the Project area by field delineation conducted in February 2004. Delineation followed the 1987 COE Wetland Delineation Manual (COE, 1987). Wetland types were classified using the FWS classification system (Cowardin *et al.*, 1979).

The near-shore marine habitat and terrestrial wetland types that would be affected by the LNG terminal include estuarine emergent marsh (coastal marsh), estuarine submerged aquatic bed (seagrass), and estuarine tidal flat. The pipeline would affect palustrine (freshwater) emergent marsh. About 4.4 acres of sparsely vegetated coastal marsh and tidal flat habitat occurs within the proposed LNG ship berth area. Of this amount, about 1.36 acres consists of coastal marsh habitat and the remaining 3.08 acres consisting of tidal flat. The dominant vegetative species in the coastal marsh is smooth cordgrass (*Spartina alterniflora*). Ingleside San Patricio indicated that five to six small black mangrove trees (*Avicennia germinans*) exist within this coastal marsh habitat. The tidal flat is vegetated with glasswort (*Salicornia* spp.), saltwort (*Batis maritime*), saltgrass (*Distichlis spicata*), Bermuda grass (*Cynodon dactylon*), camphor daisy (*Machaeranthera phyllocephala*), sea ox-eye (*Borrichia frutescens*), coastal dropseed (*Sporobolus virginicus*), and sea oats (*Uniola paniculata*).

Seagrasses occur in shallow water (less than 4 feet deep) along the margin of Corpus Christi Bay and along a spoil island across the La Quinta Channel, west of the LNG terminal site. The extent of the seagrass beds occurring within the Project area is shown in figure 4.4-1. Ingleside has identified and mapped a total of 18.8 acres of submerged aquatic seagrass beds within the Project area. Of this amount, about 11.4 acres of seagrass beds occur within an approximate 1-mile-long band along the east side of La Quinta Channel and the remaining 7.4 acres occurs along a similar 1-mile long band along the west side of the channel. Dominant seagrass species include shoal grass (*Halodule wrightii*) and manatee grass (*Syringodium filiforme*). Other less dominant species include turtle grass (*Thalassia testudinum*), clover grass (*Halophila engelmanni*), and widgeon grass (*Ruppia maritima*). Seagrasses in the Project area occur as patchy beds due to limited suitable depth.

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Figure 4.4-1
Seagrass Beds at the LNG Terminal Site

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Seagrass beds are an important habitat in coastal bay systems. Juvenile sea turtles utilize seagrass beds, as seagrass leaves comprise a major portion of their diets. There is no evidence that these species presently utilize the seagrass beds in the Project area. A variety of birds use seagrass meadows as feeding and resting areas including wading birds, gulls and terns, and waterfowl. Seagrass beds also provide important habitat for a variety of fishes, particularly juvenile stages.

The proposed pipeline would cross one palustrine emergent wetland at MP 24.7. Dominant species identified within the wetland include primrose willow (*Salix sp.*), poisonbean (*Sesbania drummondii*), herb of grace (*Ruta graveolens*), spikerush (*Eleocharis sp.*), and curly dock (*Rumex crispus*). Ingleside San Patricio submitted its wetland delineation report for the LNG terminal during July 2004 and June 2004 for the pipeline. Ingleside San Patricio indicated that about 4.8 miles of the proposed San Patricio Pipeline was not field delineated due to access restrictions. Ingleside San Patricio would follow our Procedures and conduct a wetland delineation survey along the portions of the pipeline construction right-of-way where access has been denied. Ingleside San Patricio would file the amended wetland delineation survey report with the Secretary prior to construction.

A total of about 1.36 acres of coastal marsh, 3.08 acres of tidal flats, and 1.07 acres of submerged aquatic seagrass beds, would be affected during construction of the Project. Of the 1.07 acres of submerged aquatic seagrass beds that would be affected, about 0.54 acre would be permanently removed by dredging and shoreline construction for the LNG terminal facilities and about 0.53 acre would permanently converted to open water as part of the relocation of Occidental Chemical's existing loading dock (see section 2.10.1 of this EIS). About 0.03 acre of terrestrial palustrine emergent wetlands would be affected in the uplands crossed by the pipeline. Table 4.4.1-1 lists near-shore marine habitat and terrestrial wetlands that would be affected by the Project and the anticipated area of impact.

TABLE 4.4.1-1

Wetlands Affected by the Ingleside Energy Center LNG Project

Facility	Location	Crossing Length (feet)	Wetland Classification a/	Construction Impact (acres) b/	Operational Impact (acres) c/
Terminal	See Figure 4.4-1	NA	E2EM	1.36	1.36
		NA	E2FL	3.08	3.08
		NA	E1AB d/	1.07	1.07
			Subtotal:	**5.51**	**5.51**
Pipeline					
	MP 24.7	3.0	PEM	0.03	0.02
			Subtotal:	**0.03**	**0.02**
			Total:	**5.54**	**5.53**

NA = not applicable.
a/ E2EM=Estuarine intertidal emergent, E2FL=Estuarine tidal flat, E1AB=Estuarine submerged aquatic bed, PEM=Palustrine emergent.
b/ Construction impacts for the pipeline is based on a 75-foot-wide construction right-of-way.
c/ The operational impact for the pipeline is based on a 50-foot-wide permanent right-of-way.
d/ Acreage includes the 0.53 acre that would be affected by the relocation of Occidental Chemical's existing loading dock.

In addition to direct impacts on seagrass beds within the proposed dredging footprint, adjacent seagrass beds could potentially be affected by turbidity and sedimentation created by dredging activity. The distribution of seagrasses along the eastern Corpus Christi Bay shoreline is sparse and patchy when compared to the overall seagrass coverage of the Coastal Bend area. Seagrasses nearest the eastern slope of the La Quinta Channel may receive minor siltation during dredge activity. No burial of seagrasses is anticipated from the expected siltation, although primary production may be temporarily diminished due to the effects of turbidity.

Turbidity tends to interfere with light penetration and thus reduce photosynthetic activity by phytoplankton and seagrasses. It is expected that any turbidity or sedimentation impacts would be limited to within several hundred feet of dredging operations. Thus, reductions in primary production would be localized around the immediate area of dredge operations in the La Quinta Channel and be limited to the duration of the sedimentation plume at the LNG marine terminal basin. Based on Ingleside San Patricio's mathematical dredge models, the turbidity plume would not exceed the threshold value of 30 nephelometric turbidity units (NTU), a measure of turbidity considered indicative of water column impact. Ingleside San Patricio's sediment transport analysis indicates that fine silt and clay particles that would be resuspended as a result of dredging would wash out of the channel before settling. If particles are suspended higher in the water column, or in deeper water, the settling time and distance would be greater. In its April 19, 2004 comments on the draft EIS, the TPWD recommended the use of turbidity curtains to protect adjacent seagrass beds during the dredging and loading dock relocation activities. Ingleside San Patricio would use turbidity curtains during construction. The Commission also notes that the TPWD reviews and provides comments on COE Section 10 and Section 404 permits through the Fish and Wildlife Coordination Act of 1934. Ingleside San Patricio would comply with any Project-specific recommendations or requirements to minimize suspension of sediments that are attached to dredging permits issued by the COE. To ensure that potential impacts on seagrass beds adjacent to the areas that would be dredged are monitored, **we recommend that:**

- **Ingleside San Patricio conduct post-construction surveys of seagrass beds adjacent to the areas that would be dredged and file a report that compares the results of the pre- and post-construction seagrass surveys with the Secretary <u>within 90 days</u> of completing dredging and dredge material placement. If secondary impacts to these areas are observed, Ingleside San Patricio should consult with resource and regulatory agencies to develop additional mitigation measures as necessary.**

Although seagrass and coastal marshes also occur along the shoreline of the PCCA's DMPA No. 13, an area where Ingleside San Patricio could discharge its dredged material should unforeseen circumstances preclude the use of Alcoa's tailing ponds, Ingleside San Patricio proposes to avoid impacts on these areas by using an approximate 1.1-mile-long submerged disposal line along across the La Quinta Channel and crossing the shoreline using existing access corridors maintained by the PCCA and the COE. In addition, if Ingleside San Patricio does use DMPA No. 13, it expects to be allowed to place its dredged material along the interior base of existing levees, which would result in no wetlands impacts related to dredge material placement on DMPA No. 13. Therefore, wetlands-related impacts on and in near proximity to DMPA No. 13 are not expected.

For those terrestrial wetlands that would be temporarily affected during construction, potential impacts would include the temporary disturbance of wetland vegetation, soils, and hydrology. Soil disturbance and removal of wetland vegetation could temporarily affect wetland capacities to buffer flood flows and/or control erosion. Failure to properly segregate topsoil over the pipeline trenchline could result in the mixing of the topsoil with the subsoil, which could affect the success of post-construction reestablishment and natural recruitment of native wetland vegetation. Rutting of soils from construction equipment could result in soil mixing, which could also affect success of post-construction restoration. Trenching during pipeline installation could penetrate impervious soil layers, which could alter perched water tables. Altered perched water tables could result in drier soil conditions that could inhibit the reestablishment of wetland vegetation. Uncontrolled surface runoff from adjacent disturbed upland areas could transfer silt and sediment into off right-of-way wetlands.

To minimize construction-related impacts on wetlands, Ingleside San Patricio would implement our Procedures. Some of the major components of our Procedures applicable to wetland construction are listed below:

- The construction right-of-way would be limited to 75-feet-wide or less.
- Construction equipment operating within the right-of-way would be limited to that equipment necessary for clearing, excavation, pipe installation, backfilling, and restoration activities. All nonessential equipment would use upland access roads to the maximum extent practicable.
- Equipment operating within saturated wetlands would be low-ground-weight equipment or would operate from prefabricated construction mats.
- Temporary erosion and sediment control measures would be installed immediately after the initial disturbance of wetland soils and would be inspected and maintained regularly until final stabilization.
- Sediment controls would be installed across the construction right-of-way, as needed, within wetlands to contain trench spoil.
- The uppermost foot of wetland topsoil would be segregated from the underlying subsoil in areas disturbed by trenching, except in areas with standing water or saturated soils, or where no topsoil layer is evident.

Following construction, temporarily disturbed wetlands would be restored and allowed to revegetate, and monitored in accordance with our Procedures. All of the 0.03 acre of palustrine emergent wetland affected by construction of the pipeline would be allowed to revegetate. About 0.02 acre would be within the 50-foot-wide permanent right-of-way of the pipeline. Typically, no vegetation maintenance would be required in emergent wetlands; therefore there should be no operational impacts to the palustrine emergent wetland.

In addition to the measures required by our Procedures, Ingleside San Patricio would be required to comply with the permit conditions contained in the COE's Section 404 permit and the state Section 401 permit. As part of its review of the project, the COE will evaluate whether practicable alternatives have been taken to avoid wetland impacts to the maximum extent possible. Ingleside San Patricio must also demonstrate that it has taken appropriate and

practicable steps to minimize wetland impacts in compliance with the COE's Section 404(b)1 guidelines that restrict discharges of dredge or fill material where a less environmentally damaging alternative exists.

The loss of estuarine wetlands and submerged aquatic wetlands as a result of the construction of the terminal would require compensatory mitigation. The specific type and amount of compensatory mitigation would be determined by the COE as part of the Section 404 permit process. Ingleside San Patricio has initiated consultation with the COE, EPA, FWS, TPWD, TGLO, NOAA Fisheries, and the Coastal Bends Bays and Estuaries Program (CBBEP) office regarding the development of a mitigation plan that would compensate for impacts to aquatic resources directly within the Project area as well as potential impacts to aquatic resources adjacent to the Project area.

During its consultations, Ingleside San Patricio was provided with a recommended approach for investigating, developing, and proposing a mitigation plan. It was agreed that the mitigation plan should offset the wetlands affected by the Project by providing wetland functions similar to those that would be affected. Mitigation options included enhancement of degraded wetlands or restoration of historic wetlands, wetland creation, or wetland preservation. On March 30, 2005, Ingleside San Patricio met with the FWS, TPWD, COE, and FERC to review wetland mitigation proposals. Based on previous consultations and agency feedback received at the March 30, 2005 meeting, Ingleside San Patricio developed a draft wetland mitigation plan that was filed with the Commission on May 18, 2005 (see appendix E).

In its draft plan, Ingleside San Patricio proposes to provide funding for the purchase of two tracts of land (Tract Nos. 2 and 3) totaling 32.83 acres from the Portland Harbors Corporation. The two tracts of land are located adjacent to Nueces Bay near the City of Portland and are comprised of coastal emergent marsh and tidal sand and mud flat areas. Based on preliminary surveys, Ingleside San Patricio estimates that about 8.0 acres of smooth cordgrass, 18 acres of mixed coastal vegetation, 5.0 to 6.0 acres of nonvegetated areas (tidal sand and mud flat), and 3.0 to 5.0 acres of seagrass beds exist within Tract Nos. 2 and 3. Significant development has occurred on private property adjacent to the tracts; however, no development has occurred on Tract Nos. 2 and 3. Ownership of the land would be maintained by a government entity or conservation organization/land trust with restrictive covenants to assure wetland preservation.

Tract Nos. 2 and 3 are adjacent to TX-13 Critical Habitat Unit for the federally threatened piping plover and piping plovers may occasionally use the tidal flats within these two tracts. Since Tract Nos. 2 and 3 would be preserved, we believe this would be a beneficial effect and mitigation activities within these areas may affect, but are not likely to adversely affect piping plovers. Mitigation activities (e.g. bollard installation) would be conducted outside the piping plover wintering season (August through April) and during the summer months when piping plovers are not present.

Ingleside San Patricio would conduct detailed surveys at Tract Nos. 2 and 3 to determine property boundaries and the amount of wetland habitats that exist on-site. Ingleside San Patricio expects that the mitigation exchange rate would exceed the 1:1 ratio for coastal wetlands and tidal flats and proposes out-of-kind mitigation for seagrass impacts. Although mitigation for seagrasses would not be in-kind it would provide a net ecosystem benefit by placing the two tracts into a conservation easement program. Placing restrictive covenants on Tract Nos. 2 and 3

for preservation would assure that no further loss of wetlands would occur in this area. **We recommend that:**

- **Ingleside San Patricio continue its consultation with the COE, EPA, FWS, TPWD, TGLO, NOAA Fisheries, and the CBBEP to further develop its Wetland Mitigation Plan. Prior to construction of the LNG terminal, Ingleside San Patricio should file its final plan with the Secretary for review and written approval by the Director of OEP.**

4.4.2 Upland Vegetation

The upland vegetation communities that would be affected by construction and operation of the proposed Project include grasslands, scrub/shrub rangelands, and agricultural lands. The proposed 74-acre LNG terminal site contains disturbed and undeveloped industrial areas that are covered with maintained lawn and crushed gravel. Vegetation within the LNG terminal site consists primarily of Bermuda grass (*Cynodon dactylon*). Scrub/shrub uplands and grasslands occur along the edges of the disturbed industrial areas. This area would be cleared during construction of the LNG terminal.

Construction of the proposed pipeline would require about 375.7 acres of land, of which 256.6 acres would be agricultural land and 113.9 acres would be open land. The open land is covered by grasslands and scrub/shrub vegetation. Shrub species include mesquite (*Prosopis glandulosa*), catclaw acacia (*Acacia greggii*), huisache (*Acacia smallii*), blackbrush (*Acacia rigidula*), and prickly pear (*Opuntia engelmannii*) while herbaceous species include silver bluestem (*Bothriochloa laguroides*), buffel grass (*Pennisetum ciliare*), curly mesquite (*Hilaria belangeri*), Arizona cottontop (*Digitaria californica*), and bahiagrass (*Paspalum notatum*). The TPWD noted that common species in the area between MP 20.0 and MP 24.0 include sugarberry (*Celtis laevigata*) and live oak (*Quercus virginiana*) trees. Typical crops grown on the agricultural land include sorghum and cotton. After installation of the pipeline, crops could still be grown over the right-of-way. The permanent pipeline easement in open land would be kept in an herbaceous state.

Only 1.0 acre along the pipeline route would be permanently converted from agricultural land into industrial use. This would be at the meter stations and MLV locations.

In its April 19, 2005 comments on the draft EIS, the TPWD noted that some mature oak trees may be present among other woody vegetation along the pipeline route between MP 21.0 and MP 24.0. The TPWD recommended that Ingleside San Patricio avoid removal of large trees (greater than 12 inches in diameter at breast height) that may occur in the construction right-of-way. To address this concern, **we recommend that:**

- **Ingleside San Patricio should attempt to avoid the removal of mature trees along the pipeline right-of-way with a diameter at breast height greater than 12 inches. If such trees must be removed, Ingleside San Patricio should prepare a mitigation plan, in consultation with the TPWD, and file the plan with the Secretary <u>prior to construction of the pipeline.</u>**

Ingleside San Patricio would follow our Plan and apply our mitigation measures for minimizing erosion and enhancing revegetation before, during and after the construction of the Project. Impacts on vegetation within the LNG terminal site would be minimal since this area is currently in industrial use. To minimize impacts on vegetation along the pipeline right-of-way, about 86.7 percent (22.9 miles) of the route for the 26-inch-diameter main pipeline would be immediately adjacent to existing rights-of-way.

Upon completion of construction activities, all temporarily disturbed areas would be restored to pre-construction contours. Ingleside San Patricio consulted with the NRCS about seed mixtures and would follow the recommendations included in the San Patricio County Soil Survey. In accordance with our Plan, Ingleside San Patricio would not have to seed actively cultivated farm land, unless requested to do so by the landowner. Ingleside San Patricio would use herbicides in and around buildings at the LNG terminal site, as needed. Herbicides would not be used along the pipeline right-of-way. The TPWD recommended that Ingleside San Patricio use locally native grasses and forbs in its revegetation seed mix. **We recommend that:**

- **Ingleside San Patricio should consult with the TPWD and the NRCS to develop a seed mix that includes native grass species. Ingleside should file the final seed mix specifications with the Secretary, <u>prior to construction of the pipeline</u>.**

We believe that by following our Plan and the TPWD and NRCS's recommended seed mixes in disturbed uplands, construction and operation of the Ingleside Energy Center LNG Project would have little potential for significant adverse effects on upland vegetation. In addition, our Plan addresses vegetation maintenance for uplands including guidelines for follow up inspections and guidelines for determining successful revegetation.

4.5 WILDLIFE AND AQUATIC RESOURCES

This section describes the marine, fresh water, and terrestrial wildlife species that could potentially occur in the habitats associated with the Project area, and describes potential effects of the Project on those species.

4.5.1 Marine Species

Major marine habitat complexes in the vicinity of the Ingleside Energy Center LNG Project area include the extensive brackish marsh complex of the Nueces River Delta, the fringing wetlands and open waters of Nueces Bay and Corpus Christi Bay, other similar habitats throughout the Nueces Estuarine System, and the near-shore shallow waters of the Gulf of Mexico. These habitats are highly productive of plankton and dead organic material that provides an abundant food base for those species that can tolerate the stressful estuarine environment.

Within the eastern portion of Corpus Christi Bay, the Project area encompasses four aquatic/intertidal habitat types including open bay, seagrass beds, coastal marsh, and tidal flats. The marine species that occupy the water column above the substrate of open bays (collectively called the nektonic community) include a variety of invertebrates and fishes.

4.5.1.1 Fish Species

Near-shore Gulf of Mexico fish communities consist of species found in both estuarine and offshore marine habitats, most of which are temperate in biogeographic distribution with a few tropical species. Two hundred and thirty four fish species occur within the Corpus Christi Bay National Estuary Program (CCBNEP) study area, which includes the Aransas, Corpus Christi, and Upper Laguna Madre bays and estuary systems. These species can be classified as warmwater marine or estuarine. Distribution and abundance varies greatly from time to time and place to place, depending on such factors as temperature, salinity, and predictable cycles directly related to reproduction. While some species spend their lives within the estuary, many are migratory, using the estuaries as nurseries for rapidly growing juveniles, or opportunistically as adults when conditions are favorable.

Fish are the dominant nektonic constituents of the open bay community, although most are not permanent residents of these areas and spend only a portion of their lifecycle in estuaries. Open bay fish species are the dominant secondary consumers, feeding on benthic organisms, detritus, or pelagic organisms such as zooplankton and other fish. Fish species common in the open bay habitats include 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*).

Seagrass habitats are often populated by diverse and abundant fish fauna 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 silverside (*Menidia peninsulae*), rainwater killifish (*Lucania parva*), pinfish, bay anchovy, striped mullet, menhaden (*Brevoortia* spp.), silver perch (*Bairdiella chrysura*), dusky pipefish (*Syngnathus floridae*), and speckled worm eel (*Myrophis punctatus*). These species feed on the abundant invertebrate population, epiphytic algae and/or living or decaying seagrasses. 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. Such species include the hardhead catfish, spotted seatrout, red drum, southern flounder, spot, and various sharks and rays.

Much like the seagrass habitats, coastal marshes are an important nursery habitat for a variety of marine and estuarine fishes. In addition to the species found in submerged aquatic vegetation, coastal marshes support several small, resident fish including important forage species, such as killifishes (*Fundulus* spp.), menhaden (*Brevoortia* spp.), bay anchovy, striped mullet, and western mosquitofish (*Gambusia affinis*). Moving into tidal marshes to feed on these forage fishes are a variety of larger predatory fishes such as tarpon (*Megalops atlanticus*).

When flooded, small fish will move into the tidal flats to feed on the polychaetes, gastropods and crustaceans. Fish species which can be found within the tidal flats habitat include sheepshead minnow (*Cyprinodon variegatus*), Gulf killifish (*Fundulus grandis*), rough silverside (*Membras martinica*), and larval inshore lizard fish (*Synodus foetens*), southern flounder, red drum, and spotted sea trout.

4.5.1.2 Invertebrates

The value of benthic organisms in the food chain is considerable. Additionally, invertebrates are valuable indicators of water/sediment pollution and construction-related sediment disturbance. Open bay communities support a variety of benthic invertebrates, which are typically subdivided into three size classes listed in order of increasing size: microbenthos, meiobenthos, and macrobenthos. Microbenthos, including bacteria, yeasts, fungi, microalgae (diatoms and flagellates) and protozoans, are largely decomposers and are one of the most important components of the open bay community; they form a major link between primary producers and higher trophic level consumers. The meiobenthic community typically consists of permanent residents, such as nematodes, harpacticoid copepods, gastrotrichs, and kinorhynchs, and temporary residents, including juvenile stages of clams, snails, polychaete worms and amphipods. Macrobenthos includes adult stages of clams, polychaete worms, snails and crabs. Polychaetes and bivalve mollusks dominate the macrobenthic assemblages of the Nueces Estuary.

Whereas benthic invertebrates live in the bottom sediments, epibenthic invertebrates live on or near the surface of bottom sediments. Epibenthos typically prefer protected areas such as seagrass beds and salt marshes, but they also occur in the open bay communities. Shrimp and blue crabs (*Callinectes sapidus*) are the most abundant epifauna in these areas. Common invertebrates that occupy the water column above the substrate of open bays include zooplankton, jellyfish, and the bay squid (*Lolliguncula brevis*).

During periods of inundation, coastal marshes provide habitat for a variety of invertebrates including filter-feeding mollusks, crabs, and shrimp. Coastal marshes support a variety of grazing invertebrates, such as snails and various insects. During periods of inundation, tidal flats are inhabited by a variety of benthic invertebrates including polychaetes, gastropods, and crustaceans such as the blue crab and fiddler crab (*Uca* spp.).

Site-specific background information on the benthic infauna of La Quinta Channel was provided by Dr. Paul Montagna of the University of Texas Marine Science Institute (UTMSI) in Port Aransas, Texas. While presently outside of the Project area, per se, these results would be applicable to the deep water habitat that would be created by the proposed dredging of the LNG terminal marine basin and maneuvering area in the La Quinta Channel. A taxonomic listing of infauna with average abundances provided by Dr. Montagna (UTMSI, 2004) showed the benthic community of La Quinta Ship Channel is dominated by polychaete worms, which are habitat generalists and exhibit high tolerance to environmentally stressful conditions such as low dissolved oxygen levels. Other dominant infaunal species included mollusks, unidentified oligochaete worms, amphipod crustaceans, and sea grapes (*Molgula manhattenis*).

4.5.1.3 Commercial and Recreational Fisheries

The commercial and recreational fisheries of Corpus Christi Bay are important industries that reflect the high productivity, recreational values, and aesthetic values of the estuarine and nearby Gulf of Mexico waters. Most of the commercially and recreationally important species of the northern Gulf of Mexico depend to some extent on estuarine habitats and tend to dominate them in terms of numbers and biomass. Recreational and commercial fisheries information for Corpus Christi Bay was obtained from TPWD reports and fish landings data. Table 4.5.1.3-1 provides a

list of representative commercial and recreational fish and shellfish species known to occur in Corpus Christi Bay.

In 2000, approximately 738,782 pounds of seafood, valued at $1,043,829, was caught in Corpus Christi Bay, representing about 3 percent of the total poundage of seafood caught that year in the entire state of Texas.

The most important commercial finfish species currently reported from the Project area are black drum, southern flounder, sheepshead, and striped mullet. Collectively, these four species accounted for about 90 percent of the 237,792 pounds of finfish harvested in Corpus Christi Bay in 2000. Principal shellfish species harvested in the Project area include brown shrimp, pink shrimp, white shrimp, and blue crab. In 2000, these species accounted for approximately 99 percent of the 500,990 pounds of shellfish harvested in Corpus Christi Bay.

TABLE 4.5.1.3-1

Representative Recreational and Commercial Fish and Shellfish 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
Blue crab	*Callinectes sapidus*	Warmwater marine/estuarine
Red drum	*Sciaenops occellatus*	Warmwater estuarine
Spanish mackerel	*Scomberomorus maculatus*	Warmwater marine
Atlantic croaker	*Micropogonias undulatus*	Warmwater marine/estuarine
Black drum	*Pogonias cromis*	Warmwater marine/estuarine
Gafftopsail catfish	*Bagre marinus*	Warmwater marine/estuarine
Sand seatrout	*Cynocion 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

4.5.1.4 Fisheries of Special Concern

Fish species of special concern that occur in the vicinity of the proposed Project include state and federally listed threatened and endangered species, those with EFH designations in the Corpus Christi Bay estuary, and those of commercial and recreational value. Commercial and recreational fish species are discussed above in section 4.5.1.3. Threatened and endangered fish species are discussed in section 4.6 of this EIS. Species with EFH designations in Corpus Christi Bay are discussed in appendix B of this EIS.

4.5.1.5 Project Impacts on Marine Species

All marine habitats associated with the Project would occur in the vicinity of the proposed LNG terminal maneuvering area, new ship berth, and the relocated Occidental Chemical loading dock. Construction of the LNG terminal would require the dredging of 40 acres of open bay/benthic habitat. Operation would result in the permanent loss of 1.36 acres of coastal marsh, 3.08 acres of tidal flat, 1.07 acres of submerged aquatic seagrass bed habitats. In addition, about 0.53 acres of seagrass beds would permanently converted to open water as part of the relocation of Occidental Chemical's existing loading dock (see section 2.10.1 of this EIS). Impacts on aquatic organisms would arise primarily from dredging, dock construction, and ballast water intake by LNG ships, which could result in habitat removal and conversion; loss of organisms by direct removal, entrainment, or burial; and loss related to turbidity or noise impacts.

Dredging for the LNG terminal marine basin would permanently convert existing habitat types (coastal marsh, tidal flat, and seagrass beds) to a deeper water habitat. While creation of the marine basin would have a permanent impact on species that specifically occupy seagrass beds, coastal marsh, and tidal flats habitats, most species are capable of occupying a variety of habitats, including a deeper open bay habitat sometime during their life cycle. Very slight changes in the hydrography and water and sediment quality parameters (*i.e.*, tidal amplitude, dissolved oxygen, salinity, toxic chemical accumulation, etc.) resulting from the creation of the marine basin would not cause detectable adverse effects on aquatic species. Impacts on aquatic habitats under the jurisdiction of the COE would be mitigated by the creation of similar habitats at a ratio determined by the COE, as discussed in section 4.4.1 of this EIS.

In addition to the loss or alteration of aquatic habitats, the primary impacts to fish associated with dredging include entrainment of organisms by dredging machinery, and increased turbidity and sedimentation due to the resuspension of bottom sediments. The loss of benthic organisms due to entrainment would potentially occur during dredging, but should not be extensive enough to have a significant impact on the fishery resources of Corpus Christi Bay. Demersal and pelagic fish of various life stages would also be at some risk of being entrained. However, much of the available evidence suggests that entrainment is not a significant problem for many species of fish and shellfish in bodies of water that require periodic dredging. In most instances, dredging related impacts appear to be most serious in narrow constricted river channels (Reine and Clarke, 1998).

Increases in turbidity can affect fish physiologically and/or behaviorally. Potential physiological effects include mechanical abrasion of surface membranes, delayed larval and embryonic development, reduced bivalve pumping rates, and interference with respiratory functions. Possible behavioral effects from increased turbidity include interference with feeding for sight-foraging fish and area avoidance. Alternately, the reduced visibility of predatory fish could lower vulnerability to predation for prey species. Impacts of dredging on marine water turbidity are expected to be localized, short-term, and minor, as discussed in section 4.3.2.1 of this EIS.

Siltation from dredging for the marine basin is expected to have minor effects on the adjacent seagrass bed habitat in the shallow shoreline areas of the La Quinta Channel in the vicinity of the Project. The distribution of seagrasses along the eastern Corpus Christi Bay shoreline is sparse and patchy when compared to the overall seagrass coverage of the Coastal Bend area. Ray Allen, executive director of the CBBEP, in discussing the nearby Cheniere Corpus Christi LNG

Project, described the Project area as a "fringe location" for wetland habitats along an industrial channel, with seagrass beds of lesser quality overall, than other places in Corpus Christi Bay. Seagrass beds along the La Quinta Channel may receive minor siltation during Project-related dredging activities. No burial of seagrass beds is anticipated as a result of Project dredging siltation, although primary production may be temporarily diminished due to the effects of turbidity. Turbidity tends to interfere with light penetration and thus reduce photosynthetic activity by phytoplankton and seagrasses. Such reductions in primary production would be localized around the immediate area of dredge operations in the La Quinta Channel and be limited to the duration of the sedimentation plume at the LNG terminal marine basin. It is expected that any turbidity or sedimentation impacts would be limited to within several hundred feet of dredging operations. The particles that would be resuspended as a result of dredging are fine silt and clays that would wash out of the channel before settling. If particles are suspended higher in the water column, or in deeper water, the settling time and distance would be greater. Ingleside San Patricio would comply with any Project-specific recommendations or requirements to minimize suspension of sediments that are attached to dredging permits.

Excessive nutrient loading from sediment resuspension can also have an adverse impact upon submerged seagrass beds because it can cause dramatic increase in the productivity of planktonic algal populations. The shading effect of such algal blooms can significantly curtail the productivity of submerged aquatic plants. It is expected that impacts from sediment resuspension would be limited to within several hundred feet of dredging operations. Ingleside San Patricio would comply with any Project-specific recommendations or requirements to minimize suspension of sediments that are attached to dredging permits. Ingleside San Patricio has developed a draft wetland mitigation plan to compensate for impacts on aquatic resources. We are recommending that Ingleside San Patricio continue consultations with the COE, EPA, FWS, TPWD, NOAA Fisheries, TGLO, and the CBBEP to develop a final wetland mitigation plan. We have recommended the final plan be filed with the Secretary for review and written approval by the Director of OEP, before we would allow construction of the LNG terminal to go forward.

As discussed in section 2.3.1.2, steel pipe piles would be installed as part of the construction of the marine terminal basin (*i.e.*, for breasting/mooring dolphins). Ingleside San Patricio expects that pile driving activities would occur over eight to eleven weeks. 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 (re: 1 micro Pascal [μPa]) can illicit avoidance behaviors or stun small fish (NOAA Fisheries, 2003). Sounds greater than 190 decibels (re: 1 μPa) 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).

Ingleside San Patricio has not yet identified the type of hammer that would be used to drive piles during construction of the marine terminal basin. Driving steel pipe piles with an impact hammer in similar settings has been shown to generate sound levels from 192 to 194 decibels (re: 1 μPa), above the level that is thought to injure some fish. Depending on the specific conditions at the site, these sounds can have a transmission loss rate of 0.021 to 0.046 decibels (re: 1 μPa) per foot (Nedwell and Edwards, 2002; Nedwell *et al*., 2003). Based on these values, the use of an impact hammer could generate underwater sound levels great enough to affect some fish as far as 190 feet (*i.e*., 190 decibels (re: 1 μPa)) and 1,860 feet (*i.e*., 155 decibels (re: 1 μPa)) from a steel pile. Although the sound waves of the greatest intensity would be limited to the immediate vicinity of the piles within the unloading slip, sound levels of 155 decibels (re: 1 μPa) 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 would be located in a recently dredged unloading slip, it seems likely that construction noise and activities would cause many marine species to avoid the area where the most intense sound levels would be generated.

Ship and boat traffic associated with construction and operation of the Project would also generate underwater sounds. Although vessel noise would not generally be of the intensity produced from driving steel piles, Project-related vessels (LNG carrier ships, tugs, construction barges) operating in the La Quinta Channel could generate 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).

Operation of the LNG terminal should not have a significant effect on area fisheries. Operation would involve berthing of an average of two to three LNG ships per week, or two to three additional vessel movements inward and two to three additional vessel movements outward through the Corpus Christi and La Quinta Channels per week. LNG ship traffic to and from the Project would represent an increase of about 3 percent in total ship traffic in Corpus Christi Bay.

The potential for impacts to seagrass and coastal marsh habitats to occur in the La Quinta Channel would not significantly increase based on the additional ship traffic from the proposed

construction of the LNG facility. Normal ship traffic to and from the proposed LNG facility and within the La Quinta Channel would not create abnormal conditions for existing seagrass beds or coastal marshes found within or bordering the channel. No significant adverse impacts on seagrass beds or coastal marsh habitats are expected due to increased LNG ship traffic within the La Quinta Channel. The permanent loss of seagrass beds, coastal marsh, and tidal flats resulting from construction and operation of the Project would be mitigated through an Aquatic Resources Mitigation Plan developed and implemented by Ingleside San Patricio in consultation with interested agencies.

LNG ships calling from international ports could potentially introduce aquatic invasive species into U.S. waters. Alternatively, visiting LNG ships could transport native species to other parts of the world. Although the potential for this to occur cannot be entirely eliminated, several factors, both general and specific to the project, tend to mitigate this potential. First, if it were allowed to occur, the discharge of ballast water from LNG ships could potentially impact marine organisms through the unintentional introduction of non-indigenous aquatic organisms. Ship ballast water is fresh water or salt water pumped aboard in the port of destination, as the cargo is unloaded. Ballast is a necessary safety feature of commercial shipping that provides transverse stability during voyages and while in port, ensures adequate submergence of the propeller, reduces stresses on the ship's hull, and lowers the center of gravity for improved maneuverability. Although ballast water has been identified as a major pathway for the introduction and spread of exotic species, no release of ballast water would be allowed within Corpus Christi Bay. Second, it is expected that any LNG carrier calling at the Ingleside San Patricio LNG terminal would be in full compliance with the domestic requirements for ballast water management as specified in the National Invasive Species Act of 1996 (NISA) and international standards that were adopted on February 13, 2004. According to appropriate regulations, ships can only swap out their ballast water while in the open sea, prior to entering the Gulf of Mexico. Therefore, there would be no impact on aquatic species or habitats as a result of discharge of LNG ship ballast water.

In 2003, the Port of Corpus Christi received over 1,000 tankers from various parts of the world. The top trading countries were located in South America, Africa, the Middle East, and Europe. This would indicate that the potential for routine exposure of port waters to aquatic species with diverse origins may occur and that this type of exposure has been ongoing for an extended period of time. Invasive species may negatively impact native species by predation, competition, reproduction and decrease of genetic diversity, introduction of pathogens and parasites that cause illness and/or mortality, and disruption of available nutrients. An introduced species could change the composition and normal functioning of entire ecosystems. Maintaining intact natural ecosystems ensures the continuation of ecosystem goods and services (Ecological Society of America, 1998). The Coast Guard has developed responses to exotic/invasive species associated with foreign vessels and its Office of Operating and Environmental Standards developed *Mandatory Practices for All Vessels with Ballast Tanks on All Waters of the United States*. The mandatory practices include requirements to rinse anchors and anchor chains during retrieval to remove organisms and sediments at their place of origin and to remove fouling organisms that maybe affixed to ship hulls, piping, and tanks. The removal of organisms would be conducted on a regular basis and the disposal of any removed substances would be in accordance with local, state and federal regulations. Therefore, we conclude that the introduction of non-indigenous attached species via ship hulls is not likely to significantly alter the local biotic community.

There are potential impacts on marine organisms resulting from the intake of ballast water while in port. Once at Ingleside San Patricio's terminal, each LNG ship would discharge its cargo to storage tanks on shore. While the vessel is discharging its LNG, it would be taking on seawater ballast to maintain a constant draft at the berth. The LNG ships would require approximately 2.5 million gallons of seawater ballast. Ballast water would be drawn from a common transverse manifold piping system that would be connected to two inlet boxes located on the port and starboard sides of the LNG ship. The inlet boxes would contain seawater strainers with a typical mesh size diameter of five millimeters. Aquatic species in the immediate vicinity of the LNG ship berth could therefore be impacted by entrainment during ballast water intake. Ballast water intakes on the LNG ships are near the bottom of the ships therefore entrainment would be limited to organisms in the deeper water column (24-30 feet below the surface) near the bottom of the marine terminal basin. Ballast water intake at Ingleside San Patricio's proposed LNG terminal would be similar to ongoing ballast water intake by numerous ships currently calling on the Port of Corpus Christi, and impacts from entrainment during ballast water intake by LNG ships at the proposed terminal would not add appreciably to current impacts.

In addition to ballast water intake, Ingleside San Patricio would withdraw about 420,000 gallons of seawater weekly during its testing of the firewater system. The water would be discharged back into the pump suction area adjacent to suction screens at a rate of 14,000 gpm. Aquatic species in the immediate vicinity of the firewater system intake could be impacted by entrainment during water intake; however, this impact would not add appreciably to current impacts.

4.5.2 Freshwater Species

No natural fresh water ponds, lakes, or streams occur on or adjacent to the LNG terminal site. Twelve constructed storm drainage ditches and an approximate two acre fire water make-up pond are located on the LNG terminal site. The proposed pipeline would cross 12 waterbodies, listed on table 4.3.2.2-2 of this EIS. Two of the waterbodies (Oliver Creek [MP20.0] and Chiltipin Creek [MP 21.2]) are perennial streams. The remaining waterbodies are intermittent-flowing drainages or ditches. All the waterbodies are very low gradient, and typically have high turbidity and high concentrations of suspended solids, particularly after rain events. All waterbodies are classified as warmwater fisheries. Species typical of warmwater fisheries in the Project area include largemouth bass (*Micropterus salmoides salmoides*) blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*) flathead catfish (*Pylodictis olivaris*), bluegill (*Lepomis macrochirus*), and red ear sunfish (*Lepomis microlophus*). Several species of sunfish (*Lepomis sp.*) and mosquito fish were observed by Ingleside San Patricio during field surveys.

Ingleside San Patricio would cross nine of the twelve waterbodies, including Oliver and Chiltipin Creeks, using the HDD method. Crossing by HDD would avoid direct impact on the waterbodies and associated fisheries. Three of the twelve waterbodies are intermittent roadside ditches that would be crossed by the open cut method. An open-cut crossing would result in a temporary increase in the concentration of suspended solids at the crossing location and downstream, if water is flowing at the time of the crossing. The concentration of suspended solids would decrease rapidly following the completion of instream work. Ingleside San Patricio would construct all waterbody crossings in accordance with the construction and mitigation measures in our Procedures. Our Procedures require completion of most instream work within

24 hours for waterbodies 10 feet wide or less, and within 48 hours for streams 10 to 100 feet in width.

Use of our Procedures would help reduce impacts on fisheries from construction-induced sedimentation and turbidity to short-term, temporary disturbances. Trench spoil would be stored within the approved right-of-way on or above the stream banks at least 10 feet from the water's edge. Temporary sediment control devices would be installed around spoil piles to minimize the potential for sediment-laden water to enter the stream. Additionally, all staging and temporary workspace areas would be located at least 50 feet back from the water's edge where topographic conditions permit (unless otherwise permitted), thus minimizing the potential for erosion and sedimentation along the stream banks.

Impacts on water quality from the open cut crossing would be short term and suspended sediment concentrations would be expected to return to pre-construction levels soon after construction across the waterbody is completed. Because of Ingleside San Patricio's proposed use of our Procedures, and the use of the HDD method for most waterbody crossings, impact on fish and other freshwater aquatic organisms is expected to be very localized and short term.

4.5.3 Terrestrial Wildlife

The proposed Project lies within the region of Texas described as the Gulf Coast prairies and marshes. This region is a nearly level, slowly drained plain less than 150 feet in elevation, bisected by streams and rivers flowing into the Gulf of Mexico. The Gulf Coast prairies and marshes are characterized by two main vegetation units: marshes and tidal flats in the zone of tidal influence, and prairies or grasslands above the zone of tidal influence.

Wildlife habitats that would be affected by the Project include a small amount of coastal marsh and tidal flat along the margin of Corpus Christi Bay, and agricultural land, pasture, rangeland (including mesquite shrubland), and palustrine emergent marsh. Vegetative communities are discussed in section 4.4 of this EIS and acreages of wildlife habitat that would be affected are shown in table 4.5.3-1.

Numerous vertebrates inhabit these vegetative communities and use the habitats for food, cover, shelter, and nesting. The following subsections provide a brief description of each of the wildlife habitat types present and the wildlife commonly associated with each. The final subsection describes potential effects of the Project on these terrestrial wildlife species.

4.5.3.1 Coastal Marsh Habitat

Coastal marsh habitat occurs as a narrow band of vegetation lining the edge of Corpus Christi Bay. Few reptiles and amphibians occur in the coastal marsh habitat due to high salinity; however, some species such as the diamondback terrapin (*Malaclemys terrapin)* and American alligator (*Alligator mississipiensis*), are known to inhabit brackish marshes along the Gulf coast. Common wading and aquatic shorebirds likely to inhabit the coastal marshes in the Project area include mottled ducks (*Anus fulvigula*), lesser snow goose (*Chen caerulescens*), willets (*Cataptrophorus semipalmatus*), clapper rails (*Rallus longirostris*), great blue heron (*Ardea herodias*), tricolor heron (*Egretta tricolor)*, black-crowned night heron (*Nycticorax nycticorax)*, great egret (*Ardea alba*), snowy egret (*Egretta thula*), lesser scaup (*Aythya affinis*), white pelican

(*Pelecanus erythrorhynchos*), and cormorants (*Phalacrocorax spp.*). Nutria (*Myocastor coypus*) and white-tailed deer (*Odocoileus virginianus*) are known to feed on marsh vegetation. Other mammals that utilize coastal marsh include the rice rat (*Oryzomys palustris*), cotton rat (*Sigmodon hispidus*), fulvous harvest mouse (*Reithrodontomys fulvescens*), and raccoon (*Procyon lotor*).

TABLE 4.5.3-1

Wildlife Habitats Affected by the Ingleside Energy Center LNG Project

Facility	Habitat Type	Construction Impact (acres) a/	Operational Impact (acres) b/
Terminal	Coastal Marsh	1.36	1.36
	Tidal Flat	3.08	3.08
	Agriculture, Pasture, and Rangeland, including Mesquite Shrubland	0	0
	Palustrine Wetland	0	0
	Subtotal	**4.4**	**4.4**
Pipeline	Coastal Marsh	0	0
	Tidal Flat	0	0
	Agriculture, Pasture, and Rangeland, including Mesquite Shrubland	370.5	155.0
	Palustrine Wetland	0.03	0.02
	Subtotal	**370.53**	**155.02**
	Total	**374.93**	**159.42**

a/ Construction impacts for the pipeline is based on a 100-foot-wide right-of-way except for palustrine wetland which is based on a 75-foot-wide construction right-of-way.
b/ The operational impact for the pipeline is based on a 50-foot-wide permanent right-of-way.

4.5.3.2 Tidal Flat Habitat

Tidal flats occur as a narrow band of sparse vegetation between coastal marsh and coastal grassland in the area periodically flooded by tidal waters. Tidal flats provide excellent habitat for numerous species of gulls, terns, herons, shorebirds, and wading birds, including the laughing gull (*Larus atricilla*), ring-billed gull (*Larus delawarensis*), royal tern (*Sterna maxima*), sandwich tern (*Sterna sandvicensis*), great blue heron, snowy egret, sanderlings (*Calidris alba*), least sandpiper (*Calidris minutilla*), roseate spoonbill (*Ajaia ajaja*), and white ibis (*Eudocimus albus*). Mammals that may feed on tidal flats include the Virginia opossum (*Didelphis virginiana*), gray fox (*Urocyon cinereoargenteus*), striped skunk (*Mephitis mephitis*), coyote (*Canis latrans*), eastern cottontail (*Sylvilagus floridanus*), white-tailed deer, and raccoon.

4.5.3.3 Agricultural Land and Pasture/Rangeland

The majority of the pipeline would cross agricultural land and pasture/rangeland. These habitats have generally been altered from their original vegetation community structure and diversity as a result of crop production and livestock grazing. Agricultural crops provide an important food source for a variety of songbirds, waterfowl, and game birds. Amphibian species most likely to occur in these habitats include Blanchard's cricket frog (*Acris crepitans blanchardi*), Texas toad

(*Bufo speciosus*), Great Plains narrowmouth toad (*Gastrophryne olivacea*), and bullfrog (*Rana catesbeiana*). Terrestrial reptiles that may occur include the western glass lizard (*Ophisaurus attenuatus attenuatus*), six-lined racerunner (*Cnemidophorus sexlineatus*), keeled earless lizard (*Holbrookia propinqua*), Texas spotted whiptail (*Cnemidophorus gularis*), western coachwhip (*Masticophis flagellum testaceus*), ground snake (*Sonora semiannulata*), and western diamondback rattlesnake (*Crotalus atrox*). These vegetation communities provide habitat for a variety of bird species including crows, kites, vultures, gulls, wrens, starlings, orioles, warblers, sparrows, hawks, owls, woodpeckers, thrushes, and quail. Mammals commonly associated with these habitats include cottontail, black-tailed jackrabbit (*Lepus californicus*), armadillo (*Dasypus novemcinctus*), fulvous harvest mouse, raccoon, striped skunk, and coyote.

4.5.3.4 Mesquite Shrubland

Mesquite shrubland would be crossed by a small portion of the proposed pipeline. Amphibian species likely to occur in this habitat include Blanchard's cricket frog, Texas toad, Great Plains narrowmouth toad, and bullfrog. Reptiles that may occur in this habitat include the western glass lizard, six-lined racerunner, keeled earless lizard, Texas spotted whiptail, western coachwhip, ground snake, and western diamondback rattlesnake. Mammals commonly associated with this habitat type include black-tailed jackrabbit, rice rat, fulvous harvest mouse, common raccoon, striped skunk, and coyote.

4.5.3.5 Palustrine Wetland Habitat

Palustrine wetland habitat includes emergent wetlands that are associated with perennial and intermittent streams and isolated, depressional wetlands. Wetlands are discussed in detail in section 4.4.1 of this EIS. Common mammals associated with palustrine wetlands include the American beaver (*Castor canadensis*), swamp rabbit (*Sylvilagus aquaticus*), and rice rat. Some of the bird species commonly found in this habitat type include kites, crows, gulls, vultures, wrens, starlings, orioles, warblers, sparrows, owls, cuckoos, hawks, plovers, terns, swallows, sandpipers, osprey, ibis, and numerous species of ducks. Reptiles and amphibians commonly associated with freshwater wetlands include American alligator, bullfrog, cottonmouth (*Agkistrodon piscivorus*), eastern mud turtle (*Kinosternon subrubrum*) and yellow mud turtle (*Kinosternon flavescens*), cricket frog (*Acris spp.*), plainbelly water snake (*Nerodia erythrogaster*), snapping turtle (*Chelydra serpentina*), and green frog (*Rana clamitans*).

4.5.3.6 Potential Project Impacts on Terrestrial Wildlife

The impact of construction and operation of the proposed Project on terrestrial wildlife and wildlife habitats would vary depending upon the timing of construction and types of construction techniques used, as well as on the requirements of each species and the habitat present where various Project components would be constructed. In general, impact on terrestrial wildlife would be short term and minimal because no sensitive habitats would be affected, and much of the area affected by construction would be allowed to revert to the pre-construction habitat type following construction.

Vegetation clearing along the construction right-of-way for the pipeline could potentially impact nesting migratory birds protected under the Migratory Bird Treaty Act of 1918. The Migratory Bird Treaty Act implements various treaties and conventions for the protection of migratory birds. Under this act, taking, killing, or possessing migratory birds is unlawful. Biological surveys conducted by Ingleside San Patricio indicated that the Project area contains habitat for migratory birds. About 89.4 acres of open land would be crossed by the pipeline route. This land consists of grasslands and shrub/scrub vegetation which offers potential habitat for migratory birds. Ingleside San Patricio would conduct surveys of areas that could be used by migratory birds before construction. During operation of the pipeline, relatively little vegetation maintenance would be required due to the large percentage of agricultural land crossed. Ingleside San Patricio would avoid vegetation maintenance during the peak nesting period between March 1 and August 31 of any year. If vegetation clearing must be conducted during this time, Ingleside San Patricio would survey for all migratory bird nests prior to commencing work. To further protect nesting migratory birds, **we recommend that:**

- **If an active migratory bird nest is found along the construction right-of-way, Ingleside San Patricio should consult with the FWS to identify the most appropriate measure that should be taken to avoid or minimize impacts.**

Some smaller, less mobile wildlife, such as small mammals, amphibians and reptiles, would likely experience direct mortality during clearing and grading activities. Other wildlife, such as birds and larger mammals, would leave the immediate construction area when construction activities approach, and would move to similar habitats nearby. Wildlife would return to much of the Project area following construction and restoration. Operation of the Project would result in the permanent conversion of about 75 acres of upland habitat to industrial use, of which 74 acres would be within the LNG terminal site and the remaining 1.0 acres would be within the aboveground facilities associated with the pipeline. This conversion to industrial use would represent a loss of wildlife habitat; however, impacts of this loss would be minimal since the majority of the loss would be from the LNG terminal site where the existing habitat consists of disturbed and industrial areas that are covered with maintained lawn and crushed gravel and because large areas of suitable habitat are available adjacent to the Project site.

4.6 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Section 7 of the ESA requires a federal agency to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of a federally listed endangered or threatened species or result in destruction or adverse modification of the designated critical habitat of a federally listed species. The agency is required to consult with the FWS and NOAA Fisheries to determine whether any federally listed or proposed species or any critical or proposed critical habitat may occur in the Project area, and to determine the proposed action's potential effects on these species or critical habitats. If the Project would affect a listed species, the agency must report its findings to the FWS and NOAA Fisheries in a BA.

To assist FERC in complying with Section 7 of the ESA, Ingleside San Patricio consulted with the FWS and the NOAA Fisheries regarding the presence of federally listed threatened or endangered species and their critical habitats in the Project area. In addition, Ingleside San Patricio consulted with the TPWD regarding the presence of state listed threatened or endangered species in the Project area. The FERC staff also contacted FWS and NOAA Fisheries for assistance in determining which species under their jurisdiction would have the potential to be affected by the proposed Project.

In a letter to the FWS dated June 3, 2004, Ingleside San Patricio summarized its efforts to determine threatened and endangered species potentially affected by the proposed Project, and requested the FWS concurrence that the pipeline and LNG terminal would have no impact on threatened or endangered species or their critical habitat. In reply, on June 17, 2004, the FWS acknowledged that it had received Ingleside San Patricio's summary and its determination that the proposed Project would have no effect on federally listed species and that the FERC had complied with Section 7 of the ESA (FWS, 2004). However, more recent data, including the sighting of federally listed species in the project area, led FERC to reconsider the determinations of effect and reinitiate informal consultation with the FWS. FERC has not yet obtained concurrence on its determinations for species under FWS jurisdiction or for marine species under the jurisdiction of NOAA Fisheries.

We have requested that the FWS and NOAA Fisheries consider this EIS as our BA for the Project. The draft and final EIS has been provided to the appropriate FWS and NOAA Fisheries field offices for their review. Below is our assessment of potential effects of the Ingleside Energy Center LNG Project on federally listed endangered or threatened species, including FWS and NOAA Fisheries' comments on the draft EIS and their conservation recommendations.

4.6.1 Federally Listed or Proposed Threatened and Endangered Species

Based on the consultations described above, 22 federally listed endangered or threatened species potentially occur within the Project area. These include eight mammals (five whales, ocelot, Gulf Coast jaguarundi, and West Indian manatee), six birds (Eskimo curlew, brown pelican, bald eagle, whooping crane, piping plover, and least tern), six marine reptile species (loggerhead sea turtle, green sea turtle, leatherback sea turtle, Atlantic hawksbill sea turtle, Kemp's ridley sea turtle, and American alligator), and two fish (smalltooth sawfish and Gulf sturgeon).

Based on review of available literature and the results of field surveys conducted by Ingleside San Patricio during February and March 2004, we believe that the Project would have no effect on seven of these species because the Project would not be within the known range of the species or because the Project would not impact habitat for the species (table 4.6.1-1). These seven species are not addressed further in this EIS. The remaining 15 species are listed in table 4.6.1-2 and discussed below.

TABLE 4.6.1-1

Federally Listed Endangered and Threatened Species Eliminated From Further Consideration for the Ingleside Energy Center LNG Project

Species	Status a/	Reason for Elimination from Further Consideration b/	Determination
Mammals			
Ocelot (*Leopardus pardalis*)	F- E TX - E	Inhabits dense, thorny brush, mesquite-oak and oak forests, and partially cleared land. No ocelots or suitable habitat encountered during surveys.	No effect c/
Gulf Coast Jaguarundi (*Herpailurus yagouaroundi*)	F- E TX - E	Inhabits areas that are similar to the ocelot, dense, thorny brush, and chaparral. No jaguarundi or suitable habitat encountered during surveys.	No effect c/
Birds			
Eskimo Curlew *(Numenius borealis)*	F- E TX – E	Thought to be extinct.	No effect
Least Tern (*Sterna antillarum athalossos*)	F- E TX – E	Protection under the ESA and state regulation is restricted to "interior:" populations. Project is outside of the protected range.	No effect c/
Fish			
Smalltooth Sawfish (*Pristis pecinata*)	F-E	Project is within historic range of this species, but not within current range.	No effect
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	F-T	Range includes Gulf of Mexico east of Mississippi River. Project is outside of range.	No effect
Reptiles			
American alligator (Alligator mississippiensis)	F – T TX - NL	Wetlands, swamps, and marshes, along fresh waterbodies, and in coastal brackish water habitats.	No effect

a/ Status: F = Federal, TX = Texas, E = Endangered, T = Threatened.
b/ Ingleside San Patricio conducted habitat surveys during February and March 2004.
c/ FWS acknowledged determination of no effect, and stated that no further action is required from FWS (FWS, 2004).

4.6.1.1 Marine Mammals

Whales

Five federally protected species of whales may be found in the Gulf of Mexico off of the waters of Texas, off the continental shelf (see table 4.6.1-2). The distribution of the blue whale (*Balaenoptera musculus)* and sei whale (*Balaenoptera borealis*) are uncommon in the Gulf of Mexico. The blue whale's range extends from the Arctic Ocean to mid-latitude waters and is often sighted off of eastern Canada. There are only two records of the blue whale from the Gulf of Mexico, both from strandings, and both records have been questioned (TPWD, 2004a). The sei whale's range is in northern waters. The southern limits of its spring and summer range include the Gulf of Maine and Georges Bank. It is often found in the deeper waters of the continental shelf edge (NOAA, 2004a).

TABLE 4.6.1-2

Federally Listed Endangered, Threatened Species Potentially Occurring in the Ingleside Energy Center LNG Project Area

Species	Status a/	Preferred Habitat	Determination
Mammals			
Blue Whale (*Balaenoptera musculus*)	F- E TX – E	Deep waters off the continental shelf.	Not likely to adversely affect
Fin Whale (*Balaenoptera physalus*)	F- E TX – E	Deep waters off the continental shelf.	Not likely to adversely affect
Humpback Whale (*Megapetra novaeangliae*)	F - E	Deep waters off the continental shelf.	Not likely to adversely affect
Sei Whale (*Balaenoptera borealis*)	F - E	Deep waters off the continental shelf.	Not likely to adversely affect
Sperm Whale (*Physeter macrocephalus*)	F- E TX – E	Deep waters off the continental shelf.	Not likely to adversely affect
West Indian Manatee (*Trichechus manatus*)	F- E TX – E	Warm, shallow coastal waters, estuaries, bays, rivers, and lakes with water depths between 3 and 6 feet deep. Along the coast they may be found in water nine to 15 feet deep.	Not likely to adversely affect
Birds			
Brown Pelican (*Pelecanus occidentalis*)	F- E TX – E	Shallow coastal waters within 20 miles or less of the shoreline and in depths up to 80 feet.	Not likely to adversely affect
Bald Eagle (*Haliaeetus leucocephalus*)	F – T TX – NL	Coastal areas, rivers, and large bodies of water.	Not likely to adversely affect
Whooping Crane (*Grus americana*)	F- E TX – E	Winter habitat in Texas consists of brackish bays, marshes, and salt flats and upland areas with oak mottles, grassland swales, and ponds.	Not likely to adversely affect
Piping Plover (*Charadrius melodus*)	F – T TX – T	Ocean, river, and inland lake shorelines, sandy beaches, sandbars, dunes, and silty flats.	Not likely to adversely affect
Reptiles			
Loggerhead Sea Turtle (*Caretta caretta*)	F – T TX – T	Open seas over the continental shelf, bays, estuaries, lagoons, creeks, and mouths of rivers.	Not likely to adversely affect
Green Sea Turtle (*Chelonia mydas*)	F – T TX – T	Lagoons, bays, inlets, shoals, and estuaries, as well as coral reefs, rocky outcrops, and high-energy beaches.	Not likely to adversely affect
Leatherback Sea Turtle (*Dermochelys coriacea*)	F- E TX – E	Open sea, coastal waters, and sandy beaches with a deepwater approach.	Not likely to adversely affect
Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricata*)	F- E TX – E	Coastal reefs, bays, rocky areas, estuaries, lagoons at depths of 70 feet or less, and open sea.	Not likely to adversely affect
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	F- E TX – E	Shallow coastal and estuarine waters over sand or mud bottoms.	Not likely to adversely affect

a/ Status: F = Federal, TX = Texas, E = Endangered, T = Threatened, NL = No Listing.

The fin whale (*Balaenoptera physalus*) is common from Cape Hatteras north to the Gulf of Maine. In this area, fin whales may be the dominant large cetacean species year round, with the largest standing stock, food requirements, and impact on the marine ecosystem. It is likely that fin whales occurring in the eastern Atlantic undergo migrations into Canadian waters, open-ocean areas, and subtropical or tropical regions (NOAA, 2004a). There is only one record of a fin whale in Texas waters (TPWD, 2004a).

Humpback whales (*Megaptera novaeangliae*) can be found at their feeding grounds in the Gulf of Maine, Gulf of St. Lawrence, Newfoundland Labrador, and western Greenland during the spring, summer, and fall (NOAA, 2004a). Although humpback whales migrate to the West Indies for the winter, significant numbers of whales can be found in mid- and high-latitude regions. A number of wintering humpbacks occur in coastal waters of the southeastern U.S. (NOAA, 2004a).

Sperm whales (*Physeter macrocephalus*) are found throughout the world's oceans in deep waters to the edge of the ice at both poles. It has also been documented in the northern Gulf of Mexico during all seasons. Based on year-round occurrence of strandings, sightings, and catches, it is believed that sperm whales in the Gulf of Mexico may represent a distinct population (NOAA, 2004a). Sperm whales generally occur in waters greater than 590 feet and prefer continental margins, sea mounts, and areas of upwelling where food is abundant.

Although the whale species listed usually do not occur in relatively shallow waters such as near the Project, they could potentially be impacted by collisions with LNG vessels that are transiting to and from the terminal in the open Gulf. The probability of these species encountering LNG ships in the open ocean would be inherently low given their ability to avoid on coming vessels coupled with their overall rarity.

West Indian Manatee (*Trichechus manatus*)

The West Indian manatee is federally and state listed (in Nueces County) as endangered. Collisions with boat and ship hulls and/or propellers; entrapment in floodgates, navigation blocks, fishing nets, and water pipes; poaching; vandalism; ingestion of marine debris; and hunting have all contributed to the population decline of manatees. The low reproductive rate and loss of habitat have made it difficult for manatee populations to recover (COE, 2003).

Manatees prefer rivers or estuaries to marine habitats and inhabit warm, shallow coastal waters, estuaries, bays, rivers, and lakes. They prefer water depth between 3 and 6 feet, and along the coast they may be found in water that is nine to 15 feet deep. They primarily feed on submerged, emergent, and floating vegetation. Manatee populations in the U.S. primarily occur in Florida, where they are isolated from other populations due to the cooler water of the northern Gulf of Mexico and the deeper waters of the Straits of Florida. Manatees are extremely rare in Texas; however, during September 2001, a single manatee was observed in Corpus Christi Bay, between the Texas Aquarium and the Lexington Aircraft Carrier Museum (COE, 2003), about 12 miles southwest of the Project area. A manatee was reported in La Quinta Channel from June to August 2004.

Marine Mammal Conclusion

The possibility of the Project affecting a protected marine mammal is very remote. The greatest potential for impact would be as a result of a strike by an LNG vessel. To reduce the risk associated with vessel strikes or disturbance of protected species, Ingleside San Patricio would include the NOAA Fisheries *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy, to the extent practicable for large LNG ships, as part of its Terminal Use Agreement with LNG Ship operators. NOAA Fisheries recently issued this policy to address vessels involved in the transport of LNG in the Gulf of Mexico. This policy includes recommendations for vessel strike avoidance such as using a Gulf of Mexico reference guide that includes and helps identify the 28 species of whales and dolphins, five species of sea turtles, and the single species of manatee that may be encountered in the Gulf of Mexico Outer Continental shelf; maintaining a vigilant watch for marine mammals and sea turtles and slowing down or stopping vessels to avoid striking protected species; maintaining a distance of 150 feet for sea turtles or small cetaceans and 300 feet for whales; maintaining a parallel direction to the animal's course and avoiding excessive speed or abrupt changes in direction when protected species are in the area; reducing vessel speeds to 10 knots or less when pods or large assemblages of cetaceans are observed near an underway vessel; and reducing speed and shifting engines to neutral when protected species are sighted in the vessel's path or near a moving vessel. In addition, the policy requires that crews report sightings of any injured or dead protected species immediately to the Mammal and Sea Turtle Stranding Hotline or the Marine Mammal Stranding Network. We discuss impacts on marine species in section 4.5.1.5 and have included a recommendation in section 4.6.1.3 to avoid the possibility of harm to protected marine mammals. We believe that construction and operation of the Ingleside Energy Center LNG Project is not likely to adversely affect protected marine mammals.

In comments provided to the FERC, the FWS recommended additional measures for the protection of the West Indian manatee. The FWS recommended that Ingleside San Patricio provide training to LNG personnel on avoiding potential impact to the West Indian manatee. **We recommend that:**

- **Ingleside San Patricio provide training for all personnel involved in construction and operation of the LNG terminal on measures to avoid potential impacts to the West Indian manatee, prior to site preparation at the LNG terminal. This training should 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 FWS in the event that a manatee is sighted in or near the Project area.**

In its informal consultation for this project, NOAA Fisheries offered recommendations to avoid potential noise-related impacts on sea turtles that would also apply to marine mammals (see discussion in section 4.6.1.3).

4.6.1.2 Birds

Brown Pelican *(Pelecanus occidentalis)*

The brown pelican is federally and state listed as endangered. This species was listed throughout its range as chlorinated hydrocarbon residues from pesticide use and loss of habitat due to human disturbance resulted in population declines. The 1972 ban on dichlorodiphenyltrichloroethane (DDT) use and efforts to conserve and improve remaining populations has resulted in an increase in the numbers of this species (National Wildlife Federation, 2004a).

Brown pelicans inhabit shallow coastal waters with depths up to 80 feet. They are rarely found inland and do not venture more than 20 miles out to sea except to take advantage of exceptional foraging conditions. They are colonial nesters with a preference to nest in small bushes and trees on undisturbed offshore islands that are free from human disturbance, flooding, and terrestrial predators. Occasionally, they do nest on the ground. Brown pelicans will loaf and roost on beaches, sandbars, sandpits, mudflats, and man-made structures such as piers, wharves, pilings, oil/gas platforms, and docks (COE, 2003).

Brown pelicans are a common resident along the Texas Gulf coast. Pelican Island, located about 5 miles southeast of the Project area in Corpus Christi Bay, is a known brown pelican nesting area. Potential brown pelican breeding habitat was not identified within the Project area during Ingleside San Patricio's habitat surveys, and no brown pelicans were observed. However, brown pelicans would be expected to utilize areas of the La Quinta Channel and shoreline in the vicinity of the LNG terminal site for foraging. Since brown pelicans are considered a highly mobile species and there is an abundance of foraging and nesting habitats within Corpus Christi Bay, we believe that construction and operation of the Ingleside Energy Center LNG Project is not likely to adversely affect brown pelicans.

Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle is currently classified as a federally threatened species but it is proposed for delisting in the near future. Several factors such as shooting, habitat alteration, and organochloride pesticide effects on breeding biology were responsible for population declines of this species. Over the recent years, bald eagle populations have been on the rise given that mortality through shooting is on the decline; new wintering and non-nesting habitats have been, and continue to be, created by reservoir construction; and the use of DDT and other organochloride pesticides has been banned since 1972 (COE, 2003).

Bald eagles inhabit coastal areas, rivers, and large bodies of water. Because fish and waterfowl comprise the majority of the bald eagle's diet, nest sites are rarely far from these types of water habitats. Bald eagles generally build their nests in trees in woodlands, woodland edges, or open areas. They have been known to nest on cliffs, rock pinnacles, and although rare, on man-made structures. The bald eagle winters near lakes and major river systems or, if there is an abundant supply of terrestrial prey, they may winter in areas where there is little or no water (COE, 2003).

The bald eagle ranges over the U.S. and Canada. Two subspecies are recognized, northern and southern bald eagle, based on size and weight. The northern population nests from central Alaska to northern U.S. and many migrate south for the winter. The southern population nests from New Jersey to California and tend to be more resident during the winter; however, some

northward migration during the summer has been documented. The southern subspecies nests along the Texas Gulf coast. A 1999 bald eagle nesting survey conducted for the TPWD identified 82 statewide nesting areas with the southernmost area in Refugio, Goliad, Victoria, and Matagorda Counties (COE, 2003). These counties are between 30 and 100 miles north-northwest of the Project area. Wintering bald eagles have been noted as far south as Cameron County, about 100 miles south of the Project area, and they are a rare permanent resident in Coastal Bend. Bald eagle nest sites were not identified within the Project area during Ingleside San Patricio's habitat surveys. If the bald eagle were to occur in the Project area, it would be as a rare migrant or post-nesting visitor. Therefore, we believe that construction and operation of the Ingleside Energy Center LNG Project is not likely to adversely affect bald eagles.

Whooping Crane (*Grus americana*)

The whooping crane is federally and state listed as endangered. Conversion of critical habitat to agriculture, disturbance to nesting areas by humans, uncontrolled hunting, and powerline collisions all contributed to a decline in whooping crane populations. Delayed sexual maturity and small clutch size prevent rapid population recovery of this species. Risks to the main population while in Texas include chemical spills along the GIWW, contaminated food on their wintering grounds, and severe weather events (COE, 2003).

Designated critical habitat occurs in Aransas National Wildlife Refuge (NWR) in Aransas, Calhoun, and Refugio Counties, which are between 30 and 60 miles northeast of the Project area. This habitat is used during the winter and consists of brackish bays, marshes, and salt flats that provide a variety of plant and animal foods such as blue crabs, clams, and berries. Whooping cranes may use upland areas with oak mottles, grassland swales, and ponds that provide foods such as snails, crayfish, and insects. Other habitats used by whooping cranes are located in Matagorda Island, Isla San Jose, parts of the Lamar Peninsula, and Welder Point on the east side of San Antonio Bay, located about 50 miles northeast of the Project area. The central and eastern Panhandle provides a major stopover area for migrating birds. Whooping cranes in south Texas are generally restricted to the Aransas NWR (COE, 2003). San Patricio and Nueces Counties are located outside of the whooping crane migration range. No individuals or suitable breeding habitat was observed during field or site visits in the Project area. We believe that construction and operation of the Ingleside Energy Center LNG Project is not likely to adversely affect whooping cranes.

Piping Plover *(Charadrius melodus)*

The piping plover is federally and state listed as threatened. Decline in the piping plover population has resulted from over-hunting during the early 1900s, habitat loss or modification due to human development, alteration of river and wetland systems, and predation. Piping plovers inhabit shorelines of oceans, rivers, and inland lakes and nest on a variety of sites including sandy beaches, sandbars, dunes, and silty flats. During the winter, they utilize beaches, mud and sand flats, and offshore spoil islands. The piping plover breeds on the northern Great Plains, in the Great Lakes, and along the mid- to north- Atlantic coast, and winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico. They arrive at their Texas wintering grounds during mid- to late-July and spend a majority of their time on sand and mud flats near sandy beaches. They feed on tidal flats during low tide and Gulf beaches during high tide (COE, 2003).

San Patricio and Nueces Counties are two of the twelve counties in Texas where concentrations of piping plover occur. Four sites in Corpus Christi Bay have been found to harbor wintering piping plover populations: Port Aransas (15 miles east of the Project area), Fish Pass (13 miles southeast of the Project area), Oso Bay (13 miles southwest of the Project area), and sites along the GIWW (COE, 2003). Several sites around Corpus Christi Bay have also been designated as critical habitat for the wintering piping plover, with the closest designated critical habitat being Indian Point about 6 miles west of the LNG terminal site. No piping plovers were observed within the Project area during Ingleside San Patricio's habitat surveys conducted during February and March 2004; however, potential piping plover habitat (tidal flats) was noted within the Project area. Piping plover could potentially rest and forage on or near the proposed Project site. About 3.08 acres of tidal flats within the proposed LNG terminal would be affected by excavation and dredging to construct the LNG ship berth. All impacts to tidal flat habitat would be permanent; therefore, no on-site restoration of tidal flats would occur.

Ingleside San Patricio has consulted with the COE, EPA, FWS, TPWD, NOAA Fisheries, TGLO and CBBEP to determine the measures that would be implemented to mitigate for lost aquatic resources, including tidal flats. Based on its consultations, Ingleside San Patricio prepared a draft wetland mitigation plan, which proposes to provide funding for the purchase of two tracts of land totaling 32.83 acres from the Portland Harbors Corporation. Ownership of the land would be maintained by a government entity or conservation organization/land trust with restrictive covenants to assure wetland preservation. Tract Nos. 2 and 3 are adjacent to TX-13 Critical Habitat Unit for the federally threatened piping plover and piping plovers may occasionally use the tidal flats within these two tracts. Since Tract Nos. 2 and 3 would be preserved, we believe this would be a beneficial effect and mitigation activities within these areas may affect, but are not likely to adversely affect piping plovers.

We have recommended that Ingleside San Patricio file its final wetland mitigation plan with the Secretary, prior to construction. To further protect piping plover, **we recommend that:**

- **During the wintering months (August through April) for piping plovers, Ingleside San Patricio should have a biologist on-site during construction in tidal flats to assist employees in avoiding any impacts to piping plovers during construction of the LNG terminal.**

In addition, **we recommend that**:

- **Any activities at the mitigation site should be conducted outside of the piping plover wintering season (August through April) and during the summer months (May through July) when piping plovers are not present.**

We believe that construction and operation of the Ingleside Energy Center LNG Project is not likely to adversely affect piping plovers.

4.6.1.3 Marine Reptiles

Sea Turtles

While sea turtles are well known from the Gulf of Mexico, their occurrence in the Project area is incidental. Nesting sea turtles are improbable in the Project area and impacts during nesting are

unlikely. With this in mind, we believe that the Project would not adversely impact sea turtles. The most likely affect on sea turtles from the proposed Project, albeit minimal, is for LNG tankers to strike a swimming turtle. This potential impact is discussed further below.

Loggerhead Sea Turtle (*Caretta caretta*)

The loggerhead sea turtle is federally and state listed as threatened. The greatest threats to this sea turtle are coastal development, commercial fisheries, and pollution. Loggerhead sea turtles inhabit continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, their range extends from Newfoundland to as far south as Argentina. The primary nesting sites in the Atlantic Ocean are along the east coast of Florida. Additional sites occur in Georgia, the Carolinas, and the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported ranging from Alaska to Chile (NOAA, 2004b; COE, 2003).

Mating takes place in late March-early June, and eggs are laid throughout the summer. After hatching, loggerhead hatchlings move to the sea and commonly float on sargassum masses for three to five years. Subadults occupy near-shore and estuarine habitats, whereas adults occupy a variety of habitats that range from turbid bays to clear water. Loggerhead sea turtles feed on a variety of benthic and pelagic food. The young feed on prey such as gastropods, crustacean fragments, and sargassum, while adults mainly forage on the bottom but will feed on jellyfish from the surface. Loggerhead sea turtles nest on open, sandy beaches above the high tide mark and seaward of well-developed dunes. They prefer steeply sloped beaches with gradually sloped offshore approaches (NOAA, 2004b; COE, 2003).

In Texas, loggerheads are considered to be the most abundant sea turtle, favoring shallow inner continental shelf waters. They have been recorded in Nueces County and Corpus Christi Bay and may be present in Texas marine waters year-round; however, they are most noticeable during the spring when Portuguese-Man-of-War are abundant (COE, 2003). Suitable nesting habitat for this species is not available on the proposed Project site.

Green Sea Turtle (*Chelonia mydas*)

The green sea turtle is federally and state listed as threatened. Commercial harvest of eggs and food is the greatest threat to this species, as well as collection for body parts used for leather and jewelry, and stuffing of whole small turtles. Population recovery is hindered by the incidental take of green sea turtles during shrimp harvests, and epidemic outbreaks of tumor infections have caused a severe threat to the population. Green sea turtles inhabit shallow habitats with an abundance of marine algae and seagrass such as lagoons, bays, inlets, shoals, and estuaries. They use coral reefs and rocky outcrops near feeding areas to rest, and they feed on marine plants, mollusks, sponges, crustaceans, and jellyfish. They tend to nest on their natal beach (NOAA, 2004b; COE, 2003).

Green sea turtles are circumglobal species in tropical and subtropical waters. In the eastern U.S., they are found ranging from the Virgin Islands to Massachusetts. In Texas, small numbers of green sea turtles can been found in Matagorda Bay, Aransas Bay, and the lower Laguna Madre. Although this species has been recorded in Corpus Christi Bay, green sea turtle nests in Texas are rare (NOAA, 2004b; COE, 2003). Suitable nesting habitat for this species is not found on the proposed Project site.

Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle is federally and state listed as endangered. Overexploitation by man and incidental mortality due to shrimping and fishing activities have contributed to a decline in the population, as has degradation and disruption of nesting habitat and egg collection. Leatherback sea turtles spend most of their time in the open sea and come to land to nest. They may be found in coastal waters only when nesting or following jellyfish concentrations. They feed mainly on jellyfish and sea squirts as well as sea urchins, crustaceans, fish, and floating seaweed and prefer sandy beaches with a deepwater approach for nesting (NOAA, 2004b; COE, 2003).

Leatherback sea turtles are one of the widest-ranging sea turtles; its range extends from Cape Sable, Nova Scotia, south to the U.S. Virgin Islands. To optimize both foraging and nesting opportunities, they will migrate between boreal, temperate, and tropical waters. Although leatherback sea turtle sightings have been recorded in Nueces County, this species is rare along the Texas coast and no nest sites have been recorded in more than 60 years (NOAA, 2004b; COE, 2003). Suitable nesting habitat for this species is not available on the proposed Project site.

Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricata*)

The Atlantic hawksbill sea turtle is federally and state listed as endangered. The greatest threat to this population has been the harvest of turtles to supply the tortoise shell market and stuffed turtle curios. It is also used to manufacture leather, oil, perfume, and cosmetics. This species inhabits coastal reefs, bays, rocky areas, estuaries, and lagoons at depths of 70 feet or less. Hatchlings may be found in the open sea floating on masses of marine plants while juveniles, subadults, and adults may found near coral reefs, their primary foraging area. They prefer to feed on invertebrates such as sponges, mollusks, and sea urchins, even though they are omnivorous. Atlantic hawksbill come to land to nest and prefer undisturbed, deep sand beaches, from high-energy beaches to small pocket beaches bounded by crevices of cliff walls with woody vegetation near the waterline (NOAA, 2004b; COE, 2003).

Atlantic hawksbill sea turtle are circumtropical and occur in the tropical and subtropical areas of the Atlantic, Pacific, and Indian Oceans. This species 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. Post-hatchlings and juveniles are seen with some regularity in Texas and Florida, in areas primarily associated with stone jetties (NOAA, 2004b). Although Atlantic hawksbill sea turtle sightings have been recorded in Corpus Christi Bay, they are unlikely to occur in the Project area. Suitable nesting habitat for this species is not available on the proposed Project site.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

The Kemp's ridley sea turtle is federally and state listed as endangered. Collection of eggs, capture for meat and other products, direct take for indigenous use, ingestion of man-made materials, collision with boats, and disturbance or destruction of nesting areas are all factors that have contributed to the decline of this species. Despite these factors, the population appears to be in the early stages of recovery. Kemp's ridley sea turtle inhabit shallow coastal and estuarine

waters over sand or mud bottoms. Juveniles feed on sargassum while adults are largely shallow-water benthic feeders. Food items include shrimp, snails, bivalves, jellyfish, and marine plants. (NOAA, 2004b; COE, 2003).

Juvenile Kemp's ridley sea turtle may range throughout the Atlantic Ocean, while adults are restricted to the Gulf of Mexico. The majority of this species nests along an 11-mile-long stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, about 190 miles south of the Rio Grande and 315 miles south of the Project area, and a secondary nesting area occurs at Tuxpan, Vera Cruz about 450 miles south of the Project area. Sporadic reports of nesting areas from Mustang Island, Texas south to Isla Aquada, Campeche have been documented as well. This species occurs in Texas in small numbers and has been recorded in Corpus Christi Bay. It may be transient between crustacean-rich feeding areas in the northern Gulf of Mexico and breeding grounds in Mexico (NOAA, 2004b; COE, 2003). Suitable nesting and foraging areas for this species are not found on the proposed Project site.

Offshore Sea Turtle Impacts

Sea turtles would be a rare visitor to the Project area. Many of the sea turtles discussed have feeding, swimming, or resting behaviors that keep them near the surface, where they can be vulnerable to boat strikes. In the open waters of the Gulf, the LNG tankers would represent an incrementally small increase in boat traffic over current conditions, relative to the area traversed by sea turtles. Several hundred more transits of the Gulf of Mexico per year by LNG tankers, when compared to the tens of thousands of vessel transits per year under current conditions, represent a miniscule increase in potential boat strike risk for sea turtles in the Gulf. On approach to the Corpus Christi Channel, vessel speeds are minimal so that boat strike hazards are reduced, even when considering the additional vessel traffic posed by the LNG tankers.

NOAA Fisheries recently issued a policy titled *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* that pertains to vessels involved in the transport of LNG in the Gulf of Mexico. To help reduce the risk associated with vessel strikes or disturbance of protected species, Ingleside San Patricio would include the NOAA Fisheries *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting* policy as part of its Terminal Use Agreement with LNG Ship operators.

If the rare occurrence of the species were to overlap with the rare incidence of a spill, a turtle could be at risk due to effects of respiration, skin, blood chemistry, and salt gland function (NOAA, 2004b). Ingleside San Patricio's SPCC Plan would address potential spills of fuel, lubricants, and other hazardous materials and describe spill prevention practices, spill handling and emergency notification procedures. Implementation of Ingleside San Patricio's SPCC Plan would protect turtles from this potential impact. The Project would not include water intake or discharge that could pose an entrainment risk or directly impact sea turtles. Dredging could result in habitat destruction by disrupting nesting or foraging grounds. Dredging activities during construction would be temporary and local in nature because dredging would be confined to the proposed maneuvering area in La Quinta Channel and maintenance dredging would only occur periodically. Artificial lighting could cause disorientation of adults and hatchlings thereby increasing the chances of death or injury for some individuals. Female turtles looking for nesting sites tend to avoid intensely lit and highly developed areas, whereas turtle hatchlings tend to be attracted to light and orient themselves toward a light source (NOAA, 2004b). Lighting from the

proposed LNG terminal and LNG ships would not adversely impact sea turtles since the occurrence of sea turtles in the Project area is incidental, and suitable nesting areas are not present on the Project site. In addition, no nesting habitat would be affected by the Project, and the FWS has concurred that the Project would have no effect on nesting sea turtles (FWS, 2004).

NOAA Fisheries, which has ESA jurisdiction for offshore swimming sea turtles, has been contacted by the FERC and sent a copy of the draft EIS. Through informal consultation, NOAA Fisheries identified pile driving as having the potential to affect sea turtles. Although suitable nesting or foraging grounds are not present on the proposed Project site, and sea turtles would be expected to largely avoid the dredged area during pile driving activities, a potential exists for sea turtles to be injured during the first several strikes of the pile driving hammer. To avoid the possibility of harm to sea turtles, as well as marine mammals, NOAA Fisheries recommends that Ingleside San Patricio utilize measures to reduce sound transmission into the water or perform monitoring to ensure no listed species are present in the zone of potential impact. Two recommended options to reduce sound transmission into the water include:

a. use of a bubble curtain system that must surround the piles being driven at all times, and must be effective at reducing peak sound pressure levels to at least 175 decibels (re 1 μPa) outside of the bubble curtain; or

b. use of a smaller hammer type to reduce the sound produced by pile driving. Given any hammer type used to drive the piles, peak sound pressure levels will be monitored during pile driving to ensure that they do not exceed 175 decibels (re 1 μPa) from the noise source. A monitoring report would be submitted to NOAA Fisheries Southeast Regional Office.

Alternatively, Ingleside San Patricio could perform monitoring of the area prior to pile driving activities to ensure no sea turtles or marine mammals are present in the zone of potential impact. NOAA Fisheries recommends that any monitoring protocol implemented include the following measures:

a. an observer dedicated to conduct sea turtle and marine mammal observations, posted to monitor for species presence;

b. a 225 meter 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 225 meter zone, pile driving would be delayed until the animal is observed to have left and on a heading away from the established zone. If an animal dives and cannot be resighted, pile driving may begin 30 minutes after the last sighting or until the 60-minute observation period 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 would be repeated (see b. above);

d. pile driving would not be started during nighttime hours (sunset to sunrise). Pile driving begun during the day that continually occurs into the night, may continue through the night until the hammer activity ceases; and

e. all animals must be allowed to exit the 225 meter radius under their own volition.

Ingleside San Patricio would 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 225 meter zone. All records would be available to NOAA Fisheries or FERC upon request.

To avoid the possibility of harm to listed species, **we recommend that:**

- **Ingleside San Patricio should prepare a plan consistent with NOAA Fisheries recommendations to minimize potential impacts on sea turtles and marine mammals from driving piles during construction of the marine terminal. The plan should include measures to reduce sound transmission into the water (*e.g.*, air bubble curtains, limitations on the type of hammer used, reductions in force applied to the pile) or a monitoring protocol to ensure listed species are not present in the zone of potential affect. The plan should be approved by NOAA Fisheries and filed with the Secretary for review and written approval by the Director of OEP <u>prior to construction of the LNG terminal</u>.**

With adherence to our recommendations, we believe that the Project is not likely to adversely affect sea turtles.

4.6.2 State Listed Threatened or Endangered Species

Ingleside San Patricio consulted with the TPWD to determine the potential for occurrence of state listed species within the vicinity of the proposed Project. In a letter dated July 2, 2004, TPWD identified the ocelot (federal and state endangered, see table 4.6.1-1) and five state listed threatened species that could potentially be affected by the project if suitable habitat is present (TPWD, 2004b). These species are listed in table 4.6.2-1 and discussed in the following sections.

TABLE 4.6.2-1

State Listed Species Potentially Affected by the Ingleside Energy Center LNG Project

Species	State Status in San Patricio County a/	State Status in Nueces County a/
White-tailed Hawk (*Buteo albicaudatus*)	T	T
Texas Horned Lizard (*Phrynosoma cornutum*)	T	T
Texas Scarlet Snake (*Cemophota coccinea lineri*)	T	T
Indigo Snake (*Drymarchon corais*)	T	T
Texas Tortoise (*Gopherus berlandieri*)	T	T

a/ Status: T = Threatened.

White-Tailed Hawk (*Buteo albicaudatus)*

In Texas, population declines of white-tailed hawk are primarily due to grassland habitat conversion to agriculture and an increase in brushy cover within remaining open grasslands. Over the past four decades, brush removal efforts have produced more favorable habitats for this species. In the southern and central counties of Texas, and north towards Galveston, white-tailed hawk inhabit coastal grasslands. They prefer saltgrass flats near the Gulf of Mexico and dry grassy mesquite-live oak savannahs inland (USGS, 2004). They perch on bushes, dead trees, fence posts, and utility structures and prey on small mammals, lizards, and insects. Their breeding season is from March to May, and their nest consists of grass-lined sticks in low bushes or small trees or cactus (National Wildlife Federation, 2004b). Ingleside San Patricio did not observe the white-tailed hawk or identify suitable habitat for this species during its habitat surveys.

Texas Horned Lizard (*Phrynosoma cornutum*)

The Texas horned lizard ranges from the south-central U.S. to northern Mexico. This species historically occurred throughout Texas in arid and semiarid habitats with flat, open terrain, scattered vegetation, and sandy or loamy soils (TPWD, 2004c). Although the presence of Texas horned lizard was not observed during Ingleside San Patricio's habitat surveys, there is a potential for this species to occur along the proposed pipeline.

Texas Scarlet Snake *(Cemophota coccinea lineri)*

The Texas scarlet snake occurs in extreme eastern and south Texas. It prefers hardwood, mixed, or pine forest and adjacent open areas with loose, sandy soils that support thickets of live oaks, honey mesquite, huisache and prickly pear, and watermelon patches (National Wildlife Federation, 2004c). According to information filed with the Commission, Ingleside San Patricio did not survey specifically for this species during its field surveys of the Project area. However, based on the general vegetation types identified during Ingleside San Patricio's field surveys, potential habitat for this species occurs along the proposed pipeline.

Indigo Snake *(Drymarchon corais)*

Loss of habitat is the main threat to the indigo snake. It is primarily a resident of Mexico, but occurs peripherally in the U.S., where it prefers the vast mesquite grassland savannah near streams, ponds, and windmill seeps (Texas Tech University, 2004). They frequently use rodent burrows for shelter. Although the presence of indigo snake was not observed during Ingleside San Patricio's habitat surveys, there is a potential for this species to occur along the proposed pipeline.

Texas Tortoise *(Gopherus berlandieri)*

Over the years, this species of tortoise has been heavily collected for the pet trade. It is found from south Texas into Mexico and inhabits scrub woodlands with sandy soils and chaparral and mesquite habitats. To protect itself from the midday sun, Texas tortoise will modify existing animal burrows or create a vegetative cover by scraping at the base of vegetation. This species nests from April to September and lays its eggs deep under overhanging bushes (National Wildlife Federation, 2004d). One Texas tortoise was observed during Ingleside San Patricio's

habitat surveys on the coastal flats south of the LNG terminal site. Based on the general vegetation types identified during Ingleside San Patricio's field surveys, potential habitat for this species also likely occurs along the proposed pipeline, although no burrows were identified. If Texas tortoise is encountered during construction, Ingleside San Patricio would stop clearing activities, survey the area to ensure no other individuals may be encountered, and relocate the tortoise outside of the Project area using a trained biologist.

4.6.3 Conclusions and Recommendations for Threatened, Endangered, and Other Special Status Species

A variety of measures have been proposed by Ingleside San Patricio that would minimize environmental impacts to federally and state listed species, including following our Plan and Procedures, locating most of the permanent aboveground facilities in previously disturbed areas and implementing a SPCC Plan. These measures would reduce the loss of vegetated habitats, minimize marine sediment disturbance and resulting water quality impacts, and minimize delay in restoration of areas temporarily disturbed during construction, such as along the pipeline route. While beneficial to general wildlife, fisheries, and vegetation in the area, these measures would also benefit listed species with the potential to occur in the Project vicinity.

Except for areas underlying permanent aboveground facilities and about 5.54 acres of estuarine and palustrine vegetation, all areas disturbed by construction would be returned to pre-construction conditions, which would restore habitat value of these temporarily disturbed areas. Those areas converted for use as permanent aboveground facilities are currently in agriculture or previously disturbed industrial areas with minimal wildlife habitat value. Implementation of the mitigation measures proposed to protect wildlife, aquatic resources, and habitat as described in section 4.5 of this EIS would be sufficient to prevent significant adverse effects on threatened and endangered species. Therefore, we believe that the Project would have no effect or would not be likely to adversely affect any federally or state listed threatened or endangered species. However, because consultation with FWS and NOAA Fisheries has not yet been completed, **we recommend that:**

- **Ingleside San Patricio not begin construction of the pipeline or LNG terminal until:**
  - **a. Ingleside San Patricio conducts a threatened and endangered species survey along portions of the construction right-of-way where access has been denied and files an amended field survey with the FWS and the Secretary;**
  - **b. the staff completes any necessary consultations with FWS and NOAA Fisheries; and**
  - **c. Ingleside San Patricio has received written notification from the Director of OEP that construction and/or implementation of conservation measures may begin.**

In addition, **we recommend that:**

- **If facilities are not constructed within one year from the date of issuance of the authorization from the Director of OEP that construction may begin, Ingleside San Patricio should consult with the appropriate offices of FWS and NOAA Fisheries to verify that previous consultations and determinations of effect are still current.**

4.7 LAND USE, RECREATION, AND VISUAL RESOURCES

The Ingleside Energy Center LNG Project would be located along the northeast shoreline of Corpus Christi Bay in San Patricio and Nueces Counties, Texas. The LNG terminal would be about 1.5 miles northwest of the City of Ingleside and about 5 miles southeast of the Cities of Portland and Gregory. It would be adjacent to the Occidental Chemical manufacturing complex to the north, a Navy dredge disposal area to the east, privately owned undeveloped industrial land to the south, and the La Quinta Channel to the west. The LNG terminal facility would be located on 74 acres of a 1,196 acre-site owned by Occidental Chemical.

The proposed 26-inch-diameter pipeline would extend from the LNG terminal and run in a north-northwesterly direction for about 26.4 miles to its end point north of the City of Sinton. Between MPs 0.0 and 1.0 the pipeline would be to the northwest of the City of Ingleside. Between MPs 6.0 and 7.0 it would be northeast of the City of Gregory and between MPs 14.0 and 15.0 it would be northeast of the City of Taft. About 22.9 miles of the pipeline route (86.7 percent) would be adjacent to and parallel with existing utility or road rights-of-way. About 70 percent of the pipeline route would cross agricultural land.

4.7.1 Land Use

Most of the land affected by the Project is industrial and open land at the LNG terminal and agricultural land along the San Patricio Pipeline. Construction would affect a total of 489.7 acres of land for the LNG terminal and the pipeline, of which 19 acres would be land converted to open water for the LNG ship berth and construction of a dock. In addition, 40 acres of water would be deepened in La Quinta Channel for the maneuvering area. Operation of the Project would affect about 189.7 acres of land, of which 159.7 acres would be affected by the permanent pipeline right-of-way, 27.6 acres would be converted permanently to industrial use for the LNG terminal, and 1.0 acre would be permanently converted to industrial use for operation of the aboveground facilities associated with the pipeline. About 46.4 acres of land at the LNG terminal site would remain as open space.

4.7.1.1 LNG Terminal

Existing land uses at the proposed LNG terminal site include a mixture of open water, industrial and open land. A total of about 114 acres of land and water would be required for the construction and operation of the LNG terminal. Of this amount, about 40 acres would be open water and 74 acres would be industrial and open land. Table 4.7.1.1-1 shows acreage and land use for the proposed terminal site.

The LNG ship berth would be excavated and dredged from land owned by Occidental Chemical while the maneuvering area would be dredged from property owned by the PCCA in La Quinta Channel.

The Occidental Chemical manufacturing complex is zoned for industrial use and includes facilities owned and operated by DuPont (freon manufacturing), Air Liquide (air separation), and ICLP who operate a 400-megawatt plant that supplies power and steam to the manufacturing complex and electric grid. Access to the LNG terminal site would be by way of State Route 361 and the existing access road for the Occidental Chemical manufacturing complex including

Edwards Road, which is a private road that leads into the Occidental Chemical manufacturing complex. Materials and equipment needed for the marine facilities would be delivered to the Project site and constructed from working marine barges. All other required materials would be transported to the site via truck or rail.

TABLE 4.7.1.1-1

Land Use Within the LNG Terminal Site

LNG Terminal Component	Current Land Use	Estimated Acreage
Onshore Components:		
LNG Storage Tanks	Industrial /Open land	1.3
Process Area	Industrial /Open land	4.6
LNG Transfer Lines and Pipe Racks	Industrial /Open land	2.0
Electrical Substation	Industrial /Open land	0.7
LNG Ship Berth (to be excavated)	Industrial /Open land	19.0
Open Space within the Terminal Site	Industrial /Open land	46.4
Subtotal		**74.0**
Offshore Components:		
LNG Ship Maneuvering Area	Open Water (La Quinta Channel)	40.0
Total		**114.0**
Dredge Materials Placement Areas	Open land	To be determined

During construction of its LNG terminal, Ingleside San Patricio would temporarily use one construction yard located at MP 1.6 of the San Patricio Pipeline (see section 4.7.1.2 below). Construction and operation of the LNG terminal would have minimal impacts on land use since the site is industrial and open land associated with the adjacent Occidental Chemical manufacturing complex. The open water in La Quinta Channel that would be utilized for the maneuvering area would remain open water and it would be dredged to a deeper depth. The construction of the marine basin would affect coastal marsh and aquatic vegetation. The mitigation of those impacts is discussed in section 4.4.1 of this EIS. The only land that would be converted to a different use would be the industrial and open land where the LNG ship berth would be excavated and dredged and onshore portions of the site where the storage tanks, process area, transfer lines and pipe racks, and electrical substation would be constructed.

4.7.1.2 Pipeline

Existing land uses along the pipeline right-of-way consist primarily of agricultural land with some industrial uses, and open space. Ingleside San Patricio proposes to use a 100-foot-wide construction right-of-way in upland areas and a 75-foot-wide right-of-way in wetlands.

Construction of the pipeline would affect a total of about 375.7 acres of land, including the pipeline construction right-of-way and additional temporary extra workspaces (see table 4.7.1.2-1). Construction of the ten proposed meter stations, at nine interconnect/delivery points, would affect about 1.6 acres of agricultural land, 0.23 acre of industrial land, and 0.23 acre of open land. Access to the pipeline construction areas would be along existing public and private roads. Ingleside San Patricio would use seven existing access roads of which six would require improvement (see table 2.3.2.3-1). Improvement activities would take place within the existing road footprint, which consist of about 29 acres of agricultural, pasture, and range land.

Ingleside San Patricio would use one pipe storage and contractor warehouse yard, a 6.9-acre tract of open space at MP 1.6. This tract is located at the southeast corner of State Route 361 and Edwards Road and would be used temporarily during construction of the Project, the land use would not be impacted by operation of the Project.

Agricultural lands would be the primary land use affected by construction of the pipeline and associated aboveground facilities (256.6 acres, 68.3 percent). The remaining land uses that would be affected consist of open lands (113.9 acres, 30.3 percent), and industrial lands (5.2 acres, 1.4 percent).

Typical crops grown in the Project area include sorghum and cotton. No special crops or orchards were identified along the pipeline route that would require unique construction techniques. The pipeline trench would range between 5 and 7 feet in depth and could be 10 to 30 feet wide, depending on soil types. Minimum cover requirements over the pipeline would be 3 feet in upland areas and 4 feet below the bottom of stream channels.

Land use impacts associated with the pipeline and associated aboveground facilities include disturbance of existing land use, creation of new easements, and conversion of some land to another use. About 160.9 acres of land would become part of the permanent right-of-way for San Patricio's pipeline and related facilities (see table 4.7.1.2-1). About 1.0 acre of agricultural land and open space would be permanently converted to industrial use for the operation of the meter stations and MLVs. We do not consider this to be a significant impact because the surrounding land remains agricultural. About 375.7 acres of land would be temporarily affected during construction of the pipeline and related facilities. However, after construction, these lands would be restored to their previous condition and use. In the case of agricultural lands, outside of aboveground facilities, crops could be planted over both the permanent pipeline right-of-way and the temporary workspace. Herbaceous freshwater wetlands would also be restored, along with irrigation ditches, canals, and creeks, with no net wetland loss along the pipeline (see section 4.4.1 of this EIS).

About 22.9 miles of the pipeline route (86.7 percent) would be adjacent to and parallel with existing utility or road rights-of-way. Following construction, a 50-foot-wide right-of-way would be maintained adjacent to the existing utility corridor to operate and maintain the new pipeline. No overlap of the proposed right-of-way with existing rights-of-way is anticipated.

TABLE 4.7.1.2-1

Land Use Affected by Construction and Operation of the Proposed San Patricio Pipeline a/

Facility	Agricultural		Open		Industrial		Total	
	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
San Patricio Pipeline	229.4	111.9	89.4	42.1	4.8	5.7	323.6	159.7
San Patricio Meter Station b/	-	-	-	-	0.23	0.23	0.23	0.23
Tetco Pipeline Interconnect c/	0.23	0.12	-	-	-	-	0.23	0.12
Channel Pipeline Interconnect	0.23	0.12	-	-	-	-	0.23	0.12
GulfTerra/CrossTex Interconnect	0.23	0.11	-	-	-	-	0.23	0.11
Kinder Morgan-Tejas Interconnect	-	-	0.23	0.17	-	-	0.23	0.17
Gulf South Interconnect	0.23	0.12	-	-	-	-	0.23	0.12
NGPL Interconnect	0.23	0.12	-	-	-	-	0.23	0.12
Transco Interconnect	0.23	0.12	-	-	-	-	0.23	0.12
Tennessee Gas Pipeline Interconnect d/	0.23	0.11	-	-	-	-	0.23	0.11
Access Roads	13.9	-	15.1		-	-	29.0	-
Additional Temporary Workspace	11.7	-	2.3		0.1	-	14.1	-
Contractor and Pipe Yard	-	-	6.9		-	-	6.9	-
Project Total	**256.6**	**112.7**	**113.9**	**42.3**	**5.2**	**5.9**	**375.7**	**160.9**

a/ Includes nominal 100-foot-wide construction right-of-way and 50-foot-wide operational right-of-way.
b/ Pig launcher and tie-in valves at MP 0.0 would be located at the San Patricio meter station within the proposed LNG terminal.
c/ MLV at MP 12.5 would be collocated with the Tetco meter station.
d/ Also includes pig receiver that would be collocated with the Tennessee meter station at MP 26.3.

Ingleside San Patricio would obtain an easement from the landowner in order to construct the pipeline. An easement would be used to convey both temporary (for construction) and permanent rights-of-way to Ingleside San Patricio. The easement would give Ingleside San Patricio the right to construct, operate, and maintain the pipeline, and establish a permanent right-of-way. In return, Ingleside San Patricio would compensate the landowner for use of the land. The easement agreement between the company and the landowner typically specifies compensation for the loss of use during construction, loss of nonrenewable or other resources, and allowable uses and restrictions on the permanent right-of-way after construction. These restrictions can include prohibition of construction of aboveground structures, including house additions, garages, patios, pools, or any other object not easily removable; roads or driveways over the pipeline; or the planting and cultivating of trees or orchards within the permanent easement. The areas used as temporary construction right-of-way and temporary extra workspace would be allowed to revert to pre-construction uses with no restrictions. The acquisition of an easement is a negotiable process that would be carried out between Ingleside San Patricio and individual landowners. If the necessary land cannot be obtained through good faith negotiations with property owners and the Project has been certificated by the Commission, Ingleside San Patricio may use the right of eminent domain granted under Section 7(h) of the NGA and the Federal Rules of Civil Procedure (Rule 71A) to obtain easements. Ingleside San Patricio would still be required to compensate the landowner for the right-of-way and damages incurred during construction; however, the level of compensation would be determined by a court according to state or federal law.

Ingleside San Patricio is committed to working with all landowners to avoid and/or restore irrigation systems that may be encountered during pipeline construction. Based on the specific landowner or farmer tenant farming and planting activities, Ingleside San Patricio believes scheduling construction during the winter months will avoid a majority if not all impacts.

Ingleside San Patricio would construct and maintain the pipeline in accordance with measures contained in our Plan and Procedures. Our Plan addresses pre-construction planning, construction, restoration, and right-of-way vegetation maintenance for upland areas, including agricultural lands. Our Plan is discussed in more detail in section 4.2 of this EIS. Our Procedures address pre-construction planning, construction, restoration, and vegetation maintenance for wetlands and waterbodies. Our Procedures are discussed in more detail in sections 4.3 and 4.4.1 of this EIS.

4.7.2 Existing Residences and Planned Developments

4.7.2.1 LNG Terminal

No existing residences or structures are within one mile of the proposed LNG terminal. The nearest existing residential areas to the proposed LNG terminal are about 1.2 miles southeast of the terminal within the City of Ingleside and 2.0 miles south within the community of Ingleside-on-the-Bay. The City of Gregory is about 4.5 miles north of the terminal site. The Northshore Country Club and Bayridge Subdivision are about 4.6 miles north-northwest of the LNG terminal. Both of these residential areas are continuing to be developed, and additional residences will likely be constructed within the same general distance from the proposed terminal. The nearest school is the Ingleside High School located about 1.5 miles southeast of

the proposed LNG terminal site and the nearest hospital is the North Bay Hospital in Aransas Pass, about 6.0 miles southeast of the LNG terminal site.

Potential impact on these residences as a result of construction and operation of the proposed LNG terminal could include temporary construction-related impacts, and long-term impacts associated with operation. Temporary construction impacts could include inconvenience caused by noise and dust generated by construction equipment. The primary potential impact from noise would include noise generated during pile-driving for installation of the LNG ship dock. Potential impact of noise from pile-driving would be minimal for those residences located over one mile from the construction site. Additional discussion of noise impacts is included in section 4.11.2 of this EIS.

Ingleside San Patricio would implement dust control measures during construction. Given the distance between proposed construction activity and the nearest residences and Ingleside San Patricio's proposed dust control measures, we believe impact on residences from dust generated during construction would not be significant.

The residences south of Gregory could potentially be affected during the placement of dredged material into the Alcoa tailing ponds. Likewise, placement of dredged material at the PCCA's DMPA No. 13 could affect the residences within the City of Ingleside and Ingleside-on-the-Bay. Potential Project-related impacts from the proposed DMPAs on nearby residences could include odors and dust. Odors from natural organic matter in the dredged sediment could potentially affect these residences while the sediments are being pumped into the DMPAs. The odors would be limited as long as the dredged material is below any surface of waters at the DMPAs; however, as the dredged material is dewatered there may be some odors generated. If odors are generated, it would be a temporary and localized impact and would be eliminated once the surface of the dredged material is fully dried. The potential for odors generated from dredged material disposal is expected to be minimal because the majority of material to be dredged would be deep sediments, including clean, sterile clays, with little or no organic matter present. There is the potential for the DMPAs to generate dust during the period after they have been dewatered and are drying out, but before they have been successfully revegetated. We believe dust from the DMPAs would be only a minor and temporary inconvenience. Ingleside San Patricio could reduce the dust nuisance by wetting the areas after seeding.

The primary impact to those residences discussed above during operation of the proposed LNG terminal would be visual. The LNG storage tanks would be about 178 feet tall and would be visible from points east, northwest, and southeast of the terminal site. While the proposed tanks would be visible from the nearest residential areas, they would be viewed against the existing backdrop of the Occidental Chemical manufacturing complex and visual impact would be minimal. See section 4.7.4 for further information on visual resources.

4.7.2.2 Pipeline

No existing residences or structures are located within 100 feet of the proposed work areas for the pipeline. One house is within 250 feet of the proposed pipeline between MPs 17.8 and 18.1. In residential areas, the two most significant impacts associated with construction and operation of a natural gas pipeline are disturbance during construction and encumbrance of property for future uses (*e.g.,* the limitation on future permanent structures within the permanent pipeline

right-of-way). In our analysis, we consider residences within 50 feet of construction work areas as the most likely to experience the effects of pipeline construction. Temporary construction impacts on residential areas could include inconvenience caused by noise and dust generated by construction equipment; trenching through roads or driveways; ground disturbance of lawns; removal of landscaping or natural vegetative screening; potential damage to existing septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from within the right-of-way.

No residential areas would be affected by the proposed pipeline; therefore, potential impacts to residences during construction would be limited to dust generated during construction. Dust from the construction right-of-way could affect residences at some distance from construction; the exact distance would depend on soil conditions and wind direction. Ingleside San Patricio would implement dust control measures during construction and follow the measures in our Plan that would minimize potential impact on residences from dust generated during pipeline construction.

4.7.3 Recreation and Special Interest Areas

All of the land that would be used for the LNG terminal and pipeline is privately owned. No public lands, Indian reservations, scenic areas, developed recreational facilities, parks, forests, wildlife management areas, wilderness areas, trails, or registered natural landmarks have been identified in the vicinity of the proposed LNG terminal site or natural gas pipeline.

Recreational fishing occurs in the Corpus Christi Bay, in La Quinta Channel, and off piers along the shoreline in the Ingleside and Portland areas. Numerous charter fishing boats operate in Corpus Christi Bay, originating out of the communities of Corpus Christi, Ingleside, Port Aransas, Aransas Pass, and Rockport. The recreational boating marinas closest to the Ingleside Energy Center LNG Terminal include the Bahia Marina in Ingleside-on-the-Bay about one mile south, and the Port Aransas Municipal Marina. In 1986, sport fishing in Corpus Christi Bay was a $246 million industry. Of the total fishing efforts out of Texas gulf ports between 1988 and 1998, the Corpus Christi Bay system received an average of 9.6 percent of the private boat and 17.4 percent of the party boat pressure per year. Common species sought by recreational anglers in the bay are redfish, speckled trout, drum, and flounder. Operation of the LNG facility would not affect recreational fishing. Ingleside San Patricio estimates that up to 140 LNG ships would unload at the LNG terminal each year, or between two and three ships per week. While in transit or docked, LNG vessels would have a security zone enforced around them. Other vessels, including recreational boats, would be prohibited within the security zone during the arrival of LNG ships. These effects would be temporary. Operation of the LNG terminal would not threaten the viability of a recreation resource, prohibit access to recreational areas, or cause termination of a recreational use.

The Welder Wildlife Foundation, a privately owned 7,800-acre wildlife refuge, is located about 8.0 miles northeast of Sinton. The proposed project would not affect this refuge.

4.7.4 Visual Resources

The degree of visual impact that may result from a proposed project is typically determined by considering the general character of the existing landscape and the visually prominent features of

the proposed facilities. The proposed LNG terminal would be constructed in a historically industrial area along the northeast shore of Corpus Christi Bay. The LNG terminal would be adjacent to the Occidental Chemical manufacturing complex.

The most prominent visual feature of the proposed LNG terminal would be two LNG storage tanks, each about 178 feet above the current grade and 253 feet in diameter. In addition to the LNG storage tanks, the LNG ship berth and dock, process area, transfer lines and pipe racks, and substation would contain several additional structures of a lower profile.

We evaluated estimated views of the proposed LNG storage tanks from several surrounding observation points to determine potential impact on the existing landscape. Observation points are shown on figure 4.7-1 and include:

- Southeastern shoreline of the City of Portland (about 13,700 feet west of the LNG processing area);
- Avenue "B" of the City of Ingleside (about 6,300 feet east of the LNG processing area); and
- State Route 361 (9,500 feet north of the LNG processing area).

Ingleside San Patricio prepared photo simulations of views of the proposed LNG storage tanks from each observation point to assist us in our analysis. Potential visual impact from each observation point is discussed below.

The southeastern shoreline of the City of Portland is about 13,700 feet west of the LNG terminal. The simulated observation point in figure 4.7-2 is from Portland's southeastern shoreline, looking east at the LNG facility. As shown on the visual simulation, the LNG storage tanks would be visible on the horizon. While the LNG storage tanks would be visible, they would not dominate the landscape, and the LNG tanks would be consistent in size and height with the existing structures of industrial facilities along the shoreline. We believe the LNG storage tanks would not represent a significant visual impact from the southeastern shoreline of the City of Portland.

The proposed LNG storage tanks would be visible from the western boundary of the City of Ingleside. The observation point selected for visual simulations from Ingleside is from Avenue "B", at the western edge of the city. As depicted in the simulated figure 4.7-3, the LNG storage tanks would be visible from vehicles traveling on Avenue "B" and from houses on this road. Although the LNG storage tanks would be a prominent feature in the views from this area, we believe they would not represent a significant visual impact from the western boundary of the City of Ingleside.

The third observation point of the LNG storage tanks is from State Route 361 which is the main road into Ingleside from the west. The visual simulation of the proposed LNG storage tanks from this observation point is depicted in figure 4.7-4. While the LNG storage tanks would be visible from the eastern edge of the City of Gregory, they would be visible against a backdrop of the existing Occidental Chemical manufacturing complex located north of the proposed LNG terminal. From this viewpoint, there are existing structures in the manufacturing complex that appear taller than the proposed LNG storage tanks. The LNG tanks would not dominate the landscape. We believe the LNG storage tanks would not represent a significant visual impact to viewers from State Route 361.

Non-Internet Public

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Figure 4.7-1
Observation Points for Visual Simulations

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Figure 4.7-2
Visual Simulations of LNG Storage Tanks from the Southeastern Shoreline of the City of Portland

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Figure 4.7-3
Visual Simulations of LNG Storage Tanks from Avenue "B" of the City of Ingleside

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Figure 4.7-4
Visual Simulations of LNG Storage Tanks from State Route 361

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

Construction and operation of the proposed pipeline may affect visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and from the presence of new aboveground facilities. The landscape setting along the proposed pipeline route is generally flat. No designated viewing locations are present in areas overlooking the proposed route. Impacts on visual resources due to the pipeline would be primarily temporary and short-term, occurring during construction. During construction, the cleared and graded right-of-way, as well as the construction equipment could be visible from any surrounding residences and local roads. Because the terrain over much of the Project area is flat, views of the construction activities may extend for some distance. Following construction, the right-of-way would be restored and farmers would be allowed to grow crops over the pipeline. Construction work areas would normally be difficult to distinguish from surrounding areas. Therefore, no long-term visual impacts would result from construction and operation of the pipeline.

Ingleside San Patricio proposes to install several aboveground facilities associated with the pipeline, including ten meter stations, one MLV, and a pig receiver. Because some of the facilities would be collocated, aboveground facilities would be constructed at eight separate locations along the pipeline (see section 2.2.2 of this EIS). Although site-specific designs have not been completed, a typical station would include two one-story buildings and be surrounded by a chain-link fence or equivalent. In addition, the buildings would have intrusion alarms. Yard piping, with the exception of the meter station isolation valve controls, would be installed underground for aesthetic reasons. A small satellite dish would be installed for remote data acquisition and control.

The aboveground facilities would be located along rural farm roads primarily traveled by local farmers or rural residents. The landscape along the proposed pipeline route and the location of the metering stations is dominated by agricultural land uses. No sensitive visual resources, such as schools or residential subdivisions, or public land were identified within the Project area or in the vicinity of these aboveground facilities. Therefore, the visual impact of the proposed aboveground facilities would not have a significant impact on the aesthetics of the landscape along the proposed pipeline route.

4.7.5 Coastal Zone Management

The Texas CZMP boundary delineates the coastal zone. The inland limit of the boundary is a state-defined line that in Texas generally encompasses the area within several miles of the Gulf Coast. The proposed LNG terminal lies within the designated coastal zone management area, as does a portion of the proposed pipeline.

Activities and development affecting Texas coastal resources that involve a federal permit or license are evaluated for compliance with the CZMA through a process called "federal consistency." In order to obtain a consistency determination for the Project, Ingleside San Patricio must first obtain a COE 404 Permit.

Ingleside San Patricio submitted its application with the COE during November 2004 but has not received its consistency determination from the TRRC. A determination that the Project is consistent with the Texas CZMP must be received before we could issue a notice to proceed with construction of the LNG terminal. Therefore, we recommend that:

- **Ingleside San Patricio should not begin construction of any component of its Project until it files with the Secretary a copy of the consistency determination issued by the Railroad Commission of Texas**.

4.7.6 Hazardous Waste Sites

Ingleside San Patricio conducted a hazardous material environmental data search of the TCEQ and EPA Superfund databases and identified no known hazardous sites within 0.25 mile of the proposed pipeline. The LNG terminal site would be adjacent to the Occidental Chemical manufacturing complex. Ingleside San Patricio sampled five upland locations at the site and tested the soils for total organic carbon, metals, PAHs, VOCs, pesticides, and polycyclic biphenyls. An additional six composite samples were collected from the maneuvering basin and Occidental Chemical's existing loading dock. The results of the analyses revealed that few compounds were detected and did not exceed regulatory limits set by the state.

Ingleside San Patricio would develop and implement a SPCC Plan. The SPCC Plan would describe spill prevention practices, spill handling and emergency notification procedures, and training requirements and address steps that would be taken should soil contamination be encountered, including cleanup procedures, and reporting guidelines.

4.8 SOCIOECONOMICS

Several potential socioeconomic effects may result from construction and operation of the proposed Project. Many of these potential effects are related to construction and include the number of local and non-local construction workers who would work on the Project; their income and local expenditures; and their impact on population, public services, and temporary housing during construction. Other potential effects related to construction include local construction expenditures by Ingleside San Patricio. Potential economic benefits associated with operation of the Project include increased property tax revenue, increased job opportunities and income, and ongoing local expenditures by the company.

A discussion of the effects of the proposed Project on local population, employment, the economy, housing, public services, property values, tax revenue, and environmental justice is provided below.

4.8.1 Population

The proposed Project would be located in San Patricio and Nueces Counties, Texas along the northeast shoreline of Corpus Christi Bay. The Project site is part of the Corpus Christi Metropolitan Statistical Area (CCMSA), which includes San Patricio and Nueces Counties. Nearby towns and cities include Gregory, Portland, Corpus Christi, Ingleside, Ingleside-on-the-Bay, and Aransas Pass.

Table 4.8.1-1 provides a summary of selected population and socioeconomic statistics for the State of Texas, San Patricio County, Nueces County, and cities surrounding the Project area. Both San Patricio and Nueces Counties had population growth from 1990 to 2000. However, both counties grew at a much lower rate than the state, 14.3 percent and 7.7 percent, respectively.

The population density in San Patricio and Nueces County continued to be higher than the state density; Nueces County has a population density of about five times greater than the state.

TABLE 4.8.1-1

Existing Socioeconomic Conditions in the Vicinity of the Proposed Ingleside Energy Center LNG Project

State/County/Town	Population			Population Density (persons/sq. mi.)		Per Capita Income		Civilian Labor Force (monthly average)	Unemploy-ment Rate (percent)
	1990	2000	Percent Change	1990	2000	1989	1999	2003	2003
Texas	16,986,510	20,851,820	22.8%	64.9	79.6	$12,904	$19,617	11,006,017	6.4%
San Patricio County	58,749	67,138	14.3%	84.9	97.1	$9,425	$15,425	30,229	7.4%
Nueces County	291,145	313,645	7.7%	348.2	375.3	$11,396	$17,036	154,476	6.9%
City of Corpus Christi	257,453	277,454	7.8%	1,665	1,795	$11,756	NA	NA	NA
City of Portland	12,224	14,827	21.3%	1,746	2,118	NA	NA	NA	NA
City of Ingleside	5,696	9,388	64.8%	396	652	NA	NA	NA	NA
City of Aransas Pass	7,180	8,138	13.3%	672	773	NA	NA	NA	NA
City of Gregory	2,458	2,318	-5.7%	1,756	1,656	NA	NA	NA	NA
City of Ingleside-on-the-Bay	NA	659	NA	NA	2,197	NA	NA	NA	NA

NA - data not available
Source: Texas State Data Center and Office of the State Demographer, 2004; Texas Workforce Commission. Labor Market Information Department, March 2004; U.S. Census Bureau, 1990, 2000.

Project area population impacts are expected to be temporary and relatively minor. The total population change would equal the total number of non-local construction workers, plus any family members accompanying them. The Project would be located near the Cities of Gregory, Ingleside, and Ingleside-on-the-Bay. It is assumed that workers could find housing in these communities, as well as Corpus Christi, Portland, or Aransas Pass. As discussed further in section 4.8.2, Ingleside San Patricio expects to utilize predominately local workers. Therefore, the estimated number of people who would temporarily relocate to the area during construction would not constitute a major impact on the local population of the area. Once completed, operation of the proposed LNG terminal would require approximately 34 full-time positions, split between three shifts daily. This small staff could be comprised of existing residents or non-local personnel, but would not have a significant impact on the local population.

4.8.2 Economy and Employment

For the year 2000, the government, trade/transportation/utility, education/health services, and hospitality service sectors were the largest economic sectors in CCMSA. The largest employers in the CCMSA are the petrochemical industries, health care industry, government and military, and agriculture (Texas A&M University Real Estate Center, 2004). The 1999 per capita income

in San Patricio and Nueces Counties was less than the 1999 state per capita income, at $15,425 and $17,036, respectively. The 2003 unemployment rates in San Patricio and Nueces Counties are higher than the state average of 6.4 percent, at 7.4 percent and 6.9, respectively (Texas Workforce Commission, 2004).

The Ingleside Energy Center LNG Project would be constructed over a 37-month period. During construction of the LNG terminal, Ingleside San Patricio estimated it would employ an average of about 350 workers. A maximum of approximately 550 workers would be employed during the peak construction period, when the LNG terminal and San Patricio Pipeline are both under construction.

The average workforce requirements for pipeline and meter station construction are estimated at approximately 150 persons, and anticipated to peak at a combined total of approximately 200 personnel. Construction of the proposed 26.4-mile, 26-inch-diameter pipeline would be performed by one contractor spread with a separate and/or supplemental subcontracted crew to construct the meter stations, over a 4-month time period.

Ingleside San Patricio expects to utilize predominately local workers who reside within a 100 miles of the Project. The use of local workers is dependent on various factors, such as the construction contractor hired for the Project, the methods the construction contractor uses to hire subcontractors, as well as union agreements. Additional construction personnel hired from outside the Project area would include highly skilled mechanical, electrical, and instrumentation and control tradesmen who would temporarily relocate to the Project area. An average of approximately 150 construction personnel including management and workers from outside the local area would be required for the construction of the Project.

During the proposed 37-month construction period, Ingleside San Patricio estimates that the total Project payroll would amount to about $4.2 million. During this period, some portion of the construction payroll would be spent locally for the purchase of housing, food, gasoline, entertainment, and luxury items. The dollar amount would depend on the number of construction workers in a given area and the duration of their stay. Sales tax would be paid on any construction materials as well as any goods and services purchased with payroll monies. Direct payroll and materials expenditures would have a positive impact on local economies and would stimulate indirect expenditures within the region.

Indirect sales, jobs, and salaries would be created in new or existing businesses and organizations such as construction companies, parts and equipment suppliers, and other businesses that supply goods and services to the facility during construction and operation. In addition, jobs and salaries would be created in establishments that would supply goods and services to the Project's employees and their families, such as restaurants, retail stores, grocery stores, and banks. Ingleside San Patricio estimated that an additional $0.8 million in indirect employee wages would be created within the local communities as a result of Project construction and operation.

Following construction, the LNG terminal and natural gas pipeline would be subject to state, county, and local property taxes. The local tax rate is levied against part of the assessed value of the facility, and is based on estimated future costs and revenues for each town for the entire year. Local tax rates are determined by town officials according to estimated budget needs at the beginning of each year. Tax revenues are used to support road and bridge programs, school

districts, safety, and general county administration. The assessed value of the proposed facilities would be established by the municipalities crossed by the Project.

Construction of the Project would result in increased tax revenue. Ingleside San Patricio estimated that total sales taxes to be paid to the State of Texas would be approximately $6 million. Estimated property taxes of $6 million would be received by the Ingleside Independent School District during construction. Also, during construction of the LNG terminal, the state and county would benefit from estimated payroll taxes of $1.2 and $1.3 million, respectively, for the unemployment and Worker's Compensation Funds. During operation of the Project, property taxes would be paid for the land that the LNG terminal occupies.

4.8.3 Housing

Housing statistics are presented in table 4.8.3-1. The median values of owner-occupied units in San Patricio and Nueces Counties have a lower median rent than the state median and were more than 15 percent lower than the state median value of $82,500. San Patricio and Nueces Counties had a higher percentage of vacant housing units than the state, estimated during the 2000 Census at 3,557 and 14,701 units, respectively.

TABLE 4.8.3-1

2000 Housing Characteristics in the State of Texas and San Patricio and Nueces Counties

State/County	Owner-Occupied	Renter-Occupied	Median Value, Owner-Occupied Units	Median Contract Monthly Rent	Vacancy Rate
Texas	63.8%	36.2%	$82,500	$490	9.4%
San Patricio County	68.2%	31.8%	$66,000	$411	11.1%
Nueces County	61.3%	38.7%	$70,100	$465	10.3%

Source: U.S. Census Bureau Census, 2000; Quick Facts; General Housing Characteristics, 2000, 2004.

Temporary housing is available in the form of daily, weekly, and monthly rentals in numerous motels, hotels, campgrounds, and RV parks located within commuting distance of the Project site, especially in the Corpus Christi area. In 2000, San Patricio and Nueces Counties had combined vacant housing units of 27,078, including 5,393 units available for rent, and 3,805 units available for seasonal, recreational, or occasional use (table 4.8.3-2).

Approximately 57 percent of the construction workers for Ingleside San Patricio's primary construction contractor would come from within 100 miles of the Project site and would not require temporary housing. The remaining 43 percent of the workers for the primary construction contract and all of the LNG storage tank contractor workers would require temporary housing in the Project vicinity during construction. The average number of non-local workers would be 150 in any given month, and possibly 235 at peak construction. Assuming double occupancy, these workers would require an average of 75 to 118 hotel rooms per month.

TABLE 4.8.3-2 **Vacant Housing Units in the Corpus Christi Area**		
Type of Housing Unit	**San Patricio County**	**Nueces County**
For Rent	774	4,619
For Sale Only	421	1,720
Rented or Sold, Not Occupied	186	12,676
For Seasonal, Recreational, or Occasional Use	651	3,154
For Migrant Workers	21	13
Other Vacant	718	2,125
Total	**2,771**	**24,307**

Source: U.S. Census Bureau, 2000 Census of Population and Housing.

For the pipeline construction, about 140 construction workers from outside the local area would be required to stay in temporary housing. The pipeline would be constructed in the winter months and would not have an impact on the peak summer demand for temporary housing.

Based on the information above, there is an adequate supply of local housing and temporary accommodations in Nueces and San Patricio Counties for the expected Project demand. In addition, a significant number of employees are expected to be hired locally and therefore already have housing, which would reduce the overall demand from the Project workforce. The proposed construction schedule for the Project could coincide with other demands for housing and temporary accommodations from tourism and other unrelated construction projects. Because the demand (in both number and time) from these other users would be influenced by factors such as weather and economic conditions, such demand would be unpredictable. At present, it is reasonable to assume that the facilities available near the Project area would be able to accommodate the expected workforce. Few new permanent employees would be anticipated for operation of the LNG terminal; therefore, no long-term major impacts on local housing are anticipated.

4.8.4 Public Services

San Patricio and Nueces Counties have well-developed infrastructure to provide health, police, fire, emergency, and social services near the Project site. Public health infrastructure in San Patricio County includes one community hospital, five health centers, and 10 private clinics (SuperPages, 2004). Nueces County offers more than 45 hospitals and medical centers in addition to 80 clinics and private health practices.

The nearest fire station and police station to the LNG terminal are located in Ingleside about 1.4 miles from the terminal site. The Cities of Gregory and Portland each have a police department and fire department. Ingleside-on-the-Bay has a volunteer fire department. Both Nueces and San Patricio Counties are served by the Texas Department of Public Safety. Other law enforcement and emergency services are provided by the Nueces County Sheriff's Department and San Patricio County Sheriff's Office in Sinton, Texas.

The proposed LNG terminal facility is located in an unincorporated area that is not served by a fire department. The Occidental Chemical manufacturing complex and other neighboring industries, have private fire departments and mutual aid agreements. The same agreements are in place for ambulance services.

Project demands on local agencies could include increased enforcement activities associated with issuing permits for vehicle load and width limits, local police assistance during construction to facilitate traffic flow, and emergency medical services to treat injuries resulting from construction accidents. There are adequate providers of professional and commercial services near the Project area in the communities of Corpus Christi, Portland, Gregory, Ingleside, Taft, and Sinton, capable of meeting the needs of the Project workforce. Because the non-local workforce would be small relative to the current population of the area, the Project would not have a significant impact on local infrastructure and public services.

4.8.5 Property Values

The proposed Project is not anticipated to negatively impact property values. The surrounding area is an industrialized zone with existing petroleum and chemical processing plants as well as heavy manufacturing industries nearby, which are indicative of the residential property values in the Project vicinity. Based on the location of the LNG terminal on an existing industrially zoned site, it is unlikely that the LNG terminal would negatively affect property values in the surrounding area.

The proposed pipeline may have an impact on the property values of the surrounding area; however, valuation depends on many factors, including the size of the parcel, the values of adjacent properties, the presence of other utilities, the current value of the land, and the current land use. Similar pipeline rights-of-way are present in the surrounding area; therefore, the property values in the general area of the proposed pipeline would already reflect the presence of underground utilities.

Property taxes are generally based on the actual use of the land. Construction of the pipeline would not change the general use of the land, but would preclude construction of aboveground structures on the permanent right-of-way. If a landowner feels that the presence of a pipeline easement reduces the value of his or her land, resulting in an overpayment of property taxes, they may appeal the issue of the assessment and subsequent property taxation to the local property tax agency. This issue is beyond the scope of this EIS.

4.8.6 Environmental Justice

Executive Order 12898 on Environmental Justice requires that each federal agency address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations, as well as Native Americans.

Table 4.8.6-1 presents the general ethnic mix and economic status of the State of Texas, Nueces County, and San Patricio County.

Nueces and San Patricio Counties have a lower percentage of Black and Asian populations than the State of Texas as a whole. However, both counties have a equal to or higher percentage of people of Native American, Hispanic or Latino origin than the state. Both counties have median

household incomes and per capita incomes slightly lower than the state average. Similarly, both counties have slightly higher populations living below the poverty level.

TABLE 4.8.6-1

Environmental Justice Statistics for the Project Area

	Jurisdiction		
	State of Texas	**Nueces County**	**San Patricio County**
White	71.0%	72.0%	76.8%
Black	11.5%	4.2%	2.8%
Native American and Alaskan Native	0.6%	0.6%	0.7%
Asian	2.7%	1.2%	0.6%
Persons Reporting Some Other Race	11.7%	18.7%	15.9%
Persons Reporting Two or More Races	2.5%	3.1%	3.0%
Hispanic or Latino Origins a/	32.0%	55.8%	49.4%
Median Household Income	$39,927	$35,959	$34,836
Per Capita Income	$19,617	$17,036	$15,425
Persons Below Poverty	15.4%	18.2%	18.0%

a/ Hispanics may be of any race, so also are included in applicable race categories.

The two closest communities to the Ingleside Energy Center LNG Terminal are the City of Ingleside and Ingleside-on-the-Bay. In 2000, the City of Ingleside had a population that was 62.6 percent white-non-Hispanic, 27.7 percent Hispanic, 5.6 percent Black, and 1.5 percent American Indian. Median annual household income in Ingleside in 2000 was $37,789, and 13.9 percent of the adult population had a college degree. Ingleside-on-the-Bay has a population that is 85 percent white-non-Hispanic, 12.1 percent Hispanic, and 1.8 percent American Indian. In 2000, the median annual household income in Ingleside-on-the-Bay was $45,500, and 25.4 percent of the adult population had a college degree.

The LNG terminal would be located within an existing industrial area. The proposed pipeline would cross mostly agricultural land in a sparsely populated rural region. There would be no residences within 1 mile of the LNG terminal, or closer than 250 feet from the pipeline. We have not identified any minority or low-income communities or Native American groups that would be adversely affected by the Project.

Under Executive Order 12898, each federal agency must ensure that public documents, notices, and hearings are readily available to the public. All property owners affected by the Project received notices about the Project without distinction based upon minority or income status. The NOI mailing list for this Project included local government representatives, local libraries and newspapers, and local environmental groups. The distribution list for the draft and final EISs included local newspapers and libraries, and groups and individuals who provided scoping comments or asked to remain on the mailing list. The NOI and the Notice of Availability for the draft and final EISs were published in the FR.

The FERC held a public scoping meeting and site visit on June 9, 2004 to provide the general public and governmental agencies with the opportunity to comment on the Project. The date and location of this meeting was published in the NOI. On March 30, 2005, the FERC held a public meeting in Portland, Texas to take comments on the draft EIS. Section 1.4 of this EIS further describes the public notification and participation process. Section 4.10.3 describes contacts with Native American tribes that traditionally occupied the area.

4.9 TRANSPORTATION AND TRAFFIC

4.9.1 Land Transportation

The local road and highway system in the Project area is well developed, consisting of U.S. highways, interstate highways, state highways, county roads, farm-to-market roads, and local streets. From Ingleside, State Route 361 runs north through Gregory and turns into U.S. Highway 181. U.S. Highway 181 provides access to Portland and Corpus Christi. Sinton is accessible from Ingleside by driving northwest about 22 miles along U.S. Highway 181. San Antonio is 160 miles northwest of Ingleside traveling on Interstate 37, and Houston is 215 miles north via U.S. Highway 77/59.

Existing roads would provide land access to the LNG terminal site via State Routes 35 and 361 and Edwards Road. Edwards Road is a private road currently used as access to the Occidental Chemical manufacturing complex. This road would provide primary access to the LNG terminal site during construction and operation.

Based on the available traffic count data from the Texas Department of Transportation (TDOT), in 2002 approximately 38,000 vehicles per day traveled the stretch of State Route 35 closest to the exit point for the frontage road leading to La Quinta Road, just south of Gregory. While no official level of service rating has been assigned to roads in the Project vicinity, TDOT believes they would all be considered A or B (the highest ratings).

All traffic to the LNG terminal must come to Edwards Road via State Route 361, a two-way, east-west bound road that connects Ingleside to State Route 35. Traffic coming from Aransas Pass would also use State Route 361 to Gregory.

Construction workers commuting to the Project area are expected to add an average of no more than approximately 700 vehicle trips per day (to and from the work site). At the peak of construction, a maximum of 1,100 construction worker vehicle trips are expected. In the last 13 years Occidental Chemical has completed three major projects at its manufacturing complex. The first was the construction of its VCM plant, which peaked at about 1,200 people with an average work force of about 700 people. The second project was an expansion of its VCM plant, which peaked at 700 people and averaged about 500 people. The third project was for cogeneration installation, which peaked at about 400 people with an average of about 300 people.

The local sheriff departments were consulted on all three projects and two traffic mitigation strategies were identified. First, work hours were staggered for the construction work force from the local manufacturing complex shift changes. Second, a deputy sheriff was stationed at the main construction exits to direct traffic at the end of each work day. No additional actions were

required for construction material deliveries. Based on this past experience, it is expected that the short-term traffic increase that would be generated during construction of the Project would not likely result in significant impacts to traffic patterns or road congestion in the Project area.

Ingleside San Patricio consulted with the TDOT and determined that a Project-specific Construction Transportation Management Plan would be required for its LNG terminal. This plan would include a facility site plan, site entrance details, location of drainage ways including culverts and ditches, traffic data and projections, and the potential use of local law enforcement for traffic control. The Construction Transportation Management Plan would be used by both the TDOT and other local entities responsible for transportation issues. Ingleside San Patricio would prepare its Construction Transportation Management Plan once construction details of its LNG terminal and other adjacent projects are known.

From the existing Edwards Road, inside the LNG terminal site, Ingleside San Patricio would have to build new roads around the processing area to provide all-weather access for operation and maintenance purposes. Edwards Road would be available for use as an emergency exit in accordance with NFPA 59A.

The operational workforce for the LNG terminal would be about 34 workers who would generate a maximum of 34 vehicle trips per day (round trip), assuming one worker per vehicle. We believe that the additional traffic generated by these employees on a daily basis would not result in a significant increase in traffic volume, and would not adversely affect traffic on area roadways. Truck deliveries during operation of the LNG terminal are expected to be minimal.

Access to the pipeline and associated aboveground facilities would be via existing private and public roadways. As discussed in section 4.7.1.2 of this EIS, Ingleside San Patricio would improve six existing private roads for access.

Construction of the pipeline and associated aboveground facilities would increase traffic on local roadways for the delivery of equipment and materials, and for construction worker transportation. The roads that would be utilized during construction for the pipeline are primarily two-lane local roads traversing a mostly rural, sparsely populated agricultural region. Traffic congestion on local roads could result when bulk equipment and materials are moved from roads onto and off of the construction right-of-way, and when equipment operating on the construction right-of-way must cross public roadways. Ingleside San Patricio estimated the pipe delivery would result in 10 truck trips per day for about 30 days. In addition, about 12 lowboys per day would travel on local roads during pipeline construction. The 150 to 200 pipeline workers commuting to and from the job would also contribute to congestion on local roads. Ingleside San Patricio would plan for safe and accessible conditions at all roadway crossings and access points during construction.

There may be some minor inconveniences for local traffic on lightly traveled and unimproved county roads crossed by the pipeline that would be open cut. All construction operations, including repair and surface restoration, normally would be completed in one day. Where the pipeline crosses paved or improved roads, a hole will be bored under the road and the pipe would be installed in accordance with state and local regulatory requirements.

In response to our NOI for this Project, the TDOT provided its comments in a letter dated May 28, 2004. TDOT requested that the pipeline be bored under all state roads it would cross. Ingleside San Patricio intends to comply with that request. In addition, TDOT requested that the pipeline be bored below the minimum required depth. Ingleside San Patricio would bury its pipeline at road crossings to provide a minimum cover of 4 feet, or deeper if required by permit conditions.

There is no passenger railroad service in the Corpus Christi area. Commercial railroad lines in the vicinity of the Project include the Texas Mexican, Union Pacific, Burlington Northern/Santa Fe, Missouri Pacific, and Southern Pacific. Ingleside San Patricio indicated it may be possible to ship materials for the LNG terminal via rail during construction of the proposed facilities.

4.9.2 Marine Transportation

In its application Ingleside San Patricio indicated that materials required for construction of the LNG terminal may be delivered to the site by barge about two to three times per week. While there would be minimal water transportation impacts during construction of the terminal, operation of the terminal would result in regular LNG ship traffic in Corpus Christi Bay and the La Quinta Channel. Discussion of marine traffic and transportation as it relates to marine safety is included in section 4.12.5 of this EIS. In addition, two other LNG terminals and a container terminal are proposed for locations on the La Quinta Channel. The cumulative impact on shipping of the proposed Ingleside Energy Center LNG Project combined with these other projects is discussed in section 4.13 of this EIS.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA, as amended, requires the FERC to take into account the effect of its undertakings (including authorizations under Sections 3 and 7 of the NGA) on properties listed, or eligible for listing, on the NRHP, and to provide the ACHP an opportunity to comment. Ingleside San Patricio, as a non-federal party, is assisting the FERC in meeting its obligations under Section 106 and the ACHP's implementing regulations at 36 CFR 800.

4.10.1 Results of Cultural Resource Surveys

Ingleside San Patricio initiated consultation with the Texas Historical Commission (the State Historic Preservation Office or SHPO) on February 13, 2004, requesting comments on its scope of work for cultural resources investigations for the Project. A follow-up meeting with the SHPO took place on March 25, 2004.

A combined overview and survey report (Sick *et al*., 2004a) covering a portion of the pipeline route was filed with the Commission and provided to the SHPO for review. Background research indicated that 13 archaeological sites had been previously recorded within 1 mile of the proposed pipeline, though none within the area of potential effect (APE). No previously recorded historic standing structures had been recorded within 1 mile of the proposed pipeline. Ingleside San Patricio indicated that its contractor surveyed all accessible areas, totaling about 21.6 miles of pipeline route. Areas not surveyed due to lack of access, totaling about 4.8 miles, were between MPs 4.2 and 5.0, MPs 5.4 and 6.4, MPs 8.5 and 9.5, MPs 12.3 and 12.5, MPs 18.6 and 19.3, and MPs 21.5 and 22.6.

The on-the-ground, close-interval pedestrian cultural resources inventory of the pipeline route was conducted in February and March 2004, and recorded two historic period sites (HSS-SP-03-01 and HSS-RR-03-01); both clusters of residential and agricultural outbuilding standing structures that date to the early-to-mid-twentieth century. Ingleside San Patricio's consultant recommended that these two historic sites do not qualify as eligible for nomination to the NRHP. On October 4, 2004, the SHPO stamped the cover letter of the pipeline survey report with the comments "no historic properties affected."

A close-interval, terrestrial pedestrian cultural resources inventory of the LNG terminal parcel was also conducted by a consultant for Ingleside San Patricio in February and March 2004. This survey covered about 85 acres onshore. No cultural resources were identified during the survey. The excavation of six trenches showed that the LNG terminal site was previously disturbed, including the dumping of dredged spoil fill. A literature review and file search had identified one archaeological site, 41SP36, a prehistoric shell midden recorded in 1976, within one mile of the LNG terminal. However, no evidence of site 41SP36 was found during the 2004 survey (Sick *et al*., 2004b). A copy of the LNG terminal onshore survey report was submitted to the SHPO on August 9, 2004, and a copy was also filed with the Commission. The SHPO commented, on October 4, 2004, that no historic properties would be affected within the terrestrial portion of the LNG terminal.

Ingleside San Patricio also had its consultant conduct an underwater cultural resources survey offshore of the LNG terminal. The marine remote sensing survey covered about 23 acres within the La Quinta Channel, including the area proposed for the relocation of Occidental Chemical's existing loading dock (see section 2.10.1). The marine survey was performed using a combination of technologies including a global positioning system, side-scan sonar, magnetometer, sub-bottom profiler, fathometer, and hydrographic navigational computer software (Randolph, *et al*. 2004). The survey noted 26 magnetic perturbations and seven acoustic anomalies. None of these represent submerged archaeological sites or ship wrecks, but instead were thought to be the remains of underwater piers, drag scars from shrimping, sedimentilogical changes, and lost or jettisoned refuse.

Ingleside San Patricio provided a copy of the marine survey report to the SHPO, and also filed a copy with the Commission. The SHPO commented, in a letter dated September 2, 2004, that it concurred with the conclusions of the report, and no further research was necessary.

4.10.2 Native American Consultations

Our NOI for the Project, issued on May 13, 2004, was sent to Indian tribes and Native Americans who may have historically occupied or used the Project area, and who may attach religious or cultural significance to sites in the region. Copies of the NOI went to the Coahuiltecan Nation, Comanche Tribe, Comecrudo Nation, Kiowa Tribe of Oklahoma, People of LaJunta, Lipan Apache Band of Texas, Mescalero Apache Tribe, Tonkawa, Caddo Nation, and Witchita and Affiliated Tribes. On May 3, 2004, Ingleside San Patricio sent letters about the Project to the Comanche Penateka Tribe, the Ysleta Del Sur Pueblo (Tigua Reservation), the Kickapoo Traditional Tribe of Texas, and to the Alabama-Coushatta Tribe of Texas. On August 12, 2004 and November 30, 2004, Ingleside San Patricio sent letters about the Project to the Coahuitecan Nation, Comanche Tribe, Comecrudo Nation, Kiowa Tribe, People of LaJunta, Lipan Apache Band of Texas, Mescalero Apache Tribe, Tonkawa Tribe, Caddo Nation, and

Witchita and Affiliated Tribes. The Comanche Penateka Tribe of Texas replied to the FERC, on April 21, 2004, stating that the tribe trusted the Commission's actions in this matter.

4.10.3 Unanticipated Discoveries

Both the pipeline survey report and the onshore LNG terminal report (Sick *et al*., 2004a; 2004b) contained the same plan for handling the unanticipated discovery of cultural resources or human remains during construction. The underwater survey report (Randolph *et al*., 2004) contained a different unanticipated discovery plan. The SHPO approved all three survey reports in letters dated September 2, 2004, and October 4, 2004, so we believe that the unanticipated discovery plans included in those reports are acceptable.

4.10.4 Compliance with the NHPA

Ingleside San Patricio has assisted us in addressing our responsibilities with regards to Section 101(d)(6) of the NHPA, and 36 CFR 800.2(c)(2). Ingleside San Patricio documented that they have consulted with all appropriate Native American tribes about the Project. No responses from Indian tribes to Ingleside San Patricio's contact program have been filed to date. We contacted Indian tribes which may have historically occupied or used the project area, and might attach religious or cultural significance to historic properties in the APE. No tribe identified any traditional cultural properties which may be affected by the Project. Nor were any religious, cultural, or sacred sites identified by Ingleside San Patricio's cultural resources consultants during their literature searches, or by the SHPO.

We have not yet completed the process of complying with Section 106 of the NHPA. Ingleside San Patricio needs to document a survey covering about 4.8 miles along the proposed pipeline route. In addition, we have requested that Ingleside San Patricio file a revised pipeline cultural resources inventory report that addresses our specific comments. We agree with the SHPO that no historic properties have been identified in the Project areas inventoried to date.

To ensure that the Commission's responsibilities under Section 106 of the NHPA and its implementing regulations are met, **we recommend that:**

- **Ingleside San Patricio <u>defer construction</u> and use of its proposed pipeline facilities, including related ancillary areas for staging, storage, and temporary work areas, and new or to-be-improved access roads, <u>until</u>:**

  a. **Ingleside San Patricio files with the Secretary all additional required inventory and evaluation reports, and any necessary treatment plans;**
  b. **Ingleside San Patricio files the SHPO comments on all cultural resources investigation reports and plans;**
  c. **the ACHP has been given an opportunity to comment if any historic properties would be adversely effected by the Project; and**
  d. **the Director of OEP reviews and approves all cultural resources reports and plans, and notifies Ingleside San Patricio in writing that it may proceed with treatment or construction.**

All materials filed with the Commission containing <u>location, character, and ownership information</u> about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering: "CONTAINS PRIVILEGED INFORMATION – DO NOT RELEASE."

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

4.11.1.1 Regional Climate

The climate of the Corpus Christi Bay area is predominately marine, with periods of modified continental influence during the colder months, when cold fronts from the northwest sometimes reach the coast. Because of its coastal location and relatively low latitude, cold fronts that do reach the area seldom have severe temperatures. Below freezing temperatures are recorded, on average, no more than once every three to four years. Normal monthly high temperatures range from about 64°F in January to 91°F in July and August. Average monthly low temperatures range from about 50°F in January to 79°F in July and August.

The prevailing winds are from the southeast to south-southeast, except during winter months (December and January) when prevailing winds are from either the north to north-northeast or the south-southeast. Wind speeds range from 11 to 15 miles per hour (mph) throughout the year. There is a distinct sea breeze effect increasing the wind speed by approximately 10 mph. Land breezes are normally restricted to winter months with a very light pressure gradient.

High humidity prevails throughout the year, with average dew points ranging between 48 and 74°F. The average annual precipitation totals approximately 30 inches and is generally well distributed throughout the year. Summer rains can be strong due to local thunderstorms and storms originating in the Gulf of Mexico. Severe tropical storms or hurricanes average about one every 10 years, with storms of lesser strength about once every five years.

4.11.1.2 Existing Air Quality

Ambient Air Quality Standards and Attainment Status

The EPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants for the purpose of protecting human health (primary standards) and welfare (secondary standards). The NAAQS set limits for ambient (outdoor) levels of the following criteria pollutants: NO_x, carbon monoxide (CO), ozone (O_3), SO_2, lead (Pb), and inhalable particulate matter (PM_{10}), or particles with an aerodynamic diameter less than or equal to 10 microns. (The diameter of a human hair is approximately 70 microns.) In addition, in 1997, EPA finalized new air quality standards for O_3 and $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to 2.5 microns). A series of legal challenges in the U.S. Court of Appeals ensued, culminating with the U.S. Supreme Court upholding the NAAQS for O_3 and $PM_{2.5}$ on February 27, 2001. The NAAQS are codified in 40 CFR 50 and summarized in table 4.11.1.2-1. The results of clinical and epidemiological studies established the primary NAAQS to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. The

secondary NAAQS protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

TABLE 4.11.1.2-1

National Ambient Air Quality Standards for the Ingleside Energy Center LNG Project

Pollutant	Averaging Time	Primary Standard ($\mu g/m^3$)	Secondary Standard ($\mu g/m^3$)	Local Background d/ ($\mu g/m^3$)
SO_2	Annual a/	80 (0.030 ppm)	-	32
	24-Hour b/	365 (0.14 ppm)	-	220
	3-Hour c/	-	1,300 (0.5 ppm)	910
PM_{10}	Annual a/	50	50	35
	24-Hour b/	150	150	105
$PM_{2.5}$	Annual a/	15	15	-
	24-Hour b/	65	65	-
CO	8-Hour b/	10,000 (9 ppm)	-	7,000
	1-Hour b/	40,000 (35 ppm)	-	14,000
Ozone	8-Hour c/	157 (0.08 ppm)	157 (0.08 ppm)	-
	1-Hour b/	235 (0.12 ppm)	235 (0.12 ppm)	-
NO_2	Annual a/	100 (0.05 ppm)	100 (0.05 ppm)	35
Lead	Quarter a/	1.5	-	-

$\mu g/m^3$ = micrograms per cubic meter ppm = parts per million.
a/ Arithmetic mean.
b/ Block average.
c/ Rolling average.
d/ TCEQ Screening Background Concentrations for Nueces County.

The TCEQ has adopted the NAAQS as the ambient air quality standards within the State of Texas. In addition, the TCEQ has established property line standards that limit ambient air quality at the property line of facilities. Nueces and San Patricio Counties are both classified as attainment areas for all criteria pollutants for which EPA has made attainment designations. (EPA has not yet designated which areas meet the new $PM_{2.5}$ standards described above.)

Air Quality Monitoring and Existing Air Quality

The TCEQ maintains an extensive network of air quality monitors located throughout the state for a variety of purposes. At monitoring stations around the state, the four gaseous criteria pollutants (nitrogen dioxide (NO_2), SO_2, CO, and O_3) are monitored continuously, with 1-hour averages measured each hour, every day. PM_{10} and Pb are measured at least once every six days for a 24-hour averaging period, although some sites in Texas are monitored more frequently. The TCEQ has also instituted a new continuous monitoring network of $PM_{2.5}$ monitors around the state to measure compliance with the new $PM_{2.5}$ standard. Data from many of those monitors are reported to the EPA AirData database (AirData).

Estimates of existing ambient air quality for the proposed project area, as shown in table 4.11.1.2-1, were obtained from the TCEQ Screening Background Concentrations for

Nueces County, Texas. These values represent the highest monitored values for each air pollutant in Nueces County from 1992 to 1997.

Air Quality Control Regions

Air quality control regions (AQCRs) are areas in which implementation plans describe how ambient air quality standards will be achieved and maintained. AQCRs were defined by EPA and state agencies in accordance with Section 107 of the CAA. The proposed Project would be located in AQCR 14.

4.11.1.3 Regulatory Requirements for Air Quality

The proposed Ingleside Energy Center LNG Project is potentially subject to a variety of federal, state, and local regulations pertaining to the construction or operation of air emission sources. The TCEQ is the lead agency for air permitting. The TCEQ implements its own regulations and also incorporates EPA's federal regulatory requirements. The following sections summarize the applicability of various federal and state regulatory programs. San Patricio and Nueces Counties do not have any additional air permit requirements beyond those in the federal and state programs.

Federal Air Quality Requirements

The CAA of 1970, 42 USC 7401 et seq., as amended in 1977 and 1990, and 40 CFR 50-99 are the basic federal statutes and regulations governing air pollution in the United States. We have reviewed the following federal requirements to determine their applicability to the proposed Ingleside Energy Center LNG Project.

General Conformity

Section 176c of the CAA and 30 TAC require that, prior to funding, authorizing, permitting, licensing, or otherwise approving an action, the lead federal agency (the FERC in this case) must make a determination that the proposed action will not interfere with plans that a state has developed to come into or maintain compliance with air quality standards. Since the project area is classified as in attainment for all criteria pollutants, a General Conformity Determination is not required.

New Source Review

Separate procedures have been established for federal pre-construction review of certain large proposed projects in either attainment areas or non-attainment areas. The federal pre-construction review for new or modified sources located in attainment areas is Prevention of Significant Deterioration (PSD). The review process is intended to prevent the new source from causing existing air quality to deteriorate beyond acceptable levels. The federal pre-construction review for new or modified major sources located in non-attainment areas is commonly called Non-Attainment New Source Review (NNSR). NNSR only applies to the pollutants or their precursors that are classified as non-attainment. A new facility can undergo both PSD and NNSR review, depending on the emissions of various pollutants and the attainment status of the area. Nueces and San Patricio Counties are both classified as attainment areas for all criteria pollutants. Therefore, the proposed Project area is not subject to NNSR permitting.

The emission threshold for "major stationary sources" varies under PSD according to the type of facility. As defined by 40 CFR 52.21 (b)(1)(i), a facility is considered major under PSD if it emits or has the potential to emit 250 tpy or more of any criteria pollutant or 100 tpy for specified source categories. The proposed Project will not be a major source or major modification under PSD regulations, as potential emissions of NO_x, CO, PM, sulfur oxides, and VOCs will not exceed the established trigger levels. Therefore, the proposed Project is not subject to PSD permitting requirements.

PSD regulations also provide special protection for visibility and other air quality-related values in specially designated areas such as National Parks and Wilderness Areas, designated as "Class I" areas. The Ingleside Energy Center LNG Project would not be located in a Class I area, nor would it be located within 100 kilometers of a Class I area. Therefore, a full Class I analysis is not required for the permit application. The closest Class I area to the project site is the Big Bend National Park, located in west Texas, approximately 400 miles west-northwest of the Project area.

New Source Performance Standards

New Source Performance Standards (NSPS), codified at 40 CFR 60, establish emission limits and associated requirements for monitoring, reporting, and recordkeeping for specific emission source categories. NSPS apply to new, modified, or reconstructed sources. The following NSPS requirements were identified as potentially applicable to the specified sources at the facility. Subparts Ka and Kb of 40 CFR 60, Standards of Performance for Volatile Organic Liquid Storage Vessels. These subparts list affected emission sources as storage vessels containing volatile organic liquids. Regulatory applicability depends on the construction date of the storage vessel. However, the Project would not operate volatile organic liquid storage tanks that meet the applicability requirements listed in 40 CFR 60.110b. Therefore, these regulations are not applicable.

National Emissions Standards for Hazardous Air Pollutants

National Emissions Standards for Hazardous Air Pollutants (NESHAPs), codified at 40 CFR 61, apply to emissions of specific Hazardous Air Pollutants (HAPs) from certain source categories. Although the proposed Ingleside Energy Center LNG Project would emit potential HAPs well below the NESHAPs threshold, the Occidental Chemical manufacturing complex is a major source of HAP emissions. Therefore, the NESHAPs in 40 CFR 61 apply to this Project.

Maximum Achievable Control Technology

Under 40 CFR 63, Maximum Achievable Control Technology (MACT) standards apply to major sources of HAPs in certain source categories. Although the proposed Ingleside Energy Center LNG Project would emit potential HAPs well below these thresholds, the Occidental Chemical manufacturing complex is a major source of HAP emissions. Therefore, MACT standards apply to the proposed facility.

Chemical Accident Prevention Provisions

40 CFR 68, Chemical Accident Prevention Provisions, is a federal regulation designed to prevent the release of hazardous materials in the event of an accident and minimize impacts when

releases do occur. The regulation contains a list of substances and threshold quantities for determining applicability of the rule to a facility. If a facility stores, handles, or processes one or more substances on this list and at a quantity equal to or greater than specified in the regulation, the facility must prepare and submit a risk management plan (RMP). If a facility does not have a listed substance on-site, or the quantity of a listed substance is below the applicability threshold, the facility does not have to prepare a RMP. However, it still must comply with requirements of the general duty provisions in Section 112(r)(1) of the CAA 1990 Amendments if it has any regulated substance or other extremely hazardous substance on-site. The general duty of the provision is as follows:

> "The owners and operators of stationary sources producing, processing, handling and storing such substances have a general duty ... To identify hazards which may result from such releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur."

With the exception of natural gas constituents (*e.g.,* methane, ethane, propane, etc.), no regulated substance would be handled or stored in quantities greater than the applicability threshold. Natural gas pipelines are not covered if they are regulated by the DOT or an equivalent state natural gas program certified by DOT in accordance with 49 CFR 6010.5. In addition, storage of natural gas incidental to transportation (*e.g.,* gas taken from a pipeline during non-peak periods and placed in storage, then returned to the pipeline when needed) is not covered. Consequently, an RMP is not required for this Project. However, the Occidental Chemical manufacturing complex would be subject to the Chemical Accident Prevention Provisions and would revise its RMP as necessary. The Ingleside Energy Center LNG Terminal will maintain awareness of hazard issues and meet the goals of the above-listed general duty provisions.

Title V Operating Permit

The Title V Operating Permit Program, as described in 40 CFR 70, requires major sources of air emissions and certain affected non-major sources to obtain a federal operating permit. In Texas, authority to issue Title V operating permits has been delegated by EPA to the TCEQ. The major source emissions thresholds for determining the need for a Title V operating permit are: 100 tpy of any regulated air pollutant, 10 tpy of any individual HAP, or 25 tpy for all HAPs. Emissions from the proposed Ingleside Energy Center LNG Project are not expected to exceed 100 tpy; however, emissions from the LNG terminal would be factored into the Title V permit for the Occidental Chemical manufacturing complex. Ingleside San Patricio coordinated with Occidental Chemical to prepare and submit a revision to its existing Title V permit once final facility designs are complete and emission sources are fully defined for the Ingleside Energy Center LNG Project; Ingleside San Patricio received its TCEQ Air Quality Permit dated April 15, 2005.

Control of Air Pollution from Marine Compression-Ignition Engines

Regulation 40 CFR 94 (FR, 2/28/03, 9746-9789) imposes regulations on marine compression-ignition engines manufactured on or after January 1, 2004. This standard does not apply to engines rated <37 kilowatts (kW), or engines on foreign vessels. Ingleside San Patricio would require that U.S. flagged or registered vessels equipped with affected compression ignition

engines manufactured after January 1, 2004 meet all applicable requirements of this subpart. It should be noted that most, if not all, LNG carriers are foreign flagged vessels, and not subject to this regulation.

Applicable State Air Quality Requirements

The TCEQ is the lead air permitting authority for the proposed Project. The TCEQ's air quality regulations are codified in Section 30 of the TAC Chapters 100-122. They incorporate the federal program requirements listed in 40 CFR 50-99 and establish permit review procedures for all facilities that can emit pollutants to the ambient air. Any new facility is required to obtain an air quality permit prior to initiating construction. Facilities can trigger additional review by EPA if emissions exceed the major source thresholds listed in 40 CFR Section 52.21(b)(1)(i).

Protection of Public Health and Welfare- 30 TAC 116.111(a)(2)(A)

The emissions and plant operations from the proposed new facility would comply with all rules and regulations of the TCEQ and with the intent of the Texas Clean Air Act (TCAA), including the protection of the health and physical property of the people. A summary discussion on compliance with each applicable rule is included below.

The proposed facility would not be located within 3,000 feet of an elementary, junior high/middle, or senior high school; therefore, no additional analysis is required to be performed regarding short-term or long-term side effects that an air contaminant or nuisance odor from the facility may have on individuals attending such schools.

Chapter 101- General Rules. Chapter 101 includes the general rules that are applicable to all sources. The Project would comply with applicable requirements of this chapter. The applicable sections within this chapter include: 101.3 – Circumvention; 101.4 – Nuisance; 101.5 – Traffic Hazards; 101.6 – Upset Reporting and Recordkeeping Requirements; 101.7 – Maintenance, Start-up and Shutdown Reporting, Recordkeeping, and Operational Requirements; 101.8 – Sampling; 101.9 – Sampling Ports; 101.10 – Emissions Inventory Requirements; 101.11 – Exemptions from Rules and Regulations; 101.12 – Temporary Exemptions During Drought Conditions; 101.13 – Use and Effect of Rules; 101.14 – Sampling Procedures and Terminology; 101.16 – Effect of Acceptance of Variance or Permit; 101.17 – Transfers; 101.18 – Remedies Cumulative; 101.19 – Severability; 101.20 – Compliance with EPA Standards; 101.21 – The National Primary and Secondary Ambient Air Quality Standards; 101.22 – Effective Date; 101.24 – Inspection Fees; and 101.27 – Emission Fees.

It should be noted that the majority of the general rules would not apply until the facility has started operation. The proposed Project would minimize off-site impacts during the construction process as intended by the TCAA.

Chapter 106 – Exemptions from Permitting. The proposed Project has not claimed an exemption from permitting for any of the emission units at this facility.

Chapter 112 – Control of Air Pollution from Sulfur Compounds. The proposed Project would comply with all applicable sections of this chapter. Applicable sections include: 112.2 – Sulfur Dioxide, Compliance Reporting and Recordkeeping; 112.3 – Sulfur Dioxide Net Ground Level Concentrations; 112.9 – Allowable Emission Rates – Combustion of Liquid Fuels; 112.31

– Hydrogen Sulfide Allowable Emissions – Residential, Business or Commercial Property; 112.33 – Hydrogen Sulfide Calculation Methods; 112.41 – Sulfuric Acid Emission Limits; and 112.42 – Sulfuric Acid Calculation Methods.

Chapter 115 – Control of Air Pollution from Volatile Organic Compounds (VOCs). The proposed Project would comply with all applicable sections of this chapter. Applicable sections include: Subchapter B – General VOC Sources, Division I – Storage of VOCs and Division 2, Vent Gas Control; Subchapter C – VOC Transfer Operations, Division I – Loading and Unloading of VOCs; and Subchapter J – Administrative Provisions, Division I – Alternative Means of Control and the provisions therein; 115.112 – Control Requirements; 115.113 – Alternate Control Requirements; 115.114 – Inspection Requirements; 115.115 – Approved Test Methods; 115.116 – Monitoring and Recordkeeping Requirements; 115.117 – Exemptions; 115.119 – Counties and Compliance Schedules; 15.120 – Vent Gas Definitions; 115.121 – Emission Specifications; 115.122 – Control Requirements; 115.123 – Alternate Control Requirements; 115.125 – Testing Requirements; 115.126 – Monitoring and Recordkeeping Requirements; 115.127 – Exemptions; 115.129 – Counties and Compliance Schedules; 115.211 – Emission Specifications; 115.212 – Control Requirements; 115.213 – Alternate Control Requirements; 115.214 – Inspection Requirements; 115.215 – Approved Test Methods; 115.216 – Monitoring and Recordkeeping Requirements; 115.217 – Exemptions; 115.219 – Counties and Compliance Schedules.

The Proposed Project would control VOC emissions from tanks and vent stacks in accordance with the regulations and conduct the applicable inspections, testing, monitoring and recordkeeping as required. Since the facility would be storing the natural gas as a cryogenic liquid (LNG), a majority of the provisions do not apply.

Chapter 116 – Control of Air Pollution by Permits for New Construction of Modification. The proposed Project is complying with this chapter by applying for and obtaining a permit to construct prior to initiating construction of the proposed facility.

Chapter 118 – Control of Air Pollution Episodes. The proposed Project would operate the facility in compliance with the applicable sections of this chapter. An Emission Reduction Plan, pursuant to 118.5, is not required to be prepared because the facility does not exceed the emission threshold presented in this chapter.

Chapter 122 – Federal Operating Permits. Emissions from the proposed Ingleside Energy Center LNG Project are not expected to exceed 100 tpy of any regulated air pollutant; however, emissions from the LNG terminal would be factored into the Title V permit for the Occidental Chemical manufacturing complex. Ingleside San Patricio would coordinate with Occidental Chemical to prepare and submit a revision to its existing Title V permit once final facility designs are complete and emission sources are fully defined for the Ingleside Energy Center LNG Project.

Measurement of Emissions – 30 TAC 116.(a)(2)(B)

Ingleside San Patricio would comply with all provisions associated with measuring the emissions of significant air contaminants. This can include performing fuel sampling, installing predictive

and/or continuous emission monitors, performing stack emission testing, and performing the appropriate reporting and record keeping to demonstrate compliance.

New Source Performance Standards (NSPS) – 30 TAC 116.111(a)(2)(D)

The TCEQ incorporates the NSPS, codified at 40 CFR 60, by reference. Subpart GG, Standards of Performance for Stationary Gas Turbines, applies to stationary gas turbines with a heat input at peak load equal to or greater than 10 million Btu/hr. Both NO_x and SO_2 emissions limitations (NSPSs) apply to turbines over this threshold. Subpart KKK, Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants, and Subpart LLL, Standards of Performance Onshore Natural Gas Processing Plants: Sulfur Dioxide Emissions, applies to onshore natural gas processing plants but not fuel conversion plants. The proposed LNG terminal would not have this type of equipment; therefore, it is not subject to NSPS.

Performance Demonstration – 30 TAC 116.111(a)(2)(G)

The proposed facility would achieve the performance specified. This demonstration may include requests for additional engineering data and stack testing, and air quality dispersion modeling. All such demonstrations would be performed as required to maintain facility compliance.

Prevention of Significant Deterioration (PSD) Review – 30 TAC 116.111(a)(2)(l)

The proposed Ingleside Energy Center LNG Project would not be a major source or major modification under PSD regulations, as potential emissions of NO_x, CO, PM, sulfur oxides, and VOCs would not exceed the established thresholds. Therefore, the proposed Project would not be subject to PSD permitting requirements.

Ozone Flex Agreement

TCEQ has designated the Corpus Christi area which includes Nueces and San Patricio Counties as "near nonattainment" of the NAAQS based on past near violations of the O_3 standard. State and local officials are working on voluntary programs to reduce emissions of NO_x and VOCs, both O_3 precursor pollutants. Corpus Christi signed a Flexible Attainment Region agreement with EPA to give the city more flexibility to comply with the standards, and later signed a similar Ozone Flex Agreement with EPA. Employers and citizens in the Corpus Christi area have agreed to implement various voluntary control measures to reduce the emission of O_3 precursor pollutants in an effort to maintain the attainment status of the area. Because the facility is proposed, there is no opportunity to reduce existing emissions as part of this program.

4.11.1.4 Air Quality Impacts and Mitigation

Construction Air Pollutant Emissions

Construction of the Ingleside Energy Center LNG Project would occur over a period of approximately 37 months. Air emissions would result from non-road sources such as construction and dredging equipment operating within the terminal facilities' property boundary, the La Quinta Channel, and the pipeline right-of-way. Air emissions would also be generated from delivery vehicles bringing supplies and equipment to the facility site, construction workers commuting in their personal vehicles, and other construction trucks that travel on roads. In

addition, construction activities could generate an increase in fugitive dust (airborne dust that escapes from a construction site) from earthmoving and other construction vehicle movement.

Air emissions generated during construction are not subject to any permitting requirements. Air emissions during construction are only subject to state regulations limiting nuisance conditions (30 TAC Section 101.4, Nuisance) such as fugitive dust.

The estimated construction emissions during construction are shown in table 4.11.1.4-1 excluding fugitive dust emissions (see further explanation below).

TABLE 4.11.1.4-1

Estimated Yearly Emissions from LNG Terminal and Pipeline Construction (tons)

Emission Source	NO_x	VOC	CO	SO_2	PM_{10}
Construction Equipment					
LNG Marine Terminal a/	100.8	12.0	51.6	9.0	5.8
Pipeline b/	43	21	12	-	-

a/ Construction is anticipated to complete within approximately 37 months.
b/ Emission sources assume that 300 to 500 feet of pipe would be installed per day and are measured in pounds per day. Pipeline construction should be complete within 1 year.

The primary source of emissions would be from equipment utilized during the construction of the marine terminal, because this phase would take the longest period of time to complete and would involve the largest number of sources. Construction equipment would include marine construction equipment; cranes; earthmoving equipment; forklifts and man-lifts; air compressors; welding machines; bulldozers, graders, backhoes, front-end loaders; generator, and drilling, dredging, and pile driving equipment. The pipeline construction would also include welding trucks, boring machine, small engines and pumps, and fill and test pumps. The non-road sources are primarily diesel-fueled units.

Vehicular and marine vessel exhaust and crankcase emissions from gasoline and diesel engines would comply with applicable EPA mobile source emission regulations (40 CFR 85) by using equipment manufactured to meet these specifications.

Diesel engine emission standards and mandatory reductions in diesel fuel sulfur content have been adopted that would reduce emissions from heavy-duty construction vehicles. However, the diesel sulfur fuel reductions are not required until mid-2006, and the engine emission standards would be implemented in two stages that are not scheduled to be completed until 2007. To decrease emissions in the immediate future, the EPA created a voluntary diesel retrofit program to encourage the use of various technologies such as diesel particulate filters and oxidation catalysts. These controls require all construction equipment with diesel engines greater than or equal to 60 horsepower (hp) in size that are on the Project for more than 30 days to be outfitted with emission control devices (such as oxidation catalysts) and/or use clean fuels. These controls also limit the idling of diesel vehicles to three minutes or less. Ingleside San Patricio has stated that it would take all reasonable measures to reduce air emissions at the construction site including the use of transportation grade diesel fuel for construction and use of

idling limits. Ingleside San Patricio, in conjunction with its construction contractor, would evaluate all feasible options for reducing emissions during construction.

Fugitive Dust

The existing industrial activities within the proposed LNG terminal area and vicinity currently generate dust as part of their ongoing operations, and this dust generation is expected to continue. Fugitive dust would be produced from equipment operating during construction of the proposed LNG terminal. Ingleside San Patricio estimates that the fugitive dust generated is not anticipated to be any greater than the current level of dust generation from existing activities in the area. If construction of the proposed LNG terminal and tank generates dust that causes a nuisance, then a surface wetting system would be implemented to minimize dust generation. The Project equipment schedule includes water trucks that could be used for dust suppression. There are no permanent residences located within 1 mile of the proposed LNG terminal.

Dust from the DMPAs is not anticipated to be a source of nuisance dust. Once the dredged material dries and is stable enough to be manipulated with equipment, the areas would be seeded with grasses for temporary and permanent stabilization. Until the areas are stabilized and if dust generation becomes a nuisance, the areas would be wetted as necessary until the temporary or final stabilization becomes established.

Fugitive dust would also be produced from equipment operating during construction of the proposed pipeline. Ingleside San Patricio's contractor would attempt to control airborne dust levels during construction via wetting with water where the work site or access routes approach residential or commercial areas.

Air Pollutant Emissions from Operation

LNG Terminal Stationary Sources

New stationary air emissions sources associated with operation of the proposed Ingleside Energy Center LNG Terminal include:

- one 2,000-kW emergency diesel generator;
- five 500-hp main diesel firewater pumps;
- three 500-hp standby firewater pumps (2 diesel and 1 electric);
- one emergency flare stack; and
- one primary emergency total enclosed ground flare.

Anticipated annual emission levels for operation of the proposed stationary sources at the LNG terminal are shown in table 4.11.1.4-2. The emission data presented in table 4.11.1.4-2 are based on manufacturer-supplied emission factors supplemented with EPA default emission factors.

Ingleside San Patricio would test the emergency diesel generators and firewater pumps weekly. The five main firewater pumps would be used for emergency fire fighting. Three standby firewater pumps would also be located on-site in the event that the main firewater pumps are not available. The flares would be installed for safety purposes.

TABLE 4.11.1.4-2

Estimated Yearly Emissions from Terminal Operations – Stationary Sources (tons) a/

Equipment	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2	VOC
STATIONARY SOURCES						
Emergency Generator	1.61	0.37	0.03	0.02	0.03	0.04
Main Firewater Pumps	1.94	0.42	0.14	0.14	0.02	0.15
Standby Firewater Pumps	0.77	0.17	0.05	0.05	0.01	0.06
Elevated Flare Stack	0.24	1.30	0.64	0.64	0.10	0.22
Enclosed Ground Flare	2.29	12.44	6.12	6.12	0.96	2.12
Fugitives	0.00	0.00	0.00	0.00	0.00	20.87
Total	**6.85**	**14.69**	**0.87**	**0.85**	**1.12**	**23.46**

a/ Total Stationary Emissions of HAPs would be 0.09 tpy.

LNG Carriers and Tugboats

Operation of the proposed Project would result in emissions from LNG carrier ships during receiving and handling, and from the tugboats used to assist in the docking of the LNG carriers. It is anticipated that approximately 140 LNG carriers per year would be unloaded at the proposed facility. At least two tugboats would be available to assist each LNG carrier, although up to three tugboats may be used as needed. LNG unloading would be conducted using electric-driven submerged pumps powered by an onboard diesel generator. Each LNG carrier would be in the Project area for about 21 hours. This includes six hours for escorted LNG carrier transit time (round-trip from the local pilot pickup/drop-off point before approaching the Corpus Christi Ship Channel to the dock at the proposed facility), 12 hours for unloading of LNG, and three hours for LNG carrier maneuvering and docking.

The LNG carriers would be fueled with LNG and/or residual oil to provide steam to turbines, and there may also be diesel fueled auxiliary power generators on the carriers to provide power during off-loading operations. The carriers would be fueled primarily with LNG while in transit from the LNG production point to the proposed terminal, although carrier propulsion would be switched primarily to residual oil when a carrier nears the docking area.

The primary pollutants that LNG carriers and tugboats would emit is SO_2 and NO_x, along with smaller amounts of CO, PM_{10}, $PM_{2.5}$, and VOCs, as shown in table 4.11.1.4-3. At 140 calls per year, the SO_2 emissions from LNG carriers would be about 481.00 tpy, and the emissions from tug boats working with the LNG carriers would be approximately 27.79 tpy, for a total of 508.79 tpy. The NO_x emissions from LNG carriers would be about 41.14 tpy, and the emissions from tug boats working with the LNG carriers would be approximately 164.88 tpy, for a total of 206.02 tpy.

TABLE 4.11.1-3						
Estimated Yearly Emissions from Terminal Operations – Mobile Sources (tons) a/						
Equipment	**NO_x**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**VOC**
Mobile Sources						
LNG Carriers	41.14	4.39	23.31	17.41	481.00	0.91
Tug Boats	164.88	37.78	2.86	2.39	27.79	4.41
Total	**206.02**	**42.17**	**26.17**	**19.80**	**508.79**	**5.32**

a/ Total Mobile Emissions of HAPs would be 0.56 tpy.

Pipeline

Ingleside San Patricio's supporting documentation does not provide any information specific to air quality for operation of the proposed pipeline. Operation emissions from the pipeline would be expected to be limited to fugitive dust generated by an occasional (weekly) maintenance vehicle driving on pipeline access roads. Impact on air quality from operation of the pipeline would be insignificant.

4.11.2 Noise

Noise would affect the local environment during both the construction and operation of the proposed Ingleside Energy Center LNG Project. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions and the effects of seasonal vegetative cover. Two measures used by federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level ($L_{eq(24)}$) and the day-night sound level (L_{dn}). The $L_{eq(24)}$ is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the $L_{eq(24)}$ with 10 decibels on the A-weighted scale (dBA) added to the nighttime sound levels between the hours of 10 p.m. and 7 a.m., to account for the greater sensitivity of people to sound during the nighttime hours.

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA, 1974). This publication evaluates the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. The FERC has adopted this criterion for new compression and associated pipeline facilities, and it is used here to evaluate the potential noise impact from operation of the Ingleside Energy Center LNG Terminal. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise. Because neither the State of Texas nor San Patricio County has noise regulations that would limit noise from the Ingleside Energy Center LNG Terminal, the FERC criterion is the basis for determining the acceptability of expected facility noise levels at the noise sensitive areas (NSAs).

4.11.2.1 Existing Noise Levels

Ingleside San Patricio determined, through a review of aerial photography and a site visit, that were no existing NSAs near its proposed LNG terminal. The nearest NSAs are along the western edge of the City of Ingleside (see figure 4.11-1) and consist of the following:

- NSA 1 – 8,500 feet southeast of the center of the terminal site. Several residences on the south side of the city adjacent to Main Street.
- NSA 2 – 5,800 feet east of the center of the terminal site. Residence at the corner of 8th Street and Avenue B.
- NSA 3 – 8,000 feet northeast of the terminal site. Several residences and a school along California Avenue.

Ingleside San Patricio conducted an ambient noise monitoring program over the course of two days (October 20-21, 2004), to establish the existing ambient noise levels at each of the three NSAs nearest to the LNG terminal site (Kiteck, 2004). Levels were measured during the morning, afternoon and night to establish average daytime and nighttime L_{eq} levels. These were then used to calculate the L_{dn} levels. In addition to noise level measurements, Ingleside San Patricio identified and recorded the contributing noise sources, along with the prevailing meteorological conditions. Wind speed and direction, temperature, humidity, and sky conditions were recorded at the locations.

During the ambient noise survey, the primary noise sources that were observed during the day were the noise of vehicle traffic and at times, the sounds of insects and birds. At night, the primary noise sources were insects and distant traffic. Noise from a wastewater treatment facility was audible at NSA 2. The temperature ranged from 78 to 88°F, relative humidity from 70 to 95 percent, winds were from the south at one to eight mph, and the sky was clear with high clouds and some haze. The measured daytime and nighttime ambient L_{eq} levels and the calculated L_{dn} levels are summarized in table 4.11.2.1-1.

TABLE 4.11.2.1-1

Existing Noise Levels at Nearest Noise Sensitive Areas

NSA	Distance and Direction from Terminal Site	Daytime L_{eq} (dBA)	Nighttime L_{eq} (dBA)	L_{dn} (dBA)
1	8,500 feet Southeast	57.3	47.4	57.4
2	5,800 feet East	48.7	43.6	51.2
3	8,000 feet Northeast	45.5	45.2	51.6

These recorded L_{dn} levels, ranging from 51.2 to 57.4 dBA, are fairly typical of quiet residential areas distant from busy streets and freeways. Existing nearby industries do not appear to be significantly affecting the noise environment at the NSAs.

Non-Internet Public

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Figure 4.11-1
Noise Sensitive Areas

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

Construction and Operational Impacts

Potential impacts from the Project could be caused by short-term increases in noise during construction and long-term increases in noise due to operation of the Project. Ingleside San Patricio evaluated potential noise impacts by calculating expected increases in noise associated both with Project construction and operation and comparing these levels with the FERC standard for permissible noise at NSAs.

Construction Noise

The noise impact analysis of the construction-related activities associated with the Project considers the noise produced by any significant sound source that could impact the sound contribution at the nearby NSAs. The analysis of construction noise was divided into three activities; construction of the LNG terminal, dredging operations, and pile driving.

Ingleside San Patricio assumed that the highest level of construction noise would occur during site earth work (*e.g.,* grading/clearing/grubbing) when the largest amount of construction equipment would be in operation. Dredging and excavation operations would be required for the relocation of Occidental Chemical's existing loading dock, new LNG slip and dock (see section 2.10.1 of this EIS), and maneuvering area whereas pile driving activities would be required for the relocation of the existing loading dock and construction of the LNG ship dock. For the purposes of its noise analysis, Ingleside San Patricio estimated that the relocation of the existing loading dock would require 84 piles (three- to four-week duration) and construction of the LNG ship dock would require 161 piles (five-to seven-week duration). Noise generated by pile driving would depend upon the type of pile and equipment used. Ingleside San Patricio has estimated a resultant noise level of 45.4 dBA L_{dn} at the nearest NSA.

The predicted sound level contributed by each of the three specific construction-related activities was calculated from estimated A-weighted scale of noise sources (*i.e.,* equipment) that typically operate during the specific construction activity. To produce a conservative result, this analysis was based on the most equipment intensive phase of each activity and was performed only for NSA 2, nearest NSA to the terminal site. Predicted noise levels at the other two more distant NSAs would be lower.

The results of this analysis are presented in table 4.11.2.1-2 below. Construction of the LNG terminal is expected to produce the highest levels at NSA 2 because of the shorter distance to the NSA. The highest predicted L_{dn} level is 47.4 dBA which is significantly below the 55 dBA level identified by the FERC as significant. It is also below the existing L_{dn} of 51.2 dBA at NSA 2, which means that the sound would generally not be noticeable. Therefore, construction of the LNG terminal is not expected to result in a significant noise impact at any NSAs.

Pile driving noise could potentially affect marine organisms. The possible impact from pile driving noise on marine organisms is discussed in section 4.5.1.5 of this EIS.

TABLE 4.11.2.1-2 **Expected Construction Noise Levels at NSA 2**					
LNG Terminal Construction (5,800 feet to NSA 2)		**Pile Driving Operations (8,000 feet to NSA 2)**		**Dredging Operations (8,000 feet to NSA 2)**	
L_{eq}	**L_{dn}**	**L_{eq}**	**L_{dn}**	**L_{eq}**	**L_{dn}**
41.0 dBA	47.4 dBA	39.0 dBA	45.4 dBA	31.0 dBA	37.4 dBA

Operational Noise

The operational noise impact analysis of the proposed LNG terminal considered the noise produced by all significant sources associated with operation of the LNG terminal. As with the construction noise impact analysis, this analysis was performed only for NSA 2, the closest NSA. For the purpose of this analysis, Ingleside San Patricio assumed that the LNG facility was operating at maximum capacity with the maximum amount of equipment in operation.

Noise source level data for the equipment was largely obtained from direct measurements of similar equipment at other LNG terminals. The sound power levels of the equipment, after considering the quantities of each type, ranged from a low of 96 dBA for the electrical substation to a high of 125 dBA for the flash gas compressor.

This analysis adjusted the sound power levels for distance (hemispherical radiation), atmospheric absorption, use of any noise control measures, and the shielding effects of buildings. Attenuation due to vegetation and terrain were not considered since both are minimal at the Project site. The resulting levels for each type of equipment were then summed logarithmically to obtain the total operational noise level that would be expected at NSA 2 (table 4.11.2.1-3).

TABLE 4.11.2.1-3 **Expected Operational Noise Level at NSA 2**				
Location	**Ambient L_{dn} (dBA)**	**Estimated LNG terminal L_{dn} (dBA)**	**Estimated Total L_{dn} (Ambient and LNG terminal) (dBA)**	**Estimated Increase in L_{dn} (dBA)**
NSA 2 about 5,800 feet east of site	51.2	47.0	52.6	1.4

The operational noise level of 47.0 dBA is less than the existing ambient level of 51.2 dBA L_{dn}. The addition of the maximum operating capacity noise level to the existing environment would raise the ambient noise level by only 1.4 dBA, which would likely not be noticeable. An increase of 3 dBA is generally considered to be the smallest increase that is noticeable. Also, the predicted level of 47.0 dBA is significantly below the 55 dBA level required by the FERC. Thus, noise from operation of the LNG terminal facility should not create a significant noise impact.

To ensure that there would be no significant impact to noise quality at the nearest NSAs, **we recommend that:**

- **Ingleside San Patricio should make all reasonable efforts to assure its predicted noise levels from the LNG terminal are not exceeded at the NSAs and file noise surveys showing this with the Secretary <u>no later than 60 days</u> after placing the LNG terminal in service. However, if the noise attributable to the operation of the LNG terminal exceeds 55 dBA L_{dn} at an NSA. Ingleside San Patricio should file a report on what changes are needed and should install additional noise controls to meet the level <u>within one year</u> of the in-service date. Ingleside San Patricio should confirm compliance with these requirements by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

<u>Pipeline</u>

Construction Noise

During construction of the San Patricio Pipeline, neighbors in the vicinity of the construction right-of-way would hear construction noise. Traffic and farm machinery are the primary sources of ambient noise. Pipeline construction would proceed at rates of from several hundred feet to 1 mile per day. However, due to the assembly line nature of construction, activities in any area could last from several weeks to several months on an intermittent basis.

Construction equipment would be operated on an as-needed basis. Exact noise levels cannot be determined; however, we can estimate noise level as a function of the distance of the receptor from the equipment. Assuming the operation of a piece of equipment results in typical noise levels of 88 dBA at 50 feet, the noise impact of that equipment would be 82 dBA at 100 feet and 72 dBA at 300 feet from the equipment. Noise would diminish rapidly as the distance from the noise source increases.

Normally there would be no nighttime noise from construction. Most construction, except for directional drilling, would be limited to daytime hours. Directional drilling operations are usually 24-hour per day operations requiring up to two weeks for completion. While individual receptors in the immediate vicinity would experience an increase in noise, the effect would be temporary and local.

Operational Noise

Operational noise impacts would be limited to the meter station's vicinity. The buried pipeline would not contribute to aboveground noise levels, and noise from metering stations would be insignificant.

The meter stations would be in rural/agricultural areas of San Patricio County. The NSAs are located between 500 and 1,000 feet north of the meter stations. Table 4.11.2.1-4 identifies the meter stations and their locations along the pipeline, distance to the nearest NSAs, and calculated noise levels for the proposed meter stations.

TABLE 4.11.2.1-4 **Noise Sensitive Areas Along the San Patricio Pipeline Route**			
Meter Station	**MP Location**	**Distance to Nearest NSA (feet)**	**Calculated Noise Level (dBA L_{dn})**
San Patricio	0.0	10,000	<40
Tetco	12.5	500	45
Channel	18.3	700	42
GulfTerra/CrossTex	19.7	1,300	<40
Kinder Morgan-Tejas	24.3	900	40
Gulf South	25.5	5,800	<40
NGPL	25.7	7,300	<40
Transco	26.1	5,000	<40
Tennessee	26.3	4,500	<40

As shown in table 4.11.2.1-4, the calculated noise levels would be not exceed an L_{dn} of 55 dBA. No mitigation is proposed at any of the meter station site since the predicted levels are below an L_{dn} of 55 dBA.

4.12 RELIABILITY AND SAFETY

Three federal agencies share in the oversight of the safety and security of LNG import terminals: the FERC, the Coast Guard, and the DOT. The FERC authorizes the siting and construction of LNG import terminals and is the lead federal agency under NEPA to analyze the environmental, safety, security, and cryogenic design of proposed facilities. The Coast Guard has authority over the safety of LNG vessels and the marine transfer area. The Coast Guard also has authority over security of LNG vessels and the entire LNG facility. The DOT has exclusive authority to promulgate and enforce safety regulations and standards over the onshore LNG facilities beginning at the last valve immediately before the LNG storage tank(s).

In February 2004, the three participating agencies entered into an Interagency Agreement to assure that they work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals, including the terminal facilities and tanker operations, and to maximize the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. The Interagency Agreement ensures a seamless safety and security review by the three federal agencies.

The operation of the proposed Ingleside Energy Center LNG Terminal poses a potential hazard that could affect the public safety without strict design and operational measures to control potential accidents. The primary concerns are those events that could lead to an LNG spill of sufficient magnitude to create an off-site hazard. However, it is also important to recognize the stringent requirements for the design, construction, operation and maintenance of the facility as well as the extensive safety systems to detect and control potential hazards.

With the exception of the October 20, 1944 fire at the LNG facility in Cleveland, Ohio, the operating history of U.S. LNG facilities has been free of LNG safety-related incidents resulting

in adverse effects to the public or the environment. The 1944 Cleveland incident was attributed to the use of materials inadequately suited for cryogenic temperatures and the lack of spill impoundments at the site.[11] More recently, an operational accident occurred in 1979 at the Cove Point LNG facility in Lusby, Maryland, when a pump seal failed, resulting in gas vapors entering an electrical conduit and settling in a confined space. When a worker switched off a circuit breaker, the gas ignited, resulting in heavy damage to the building and a worker fatality. Lessons learned from this accident resulted in changing the national fire codes, with the participation of the FERC, to ensure that the situation would not occur again. The proposed facilities would be designed, constructed, and operated in compliance with these codes.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria LNG liquefaction facility that killed 27 and injured 56 workers. No members of the public were injured. Preliminary findings of the accident investigation suggest that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced to the high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler firebox which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas (LPG) separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998-1999, Train 40 had been operating with its original equipment since start-up in 1981.

Although there are major differences between the equipment involved in the accident and that of the proposal by Ingleside San Patricio (*i.e.,* high-pressure steam boilers that power refrigerant compressors would not be used here nor are they used at any LNG facility under FERC jurisdiction), the sequence of cascading events identifies potential failure modes that warrant further evaluation. As a result, we have provided a recommendation in section 4.12.2, *Cryogenic Design and Technical Review,* to address this issue.

A discussion of the principal properties and hazards associated with LNG is presented in section 4.12.1. A summary of our preliminary design and technical review of the cryogenic aspects of the LNG terminal is presented in section 4.12.2. Storage and retention systems are discussed in section 4.12.3. An analysis of the thermal radiation and flammable vapor cloud hazards resulting from a credible land-based LNG spill is presented in section 4.12.4, while the safety aspects of LNG transportation by ship is discussed and summarized in section 4.12.5. A discussion on security awareness related to terrorism is presented in section 4.12.6.

4.12.1 LNG Hazards

LNG's principal hazards result from its cryogenic temperature (-260°F), flammability, and vapor dispersion characteristics. As a liquid, LNG will neither burn nor explode. Although it can cause freeze burns and, depending on the length of exposure, more serious injury, its extremely cold state does not present a significant hazard to the public, which rarely, if ever, comes in contact with it as a liquid. As a cryogenic liquid, LNG will quickly cool materials it contacts, causing extreme thermal stress in materials not specifically designed for ultra-cold conditions. Such thermal stresses could subsequently subject the material to brittleness, fracture, or other

[11] For a description of the incident and the findings of the investigation, see "U.S. Bureau of Mines, Report on the Investigation of the Fire at the Liquefaction, Storage, and Regasification Plant of the East Ohio Gas Co., Cleveland, Ohio, October 20, 1944, February 1946."

loss of tensile strength. These hazards, however, are not substantially different from the hazards associated with the storage and transportation of liquid oxygen (-296°F) or several other cryogenic gases that have been routinely produced and transported in the United States.

Methane, the primary component of LNG, is colorless, odorless and tasteless, and is classified as a simple asphyxiant. Methane could, however, cause extreme health hazards, including death, if inhaled in significant quantities within a limited time. At very cold temperatures, methane vapors could cause freeze burns. Asphyxiation, like freezing, normally represents a negligible risk to the public from LNG facilities.

When released from its containment vessel and/or transfer system, LNG will first produce a vapor or gas. This vapor, if ignited, represents the primary hazard to the public. LNG vaporizes rapidly when exposed to ambient heat sources such as water or soil, producing 620 to 630 standard cubic feet of natural gas for each cubic foot of liquid. LNG vapors in a 5 to 15 percent mixture with air are highly flammable. The amount of flammable vapor produced per unit of time depends on factors such as wind conditions, the amount of LNG spilled, and whether it is spilled on water or land. Depending on the amount spilled, LNG may form a liquid pool that will spread unless contained by a dike.

Once a flammable vapor-air mixture from an LNG spill has been ignited, the flame front will propagate back to the spill site if the vapor concentration along this path is sufficiently high to support the combustion process. An unconfined methane-air mixture will burn slowly, tending to ignite combustible materials within the vapor cloud, whereas fast flame speeds tend to produce flash burns rather than self-sustaining ignition.

LNG is not explosive as it is normally transported and stored. However, LNG vapors (primarily methane) can explode if contained within a confined space, such as a building or structure, and ignited. There is no evidence, however, suggesting that LNG is explosive in unconfined open areas. Experiments to determine if unconfined methane-air mixtures will explode have been conducted and, to date, have all been negative. Unconfined methane-air mixtures will burn but will not explode. Nevertheless, a number of experimental programs have been conducted to determine the "amount of initiator charge" required to detonate an unconfined methane-air mixture.

Over the years, various parties have occasionally expressed the energy content of an LNG storage tank or LNG ship in equivalent tons of trinitrotoluene (TNT), as an implied measure of its explosive potential. However, such a simplistic analogy fails to consider that explosive forces are not just a function of the total energy content but also of the rate of energy release. For an explosion to occur, the rate of energy release must be nearly instantaneous, such as with a TNT charge initiated by a blasting cap. Unlike TNT or other explosives which inherently contain an oxidizer, an unconfined vapor cloud must be mixed with oxygen within the flammability range of the fuel for combustion to occur. For a large unconfined vapor cloud, the flammability range tends to exist at the mixing zone at the edges of the cloud. When ignited, flame speeds of about 20-25 m/sec (66-82 ft/sec) and local over pressures up to 0.2 psig have been estimated for hydrocarbon vapor clouds, well below the flame speeds and over pressures associated with explosion.

A rapid phase transition (RPT) can occur when a portion of LNG spilled onto water changes from liquid to gas, virtually instantaneously. Unlike an explosion that releases energy and combustion products from a chemical reaction as described above, an RPT is the result of heat transferred to the liquid inducing a change to the vapor state. The rapid expansion from the liquid to vapor state can cause locally large overpressures. RPTs have been observed during LNG test spills onto water. In some test cases, the overpressures generated were strong enough to damage test equipment in the immediate vicinity of the LNG release point. The sizes of the overpressure events have been generally small and are estimated to be equivalent to several pounds of TNT. Such a small overpressure is not expected to cause significant damage to an LNG vessel. However, the RPT may increase the rate of LNG pool spreading and the LNG vaporization rate.

4.12.2 Cryogenic Design and Technical Review

The cryogenic design and technical review emphasizes the engineering design and safety concepts as well as the projected operational reliability of the proposed facilities. The principle areas of coverage include: materials in cryogenic environments; insulation systems; cryogenic safety; thermodynamics; heat transfer; instrumentation; cryogenic processes; and other relevant safety systems.

Study and evaluation of information for the proposed design and installation of the Ingleside Energy Center LNG Terminal has been performed by the FERC staff. The design and specifications submitted for the proposed facility to date are considered to be preliminary but would be the basis for any detailed design to follow. A significant amount of the design involving final selection of equipment manufacturers, process conditions, and resolution of some safety related issues would be completed in the next phase of the project development if authorization is granted by the Commission. This information would need to be submitted to FERC staff for review and approval.

As a result of the technical review of the information provided by Ingleside San Patricio in the submittal documents, a number of concerns were identified by staff relating to the reliability, operability, and safety of the proposed design. In response to staff's questions, Ingleside San Patricio provided written answers prior to the technical conference on February 8, 2005. However, several areas of concern are noted that require additional consideration and/or action on behalf of the company. Follow up on those items requiring additional action should be documented in reports to be filed with the FERC. As a result, **we recommend that:**

> **The following measures should apply to the LNG terminal design and construction details. Information pertaining to these specific recommendations should be filed with the Secretary for review and approval by the Director of OEP either: prior to initial site preparation; prior to construction of final design; prior to commissioning; or prior to commencement of service. This information should be submitted a minimum of 30 days before approval to proceed is required.**
>
> - **A complete plan and list of the hazard detection equipment should be filed <u>prior to initial site preparation</u>. The information should include a list with the instrument tag number, type and location, alarm locations, and shutdown**

functions of the proposed hazard detection equipment. Plan drawings should clearly show the location of all detection equipment.

- **Ingleside San Patricio should provide a technical review of its facility design that:**

  a. Identifies all combustion/ventilation air intake equipment and the distance(s) to any possible hydrocarbon release (LNG, flammable refrigerants, flammable liquids, and flammable gases).

  b. Demonstrates that these areas would be adequately covered by hazard detection devices and indicate how these devices would isolate or shutdown any combustion equipment whose continued operation could add to or sustain an emergency.

  Ingleside San Patricio should file this review <u>prior to initial site preparation</u>.

- **A complete plan and list of the fixed and wheeled dry-chemical, fire extinguishing, high expansion foam, and hazard control equipment should be filed <u>prior to initial site preparation</u>. The information should include a list with the equipment tag number, type, size, equipment covered, and automatic and manual remote signals initiating discharge of the units. Plan drawings should clearly show the planned location of all fixed and wheeled extinguishers.**

- **The design of the Bottle-Up Vessel and system should be re-evaluated for process design, pressure and volume containment under all conditions and the proposed design basis and design filed <u>prior to initial site preparation</u>.**

- **The <u>final design</u> of the hazard detection equipment should identify manufacturer and model.**

- **The <u>final design</u> of the hazard detection equipment should include redundancy and fault detection and fault alarm monitoring in all potentially hazardous areas and enclosures.**

- **The <u>final design</u> should specify that open path detectors should be calibrated to detect the presence of flammable gas and alarm at the lowest reliable set point, in addition to the required 25 percent LEL set point.**

- **The <u>final design</u> of the fixed and wheeled dry-chemical, fire extinguishing, high expansion foam hazard control equipment should identify manufacturer and model.**

- **The <u>final design</u> should include equipment and instrumentation for the measurement of translational and rotational movement of the inner vessel for use during and after cool down.**

- **The final design should include details of the boil-off gas flow measurement system provided for each tank.**

- **The final design should include details of the LNG flow measurement system provided for the top and bottom fill to each tank.**

- **The final design should include a reliable measurement system to monitor deflections during the hydraulic test. At a minimum, this system should include two slope indicator ducts which bisect the tank in mutually perpendicular directions, monitoring points at the terminals of these ducts, and other monitoring points along the perimeter of the concrete shell, so that sag, warping, tilt, and settlement can be monitored. Tolerances for sag, tilt, and shell warping should meet or exceed the limits specified by the tank manufacturer.**

- **The final design should include details of the LNG tank tilt settlement and differential settlement limits between each LNG tank and piping and procedures to be implemented in the event that limits are exceeded.**

- **The final design should include drawings and specifications of the spill protection system to be applied to the LNG tank roofs.**

- **The final design should include a discretionary vent for each tank, to be operated through the DCS. The outlet from the vent piping should be designed to discharge beyond the outer containment, to prevent vapor from flowing into the annular containment.**

- **The final design should include provisions to measure the discharge flow of each intank pump.**

- **The final design of the vaporizers should include double block isolation on the suction and double block isolation and check valve on the discharge of each vaporizer. One of the valves on the suction and one valve on the discharge should be automatically actuated.**

- **The final design should include provisions to ensure that hot glycol/water circulation is operable at all times when LNG is present in the LNG booster pump discharge piping or when the temperature in the LNG inlet channel to any vaporizer is below 0°F.**

- **The final design should include detection instrumentation and shut down procedures for vaporizer tube leak, shell side overpressure, or bursting disc failure.**

- **The final design should include temperature measurement of the vaporizer common discharge header which should alarm the low temperature condition.**

- **The final design should include a fire protection evaluation carried out in accordance with the requirements of NFPA 59A, chapter 9.1.2.**

- **The final design should include details of the shut down logic, including cause and effect lists for alarm and shutdown.**

- **The final design should include emergency shutdown of equipment and systems activated by hazard detection devices for flammable gas, fire, and cryogenic spills, when applicable.**

- **Security personnel requirements for prior to and during LNG vessel unloading should be filed prior to commissioning.**

- **Operation and Maintenance procedures and manuals, as well as emergency plans, emergency evacuation plan and safety procedure manuals, should be filed prior to commissioning.**

- **Copies of the Coast Guard security plan, vessel operation plan, and emergency response plan should be provided to the FERC staff prior to commissioning.**

- **The contingency plan for failure of the outer LNG tank containment should be filed prior to commissioning.**

- **A copy of the criteria for horizontal and rotational movement of the inner vessel for use during and after cool down should be filed prior to commissioning.**

- **The FERC staff should be notified of any proposed revisions to the security plan and physical security of the facility prior to commencement of service.**

- **Progress on the construction of the LNG terminal should be reported in monthly reports filed with the Secretary. Details should include a summary of activities, problems encountered and remedial actions taken. Problems of significant magnitude should be reported to the FERC within 24 hours.**

In addition, we recommend that the following recommendations be applied throughout the life of the facility:

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least a biennial basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Ingleside San Patricio should respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed piping and instrumentation diagrams reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted annual report, should be submitted.**

- **Semi-annual operational reports should be filed with the Secretary to identify changes in facility design and operating conditions, abnormal operating experiences, activities (including ship arrivals, quantity and composition of imported LNG, vaporization quantities, boil-off/flash gas, etc.), plant modifications including future plans and progress thereof. Abnormalities should include, but not be limited to: unloading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, vapor or liquid releases, fires involving natural gas and/or from other sources, negative pressure (vacuum) within a storage tank and higher than predicted boil-off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within <u>45 days</u> after each period ending <u>June 30 and December 31</u>. In addition to the above items, a section entitled "Significant plant modifications proposed for the next 12 months (dates)" also should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.**

- **In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material the Commission should be notified within 24 hours and procedures for corrective action should be specified.**

- **Significant non-scheduled events, including safety-related incidents (i.e., LNG or natural gas releases, fires, explosions, mechanical failures, unusual over pressurization, and major injuries) and security-related incidents (i.e., attempts to enter site, suspicious activities) should be reported to FERC staff within 24 hours. In the event an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification should be made immediately, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. This notification practice should be incorporated into the LNG facility's emergency plan. Examples of reportable LNG-related incidents include:**

  a. fire;

  b. explosion;

  c. estimated property damage of $50,000 or more;

  d. death or personal injury necessitating in-patient hospitalization;

  e. free flow of LNG for five minutes or more that results in pooling;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes gas or LNG;

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes gas or LNG;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes gas or LNG to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure limiting or control devices;

i. a leak in an LNG facility that contains or processes gas or LNG that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes gas or LNG;

l. safety-related incidents to LNG vessels occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property or the environment, including authority to direct the LNG facility to cease operations. Following the initial company notification, FERC staff would determine the need for a separate follow-up report or follow-up in the upcoming semi-annual operational report. All company follow-up reports should include investigation results and recommendations to minimize a recurrence of the incident.

4.12.3 Storage and Retention Systems

LNG storage tanks come in a variety of categories. The following are descriptions of the tank designs most commonly used worldwide:

- single containment cylindrical metal tanks (predominately used in the U.S.);

- spherical storage tanks (predominately used in LNG carriers);
- double containment cylindrical metal inner tank and metal or concrete outer tank (commonly thought of as an LNG tank with a high wall dike; the design proposed by Ingleside San Patricio is of this type);
- full containment cylindrical metal inner tank and metal or concrete outer tank (Cameron/Hackberry was the first project proposing this design in the United States; Freeport LNG was the second; and currently, numerous LNG projects are proposing this type of tank design);
- pre-stressed cylindrical concrete tank with an internal metal membrane (membrane tank). (None in the U.S.); and
- cryogenic cylindrical concrete tank, internal cryogenic tank, and prestressed concrete outer tank (one operational in the U.S.; the remainder worldwide).

These tank categories are described in Annex H of the European Standard for LNG facilities (EN 1473) and are summarized below for the LNG storage tanks commonly found in proposals before the Commission.

H.1 Single containment tank

A single primary container and generally an outer shell designed and constructed so that only the primary container is required to meet the low temperature ductility requirements for storage of the product.

The outer shell (if any) of a single containment storage tank is primarily for the retention and protection of insulation and to contain the purge gas pressure, but is not designed to contain refrigerated liquid in the event of leakage from the primary container.

An aboveground single containment tank shall be surrounded by a bund (dike) wall to contain any leakage. Examples of single containment are given in figure H.1.

H.3 Double containment tank

A double containment tank is designed and constructed so that both the inner self-supporting primary container and the secondary container are capable of independently containing the refrigerated liquid stored. To minimize the pool of escaping liquid, the secondary container should be located at a distance not exceeding 6 meters from the primary container.

The primary container contains the refrigerated liquid under normal operating conditions. The secondary container is intended to contain any leakage of the refrigerated liquid, but it is not intended to contain any vapor resulting from this leakage.

Examples of double containment tanks are given in figure H.3. Figure H.3 does not imply that the secondary container is necessarily as high as the primary container.

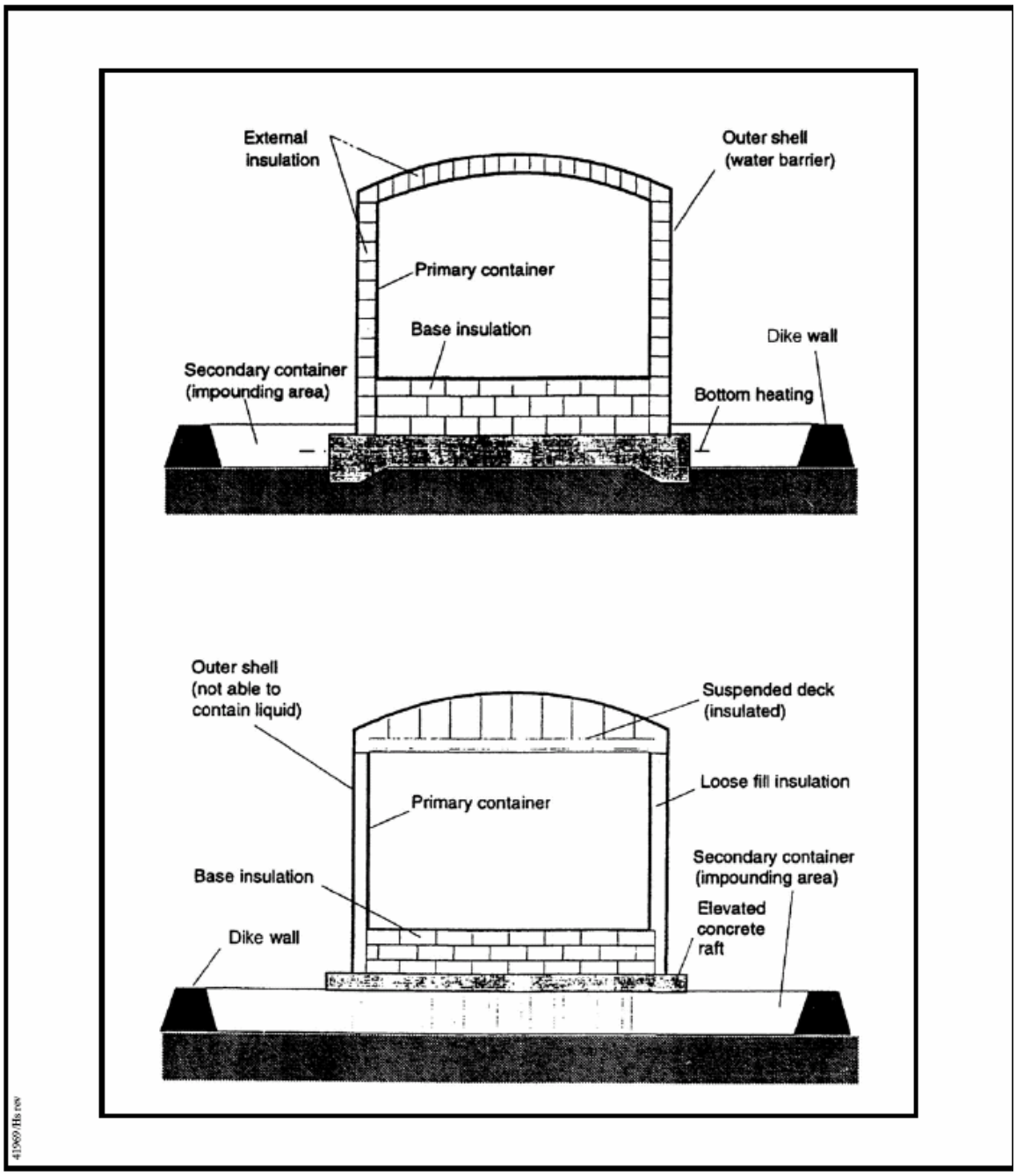

Figure H-1
Examples of Single Containment Tanks

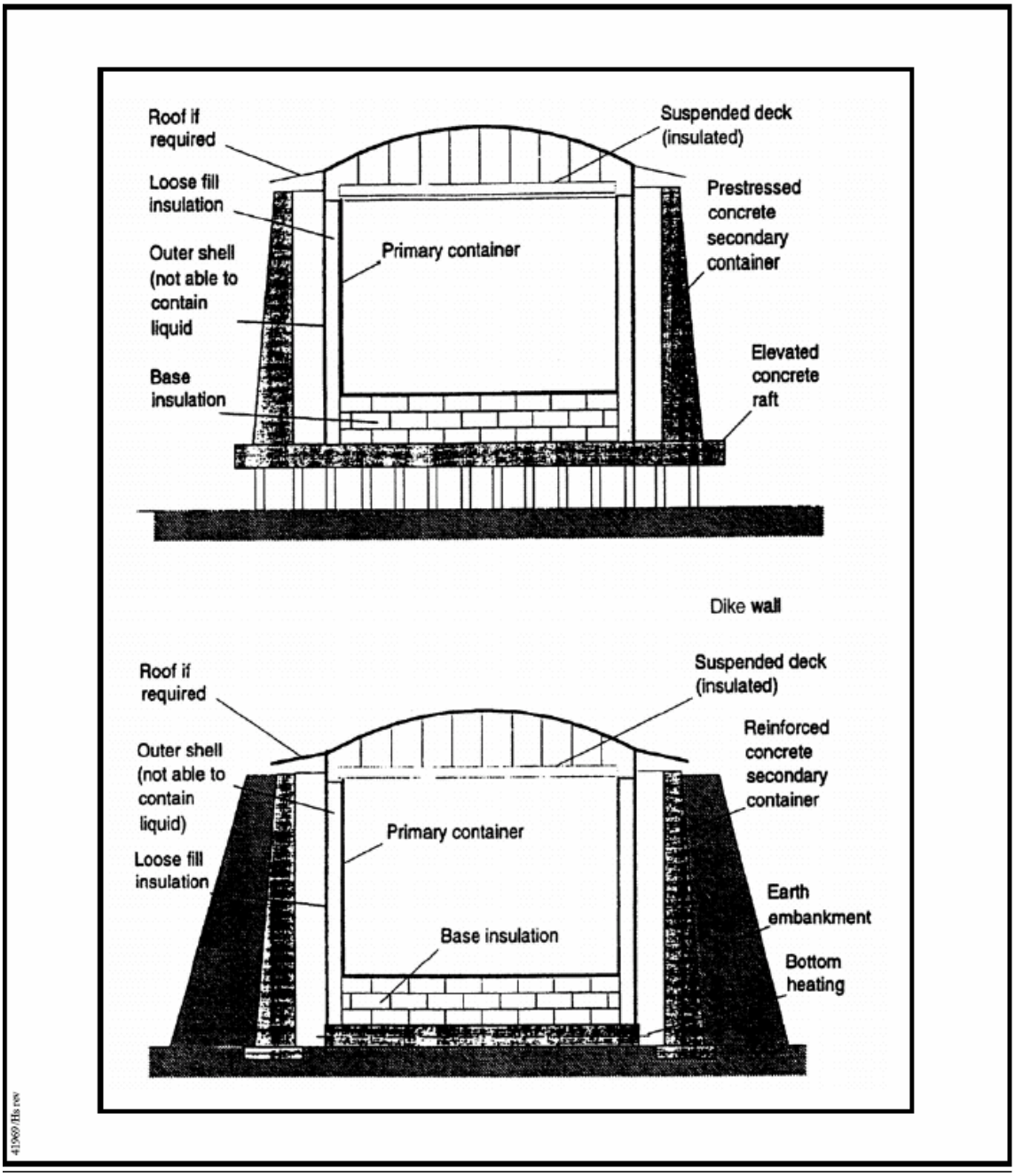

Figure H-3
Examples of Double Containment Tanks

H.4 Full containment tank

A tank designed and constructed so that both self supporting primary container and the secondary container are capable of independently containing the refrigerated liquid stored and for one of them its vapor. The secondary container can be 1 or 2 meters in distance from the primary container.

The primary container contains the refrigerated liquid under normal operating conditions. The outer roof is supported by the secondary container. The secondary container shall be capable both of containing the refrigerated liquid and of controlled venting of the vapor resulting from product leakage after a credible event. Examples of full containment tanks are given in figure H.4.

We are not declaring a preference over any of the tank designs (or other variations of these tank designs) and/or which tank designer is better at designing and constructing LNG storage tanks. Ingleside San Patricio is proposing to install double containment tanks.

4.12.4 Siting Requirements – Thermal and Dispersion Exclusion Zones

Regulatory Requirements

LNG facilities proposed in this project must comply with the siting requirements of 49 CFR 193, Subpart B. On March 30, 2000, the DOT revised 49 CFR 193 to incorporate NFPA 59A (1996 edition) into the LNG regulations. On April 9, 2004, the DOT further revised 49 CFR 193 to incorporate the 2001 edition of NFPA 59A. The following sections specifically address off-site hazards:

Part 193.2001, Scope of Part, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the marine vessel and the last manifold or valve immediately before a storage tank.

Part 193.2051, Scope, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements in accordance with Subpart B and NFPA 59A. In the event of a conflict with NFPA 59A, then Part 193 prevails.

Part 193.2057, Thermal radiation protection, requires that each LNG container and LNG transfer system have thermal exclusion zones based on three radiation flux levels in accordance with Section 2.2.3.2 of NFPA 59A.

Part 193.2059, Flammable vapor-gas dispersion protection, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A.

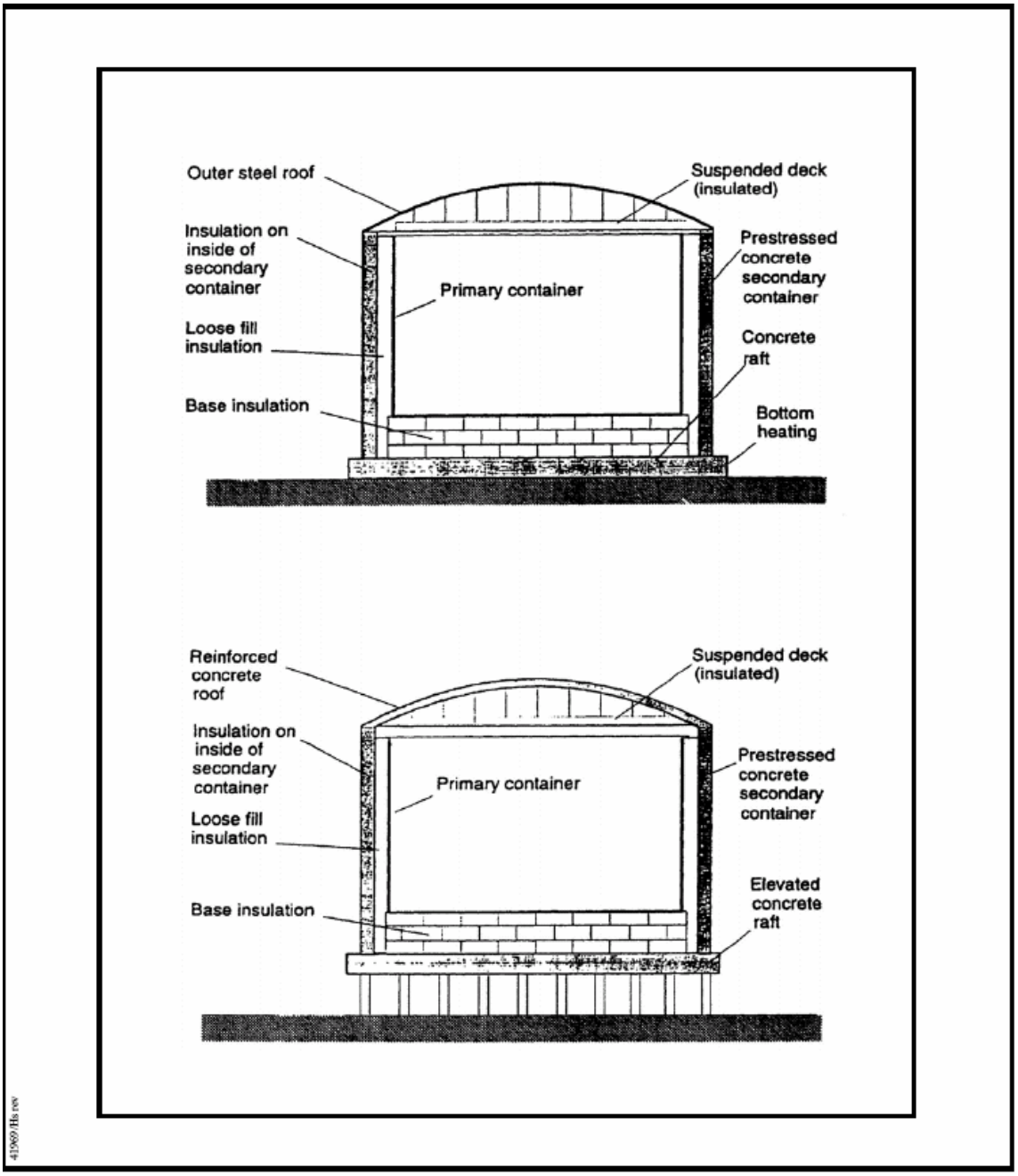

Figure H-4
Examples of Full Containment Tanks

For the following LNG facilities that are proposed in this project, we have identified the applicable siting requirements from Part 193 and NFPA 59A:

- Two 1,006,000-barrel (160,000 m^3) LNG storage tanks - Parts 193.2057 and 2059 require the establishment of thermal and flammable vapor exclusion zones for LNG tanks. NFPA 59A Section 2.2.3.2 specifies four thermal exclusion zones based on the design spill and the impounding area. NFPA 59A Sections 2.2.3.3 and 2.2.3.4 specify a flammable vapor exclusion zone for the design spill which is determined with Section 2.2.3.5.

- Marine cargo transfer system consisting of three 16-inch-diameter liquid transfer arms; one 16-inch-diameter vapor return arm; and a 36-inch-diameter transfer line - Parts 193.2001, 2057, and 2059 require thermal and flammable vapor exclusion zones for the transfer system. NFPA 59A does not address LNG transfer systems.

- Six 4,756-gpm in-tank pumps (three per tank with a spare pump tube) and six 1,950 gpm high-pressure sendout pumps - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A Section 2.2.3.2 specifies the thermal exclusion zone and Sections 2.2.3.3 and 2.2.3.4 specify the flammable vapor exclusion zone based on the design spill.

- Eight shell and tube vaporizers - Same requirements as for LNG pumps.

The incorporation of the NFPA 59A requirements into Part 193 has resulted in some confusion and possible misinterpretation in applying the siting requirements:

Parts 193.2057 and 2059 require exclusion zones for LNG transfer systems, which are defined to include transfer piping. However, NFPA 59A only requires exclusion zones for "transfer areas" which are defined as the part of the plant where liquids are introduced or removed from the facility such as truck loading or ship unloading areas. The definition of transfer area in NFPA 59A specifically excludes permanent plant piping such as cargo transfer lines. Additionally, NFPA 59A Section 2.2.3.1 (2001) specifically excludes transfer area at the water edge of marine terminals. When the DOT incorporated NFPA 59A into its regulations, it removed the requirement for impounding systems around transfer piping (old Part 193.2149). In the preamble to the final rule, the DOT determined that the most likely sources of leaks within LNG plant are LNG storage tanks, cargo transfer areas, and vaporizers and process equipment, which are all addressed in NFPA 59A Section 2.2.1.2. The result is that while Part 193 retains exclusion zones for LNG transfer systems, neither Part 193 nor NFPA 59A requires the impoundment from which to base the calculations. We do not believe that this was the intent, nor do we believe that omitting containment for transfer piping is a sound engineering practice. The FERC staff will continue to require containment for all LNG transfer piping within a plant site.

The incorporation of NFPA 59A also changed the way in which design spills and impoundment capacities may be determined. Under Section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume during a 10-minute period from any single accidental leakage source or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the authority having jurisdiction. Similar criteria appear in Section 2.2.3.5 for determining the design spill used in

thermal and flammable vapor exclusion zone calculations. Prior to the incorporation of NFPA 59A, the design spill in Part 193 assumed the rupture of a single transfer pipe with the greatest overall flow capacity, for not less than 10 minutes (old Part 193.2059(d)). As a result, the spill rate for vaporization, process, or LNG transfer areas may be assumed to be a "leakage source" rather than a full pipe rupture; however, the spill duration must be 10 minutes unless the authority having jurisdiction (*i.e.,* DOT's Office of Pipeline Safety), determines that a shorter time is acceptable. Again, given the confusion in applying the two requirements, the FERC staff will continue to utilize the 10-minute spill criteria at the maximum flow possible for containment sizing. This will ensure that impoundments are sized for a catastrophic failure, while recognizing that less conservative spill scenarios may be appropriate to calculate flammable vapor exclusion zones. In giving recognition to the integrity of all-welded transfer piping, the determination of the single accidental leakage source should be based on an evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc., and any flanges that may be used at valves or other equipment, in order to determine the largest spill rate. This approach is the result of discussions with DOT, Office of Pipeline Safety (OPS) concerning the basis for design spills and application to exclusion zone determinations for proposals before the Commission.

Impoundment Systems and Sizing Spills

Part 193.2181 specifies that the impoundment system serving a single LNG storage tank must have a volumetric capacity of 110 percent of the LNG tank's maximum liquid capacity. Ingleside San Patricio proposes a double containment storage tank design where a concrete wall (269 feet in diameter and 137 feet high) serves as the secondary container. The volumetric capacity of the concrete wall would be 58,391,792 gallons (1,390,281 barrels), which would exceed the 110 percent requirement by 7,924,929 gallons.

Ingleside San Patricio proposes two impoundment basins, the main LNG impoundment basin and the LNG/Glycol impoundment basin, at the LNG terminal site. The main LNG impoundment basin would measure 50-feet-wide by 50-feet-wide with a depth of 30 feet, a usable capacity of 561,039 gallons. This basin would be located west of the LNG storage tanks, approximately midway between the tanks and the jetty. The main LNG impoundment basin would contain spills from the in-tank pumps header, the marine unloading line, and the send-out pumps. Any leakage from the vaporizers, which would contain both LNG and glycol, would be drained to the LNG/Glycol containment basin. This impoundment basin would be located approximately 140 feet southeast of the main LNG impoundment basin and would measure 20-feet-wide by 20-feet-wide with a depth of 30 feet. The holding capacity of this impoundment would be 89,766 gallons. These impoundment basins would be sloped for drainage and equipped with pumps that would discharge rainfall runoff at a rate equal to or greater than 25 percent of the 10-year frequency, one-hour duration storm.

Each LNG storage tank would be equipped with three in-tank pumps, each designed for 4,756 gpm. A rupture of the in-tank pump discharge header would result in a spill rate of 14,268 gpm, which equates to a spill volume of 142,680 gallons. This spill would be directed to the main LNG impoundment basin. Any LNG spills from the 36-inch-diameter unloading line as well as the sendout pumps discharge header would be directed to the same basin through impoundment troughs. The maximum flow through the ship unloading line would be 52,877 gpm, equating to 10-minute spill of 528,767 gallons. A 10-minute spill from the sendout

pumps discharge header would release 86,633 gallons of LNG. Each of these individual spills would be contained by the main LNG impoundment basin.

The area containing the vaporizers would be curbed and graded so that any spilled LNG would flow through impoundment troughs to the LNG/Glycol impoundment basin. This sump would contain a 10-minute spill from the vaporizer suction header, a spill of 89,709 gallons.

Table 4.12.4-1 presents the impounding areas and spill size volumes used to determine adequate impounding capacity.

TABLE 4.12.4-1

Impoundment Areas

Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
LNG Storage Tank	50,466,863	Concrete Wall	58,391,792
Marine Cargo System	528,767	Main LNG Impoundment Basin	561,039
In-tank LNG Pumps	142,680	Main LNG Impoundment Basin	561,039
Sendout Pumps Discharge Header	86,633	Main LNG Impoundment Basin	561,039
Vaporizer Suction Header	89,709	LNG/Glycol Impoundment Basin	89,766

Thermal Exclusion Zone

If a large quantity of LNG is spilled in the presence of an ignition source, the resulting LNG pool fire could cause high levels of thermal radiation. Exclusion distances for various flux levels were calculated according to 49 CFR 193.2057 and Section 2.2.3.2 of NFPA 59A, using the "LNGFIRE III" computer program model developed by the Gas Research Institute. NFPA 59A establishes certain atmospheric conditions (0 mph wind speed, 70°F, and 50 percent relative humidity) which are to be used in calculating the distances. However, Part 193.2057 supersedes these requirements and stipulates that wind speed, ambient temperature, and relative humidity which produce the maximum exclusion distances must be used, except for conditions that occur less than 5 percent of the time based on recorded data for the area. For its analysis, Ingleside San Patricio selected the following ambient conditions to produce the maximum distances: wind speed of 16.6 mph; ambient temperature of 50°F; and 48 percent relative humidity. These conditions yield longer distances than the 0 mph wind speed, 70°F ambient temperature, and 50 percent relative humidity specified in NFPA 59A. We agree with Ingleside San Patricio's selection of atmospheric conditions.

Thermal radiation distances were calculated for 1,600- to 10,000-Btu/ft^2-hr incident flux levels for an LNG storage tank impoundment fire. The concrete wall's diameter (269 feet) was used as the pool diameter, with a flame height equal to the top of the concrete wall (137 feet). Target height was set at ground level (0 feet). In addition, the thermal radiation distances were determined for the 1,600-Btu/ft^2-hr incident flux level centered on both the main LNG impoundment basin and the LNG/Glycol impoundment basin.

Table 4.12.4-2 presents the calculated maximum distances for incident flux levels ranging from 1,600 to 10,000-Btu/ft^2-hr, as verified by FERC staff. These exclusion zones remain completely on the proposed plant site.

TABLE 4.12.4-2

Thermal Exclusion Zones

Source	Exclusion Area NFPA 59A Section 2-2.3.2(a)	Incident Flux (Btu/ft^2 hr) (a/)	Exclusion Zone (feet)
LNG/Glycol Impoundment Basin	Property line that can be built upon.	1,600	131
Main LNG Impoundment Basin	Property line that can be built upon.	1,600	275
LNG Storage Tank Impoundment	Outdoor assembly area occupied by 50 or more people.	1,600	941
LNG Storage Tank Impoundment	Off-site structures used for occupancies or residences.	3,000	732
LNG Storage Tank Impoundment	Property line that can be built upon.	10,000	373

a/ The 1,600 Btu/ft^2-hr flux level is associated with an exposed person experiencing burns within about 30 seconds. At 3,000 Btu/ft^2-hr, an exposed person would experience burns within 10 seconds; however, a wooden structure would not be expected to burn and affords protection to sheltered persons. At 10,000 Btu/ft^2-hr, clothing and wood can ignite spontaneously.

Vapor Dispersion Zone

A large quantity of LNG spilled without ignition would form a flammable vapor cloud that would travel with the prevailing wind until it either dispersed below the flammable limits or encountered an ignition source. Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A and Part 193.2059 require that provisions be made to minimize the possibility of flammable vapors from reaching a property line that can be built upon and that would result in a distinct hazard. Part 193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (one half the lower flammability limit [LFL] of LNG vapor) under meteorological conditions which result in the longest downwind distances at least 90 percent of the time. Alternatively, maximum downwind distances may be estimated for stability Class F, a wind speed of 4.5 mph, 50 percent relative humidity, and the average regional temperature. The section allows the use of the DEGADIS Dense Gas Dispersion Model, or the FEM3A model, to compute dispersion distances. Design spills into impounding areas serving LNG containers, transfer systems, and piping are to be determined in accordance with Section 2.2.3.5 of NFPA 59A.

In accordance with Section 2.2.3.3 of NFPA 59A, an average concentration of methane in air of 50 percent of the LFL cannot cross the property line from a design spill into each tank impoundment. In this case, compliance with Section 2.2.3.3 would also meet the requirements of Section 2.2.3.4 of NFPA 59A. According to table 2.2.3.5 of NFPA 59A, the design spill is the largest flow from the container (*i.e.*, storage tank) withdrawal pumps for a 10-minute duration at full-rated capacity. This would be a guillotine rupture of the discharge header for the in-tank

LNG pumps. Since each pump is rated at 4,756 gpm and there are three pumps per tank, the resulting spill would be 142,680 gallons.

Ingleside San Patricio's application contained a vapor dispersion analysis for the main LNG impoundment basin and the LNG/Glycol impoundment basin. An average regional temperature of 71°F, 50 percent relative humidity, and 4.5 mph wind speed were used as input conditions. In its application, Ingleside San Patricio elected to model a guillotine rupture of the unloading transfer line, a spill rate of 52,877 gpm, which would result in a 10-minute spill of 528,767 gallons to the main LNG impoundment basin. According to Ingleside San Patricio, both impoundment basins would consist of concrete walls and insulating perlite concrete (IPC) floors. However, Ingleside San Patricio submitted calculations simulating the entire sump as either concrete or IPC, but not as a mixture of both. With concrete as the main LNG impoundment basin's material, Ingleside San Patricio's analysis for a full flow from an unloading line indicated a distance of 1,181 feet to the edge of the one-half LFL envelope. This would extend approximately 274 feet beyond the south boundary of the site. Ingleside San Patricio also calculated a vapor dispersion zone of 763 feet with the entire sump constructed of IPC. From the plot plans provided, this exclusion zone would not extend beyond the plant property line.

Since the vapor dispersion zone for a concrete impoundment basin would cross over the plant boundaries, FERC staff requested Ingleside San Patricio to submit revised calculations that take into account the combination of concrete and insulating perlite concrete as impoundment materials. However, in its comments to the Draft EIS, Ingleside San Patricio once again submitted calculations modeling the entire sump as either concrete or IPC, but not as a mixture of both Consequently, **we recommend that:**

- **Ingleside San Patricio should either provide revised vapor dispersion calculations based on the main LNG impoundment configuration with both concrete walls and an insulating perlite concrete floor or specify a different impoundment configuration. This information should be filed with the Secretary 30 days prior to initial site preparation for review and approval by the Director of OEP. Alternatively, Ingleside San Patricio may provide evidence of its ability to exercise legal control of the activities that occur with the portions of the vapor dispersion exclusion zone shown to fall outside of the site property line.**

The vaporizers, which contain both LNG and glycol, would drain to the LNG/glycol containment sump. Ingleside San Patricio elected to define the largest single accidental leakage source to the LNG/Glycol impoundment basin as a full flow of 86,640 gallons from the vaporizer suction header. This spill would result in a one half LFL envelope of 787 feet for a concrete sump and 391 feet for an IPC sump. With either concrete or IPC as the sump material, the vapor exclusion zones from the LNG/Glycol containment sump would remain within the plant boundaries.

Another issue is the lengthy distance from potential spill locations to the process and dock area sumps. While it is an appropriate design philosophy to direct potential spills away from process equipment to remote impoundments, and it is technically correct to base exclusion zone calculations on these impoundments, it is also relevant to consider the control of vapors produced in the channels or trenches leading to these sumps. Long trenches increase the surface area available for heat transfer and, correspondingly, increase vapor generation. A number of vapor control options are available including: vapor fences; fixed high expansion foam

generators; reduced trench lengths and/or surface area; and additional sumps at intermediate locations along transfer piping. As a result, **we recommend that:**

- **Ingleside San Patricio examine provisions to retain any vapor produced along the transfer line trenches and other areas serving to direct LNG spills to associated impoundments. Measures to be considered may include, but are not limited to: vapor fencing; intermediate sump locations; or trench surface area reduction. Ingleside San Patricio should file final drawings and specifications for these measures with the Secretary 30 days prior to initial site preparation for review and approval by the Director of OEP.**

4.12.5 Marine Safety[12]

The February 2004 Interagency Agreement provides the framework for the participating agencies to work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals. The FERC closely coordinates its pre-certificate review of the proposal with the Coast Guard, which has authority over the safety of LNG vessels and the marine transfer area as well as the security of the LNG vessels and the entire LNG facility.

The hazards associated with the marine transportation of LNG differ from land-based hazards. Whereas the land-based facilities have features to both limit the duration of LNG spills and contain credible spill volumes, an LNG spill on water may be unconfined and may vaporize rapidly due to heat input from the water.

The history of LNG shipping has been free of major incidents, and none have resulted in significant quantities of cargo being released (see section 4.12.5.5). No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargoes being released. However, the possibility of an LNG spill from a ship over the duration of the proposed project must be considered. Historically, the events most likely to cause a significant release of LNG were a ship casualty such as:

- a vessel colliding with an LNG ship in transit;
- an LNG ship alliding[13] with the terminal or a structure in Corpus Christi Bay;
- a vessel alliding with an LNG ship while moored at the terminal; or
- a grounding sufficiently severe to puncture an LNG cargo tank.

However, the attacks on September 11, 2001, have made the public keenly aware of additional risks that must be considered in the evaluation of marine safety and security:

- a deliberate attack on an LNG ship by a terrorist group.

Any of the above events would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. Previous incidents with LNG ships have primarily involved

[12] This section was written with the cooperation and assistance of the U.S. Coast Guard, Marine Safety Unit Galveston.

[13] "Allision" is the action of dashing against or striking upon a stationary object (*e.g.*, the running of one ship upon another ship that is docked) – distinguished from "collision", which is used to refer to two moving ships striking one another.

grounding, and none of these have resulted in the breach of the double hull and subsequent release of LNG cargo.

The following discussion provides a chronology of the LNG ship voyage from the liquefaction facility to the import terminal, disclosing the risks at each step and how they are managed. Details and analysis are provided in subsequent sections.

LNG Vessels and Ocean Voyage

Imported LNG could be obtained from exporting terminals throughout the world and delivered by LNG ships to the proposed terminal. Exporting countries include Algeria, Australia, Brunei, Indonesia, Malaysia, Nigeria, Oman, Qatar, Trinidad, and United Arab Emirates. In 2003, LNG imports to the U.S. included: 72 percent from Trinidad, 12 percent from Nigeria, 10 percent from Algeria, 3 percent from Qatar, 2 percent from Oman, and 1 percent from Malaysia. At this time, Ingleside San Patricio has not confirmed the source(s) of LNG supplies.

The LNG ships used to import LNG to the U.S. would be constructed and operated in accordance with the International Maritime Organization (IMO) Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk, the SOLAS, and 46 CFR Part 154, which contain the U.S. safety standards for vessels carrying bulk liquefied natural gas. Foreign flag LNG ships are required to possess a valid IMO Certificate of Fitness and a Coast Guard Certificate of Compliance.

In 1993, amendments to the IMO's Code for the Construction and Equipments of Ships Carrying Dangerous Chemicals in Bulk require all tankers to have monitoring equipment with an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a cargo tank. In addition, the cargo tanks are heavily instrumented, with gas detection equipment in the hold and inter-barrier spaces, temperature sensors, and pressure gauges. Fire protection must include the following systems:

- a water spray (deluge) system that covers the accommodation house control room and all main cargo valves;
- a traditional firewater system that provides water to fire monitors on deck and to fire stations found throughout the ship;
- a dry chemical fire extinguishing system for hydrocarbon fires; and
- a carbon dioxide system for protecting machinery including the ballast pump room, emergency generators, and compressors.

As a result of September 11, 2001, the IMO agreed to new amendments to the 1974 SOLAS addressing port facility and ship security. The International Ship and Port Facility Security (ISPS) Code was adopted in 2003 by the IMO. This code requires both ships and ports to conduct vulnerability assessments and to develop security plans. The purpose of the code is to: prevent and suppress terrorism against ships; improve security aboard ships and ashore; and reduce the risk of passengers, crew, and port personnel on board ships and in port areas, for vessels and cargoes. All LNG vessels as well as other cargo vessels 300-gross tons and larger, and ports servicing those regulated vessels, must adhere to these IMO and SOLAS standards. Some of the IMO requirements are as follows:

Ships:

- Ships must develop security plans and have a Ship Security Officer.
- Ships must be provided with a ship security alert system. These alarms transmit ship-to-shore security alerts to a competent authority designated by the Administration, which may include the company, identifying the ship, its location, and indicating that the security of the ship is under threat or has been compromised.
- Ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships.
- Ships may have certain equipment onboard to help maintain or enhance the physical security of the ship.

Port Facilities:

- The port facility must have a security plan and a Facility Security Officer (FSO).
- Certain security equipment may be required to maintain or enhance the physical security of the facility.

Both ships and ports must:

- Monitor and control access.
- Monitor activities of people and cargo.
- Ensure security and availability of communications.
- Complete a Declaration of Security.

LNG Vessel Transit in Corpus Christi and La Quinta Channels

LNG ships in route to the LNG terminal would transit the 17.3 nautical miles from the sea buoy to the berth under the direction of a pilot from the Aransas-Corpus Christi Pilots Association (Pilots). The Pilots are presently the controlling body in terms of scheduling, monitoring of weather conditions, establishing working conditions, and declaring channel closure days based on inclement weather. Pilots meet ships, day or night, at the sea buoy located southeast of the Port Aransas jetties.

LNG ships would enter the port through Aransas Pass. From there, vessels would travel along the Lower Bay Reach of the Corpus Christi Ship Channel for about 8.5 nautical miles, at which point they would turn north and continue along the La Quinta Channel for about 5 nautical miles to the LNG terminal.

Ingleside San Patricio has stated that it would arrange for three dedicated tractor tugs designed with an appropriate amount of bollard pull to handle an LNG ship. Typically the LNG ship would arrive and enter the port during early daylight hours and would be assisted by three tractor tugs in the approach to the LNG terminal. The berth would be aligned such that the LNG vessels would be turned by the tugs and backed onto berth. Docking, LNG offloading, and undocking would take less than 24 hours. The LNG ship would depart during daylight hours on the second day.

In addition to the Pilots, the Coast Guard would control the transit of the LNG vessel through the harbor and while unloading cargo. Typical Coast Guard requirements for other LNG import terminals include 96- and 24-hour advance notification of the vessel arrival. Upon arrival at the sea buoy, Coast Guard personnel may board the LNG vessel for an inspection of the ship safety systems and review of the manifest. Other requirements may include: a Coast Guard escort through the channel and to the dock; establishment of a moving safety and/or security zone around the vessel while in route and during unloading operations; an inspection of the dock safety systems prior to commencing cargo transfer; monitoring of all operations until the vessel departs; and maintaining security of the dock and vessel (see section 4.12.5.2).

LNG Vessel Casualties

The operational controls by the Coast Guard and the Pilots, as well as the characteristics of the Corpus Christi and La Quinta Channels, minimizes the possibility of an LNG cargo spill from groundings, collisions, and allisions. The soft nature of the sea bottom in the Corpus Christi and La Quinta Channels makes an LNG spill from cargo tanks highly unlikely in a grounding incident. The entrance jetties are bordered by shallow water approximately 25 to 30 feet deep, thereby preventing the LNG ships, which have drafts of over 38 feet, from contacting the jetties.

The Coast Guard is authorized to establish safety zones, or other measures for limited, controlled, or conditional access and activity, when necessary for the protection of any vessel, structure, waters, or shore area. Both the Coast Guard and the Pilots may enforce moving safety and/or security zones around the LNG ships. Although not yet defined, typically these zones would clear the harbor of the vessels with the tonnage and speed required to cause an LNG spill (see section 4.12.5.2).

Deliberate Attack on an LNG Vessel

In addition to addressing the potential hazards from LNG vessel casualties, the possibility of a deliberate attack on an LNG ship by a terrorist group must also be considered. Security of the LNG vessel is the responsibility of the owner/operator and the master of the vessel. Security of the facility is the responsibility of the owner/operator of the facility. Protection of the LNG vessel and the import terminal would involve personnel from the Coast Guard, Ingleside San Patricio security staff, and state and local law enforcement. The Coast Guard would conduct random shoreside and waterside security patrols to include visits/passes of the LNG facility. In addition, the Coast Guard may establish a safety and/or security zone around the LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port or the District Commander would be permitted in the safety/security zone.

Ingleside San Patricio would provide security for the terminal according to a Facility Security Plan prepared under 33 CFR 105 and approved by the Coast Guard Captain of the Port. Some of the requirements include:

- a Facility Security Assessment to identify site vulnerabilities, possible security threats, consequences of an attack, and facility protective measures;
- a Facility Security Plan with procedures for responding to security incidents;
- a designated Facility Security Officer responsible for implementing and periodically updating the Facility Security Plan and Assessment;

- scalable security measures to provide increasing levels of security at increasing Maritime Security (MARSEC) levels;
- security exercises at least once each calendar year and drills at least every three months; and
- mandatory reporting of all breaches of security and security incidents.

Security at the facility would be provided by both active and passive systems. The entire site would be surrounded by a protective enclosure (*i.e.,* a fence) with sufficient strength to deter unauthorized access. The enclosure would also be illuminated with not less than 2.2 lux between sunset and sunrise. Intrusion detection systems and day/night camera coverage would identify unauthorized access. A separate security staff would conduct periodic patrols of the plant, screen visitors and contractors, and assist in maintaining security of the marine terminal during cargo unloading. Ingleside San Patricio would be required to submit their Facility Security Plan to the Captain of the Port 60 days prior to commencement of operations. In order to ensure that the responsibilities of Ingleside San Patricio's security staff enhance overall security, **we recommend that:**

- **Ingleside San Patricio coordinate with the Coast Guard to define the responsibilities of Ingleside San Patricio's security staff in supplementing other security personnel and in protecting the LNG tankers and terminal prior to commissioning.**

A detailed evaluation of the consequences of a terrorist attack on a modern membrane LNG tanker was prepared by Lloyds Register North America for the Weaver's Cove LNG Project (see section 4.12.5.5). This analysis provides a basis for estimating the potential magnitude of a hazard from a successful terrorist attack and for developing LNG vessel and waterfront security plans.

In addition, the U.S. Department of Energy (DOE) released a study by Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water* (Sandia Report) December 2004. The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills.

The methodology described in the ABSG Consulting Inc. (ABSG) study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, and revised in staff's responses to comments on the report (issued June 18, 2004), was used to calculate the thermal radiation and flammable vapor dispersion distances for several holes ranging in diameter from 1 meter to 3.9 meters. Using the methodology, we have estimated distances to range from 4,340 to 4,815 feet for a thermal radiation of 1,600 Btu/ft^2-hr, the level which is hazardous for persons located outdoors and unprotected, from 3,300 to 3,705 feet for

3,000 Btu/ft^2-hr, an acceptable level for wooden structures, and from 1,970 to 2,176 feet for 10,000 Btu/ft^2-hr, a level sufficient to damage process equipment for a nominal hole size of 5 m^2.

These intentional breach scenarios provide guidance in developing the operating restrictions for LNG vessel movements in the Corpus Christi and La Quinta Ship Channels, as well as in establishing potential impact areas for emergency response and evacuation planning. Except for the 17.3 nautical mile transit through the Corpus Christi and La Quinta Channels to the LNG berth, the transit would be in the open water of the Gulf of Mexico. Large portions of the Corpus Christi and La Quinta Channels have no development or communities adjacent to the channel. However, within 4,340 to 4,815 feet of the Corpus Christi and La Quinta Channels are the communities of Port Aransas, Port Ingleside, and Ingleside-on-the-Bay. These communities are already familiar with oil, chemical, and LPG vessels passing at close range.

Assuming an LNG vessel transit through the channel at 8.0 knots (without tug assist), these areas would be exposed to a potential transient hazard of approximately 12 minutes. Assuming tug assist, LNG vessel transit would be 3.0 knots, and these areas would be exposed to a potential transient hazard of approximately 30 minutes. In addition, a temporary hazard would exist around the slip during part of the 24-hour period while the LNG vessel is at the dock and unloading cargo. The LNG vessel movement requirements that the Coast Guard would impose in its operation plan, as well as any operational restrictions imposed by the Pilots, would minimize the possibility of a hazardous event occurring in the Corpus Christi and La Quinta Channels.

Emergency Response and Evacuation Planning

Prior to commencing operations, Ingleside San Patricio would prepare emergency procedures manuals, as required by 49 CFR Part 193.2509 that provide for: (a) responding to controllable emergencies and recognizing an uncontrollable emergency; (b) taking action to minimize harm to the public including the possible need to evacuate the public; and (c) coordination and cooperation with appropriate local officials. Specifically, section 193.2509(b)(3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…" Typically, the manuals are prepared at the later stages of the construction process and submitted to FERC as a requirement prior to placing the facility in service.

While the worst-case scenarios evaluated for the onshore facility in section 4.12.4 and for marine spills in 4.12.5 provide guidance on the maximum extent of potential hazards, they should not be assumed to represent the evacuation zone for *every* potential incident. As with any other fuel or hazardous material, the actual severity of the incident will determine what area needs to be evacuated, if any, rather than a worst-case maximum zone. It is anticipated that the emergency evacuation plans will identify evacuation distances based upon increasing severity of events.

While recognizing that preparing emergency procedures typically occurs at the end of the construction phase rather than at the EIS stage, there remain a number of issues concerning the viability of the Emergency Response and Evacuation Plan that need to be demonstrated. Therefore**, we recommend that:**

- **Ingleside San Patricio develop emergency evacuation routes/methods for the areas along the route of the LNG vessel transit in conjunction with the local emergency**

planning groups and town officials and file the routes/methods with the Secretary for review and written approval by the Director or OEP <u>prior to initial site preparation.</u>

In addition, **we recommend that:**

- **Ingleside San Patricio develop an Emergency Response Plan (including evacuation) and coordinate procedures with local emergency planning groups, fire departments, state and local law enforcement, and appropriate Federal agencies. This plan should include at a minimum:**

  a. designated contacts with state and local emergency response agencies;

  b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

  c. procedures for notifying residents and recreational users within areas of potential hazard;

  d. evacuation routes for public use areas and residents of areas along the route of the LNG transit;

  e. locations of permanent sirens and other warning devices; and

  f. an "emergency coordinator" on each LNG vessel to activate sirens and other warning devices.

  The Emergency Response Plan should be filed with the Secretary for review and approval by the Director of OEP <u>prior to commencement of service</u>. Ingleside San Patricio should notify FERC staff of all meetings in advance and should report progress on its Emergency Response Plan at 6-month intervals starting at the commencement of construction.

4.12.5.1 Corpus Christi and La Quinta Shipping Channels

Corpus Christi Bay has a number of port and waterfront facilities, most of which are centered around the City of Corpus Christi on the west side of the bay. The port's deep water facilities are located along the dredged ship channels which are a continuation of the main Corpus Christi channel used as access to and from the Gulf of Mexico.

Cargoes handled at the Port of Corpus Christi include grain, general freight, alumina, aluminum hydrate, caustic soda, crude oil, petroleum/petrochemical products, LPG, and chemicals. Additionally, there are extensive marine support facilities including ship repair, bunkering, lay-up berths, and also bases for serving offshore oilfield supply vessels. There are other port/waterfront facilities located around the Corpus Christi Bay area, including the:

- Naval Station Ingleside (close to the crossing point of the Corpus Christi and La Quinta Channels and GIWW;
- Port Aransas Ferry facilities between Port Aransas and Harbor Island (within 1 mile of the cut between San Jose Island and Mustang Island);

- Kiewit Offshore Services (construction of oil rigs and production platforms) located near Ingleside;
- numerous leisure facilities (marinas, moorings, boatyards, etc.) at various locations around the Bay area; and
- numerous fishing vessel facilities (vessel docks and landing sites) at various locations around the Bay area.

All LNG shipping would enter and depart the Corpus Christi Bay area by the Corpus Christi Channel, as is the case with most of the seagoing shipping bound for the Port of Corpus Christi. The Corpus Christi Channel is approximately 34 nautical miles long from the sea buoy in the Gulf of Mexico to the end at Corpus Christi Harbor, including the length of the La Quinta Channel. The length of each segment of the channel that would be traversed, and channel characteristics as they relate to marine safety, are summarized in table 4.12.5.2-1.

TABLE 4.12.5.2-1

Channel Characteristics for Route That Would be Used by LNG Ships Calling on Proposed LNG Terminal

Channel Segment	Length (NM)	Width (ft)	Depth (ft)
Aransas Pass Outer Bar to Inner Basin	3.9	600 - 700	45 - 47
Corpus Christi Channel (Inner Basin to La Quinta Junction)	8.5	300 - 600	45
La Quinta Channel	4.9	300 - 400	45
Total Length	**17.3**		

Source: Port of Corpus Christi Authority, 1998.

Upon reaching the Ingleside Energy Center LNG Terminal, an LNG ship would be required to turn in a specially constructed turning basin in the La Quinta Channel, adjacent to the LNG berth. Ingleside San Patricio coordinated the design of this basin with the Pilots and has incorporated the Pilots' suggested revisions. Once turned in the basin with tug assistance, the ship would be maneuvered back and onto the LNG berth. The ship would be moored so that it points outward towards the La Quinta Channel. This would allow ships to depart the LNG terminal without turning, which would provide for a more rapid emergency evacuation from the berth should this be required.

Current Traffic

Vessel movements in Corpus Christi Bay are heavily dominated (numerically) by barge traffic, much of which transits to and from Corpus Christi Bay ports via the GIWW. The number of inbound vessel transits in Corpus Christi Bay from 1993 to 2002 are shown in figure 4.12-1. The dominant cargo commodity for vessels entering Corpus Christi Bay is petroleum products (figure 4.12-2).

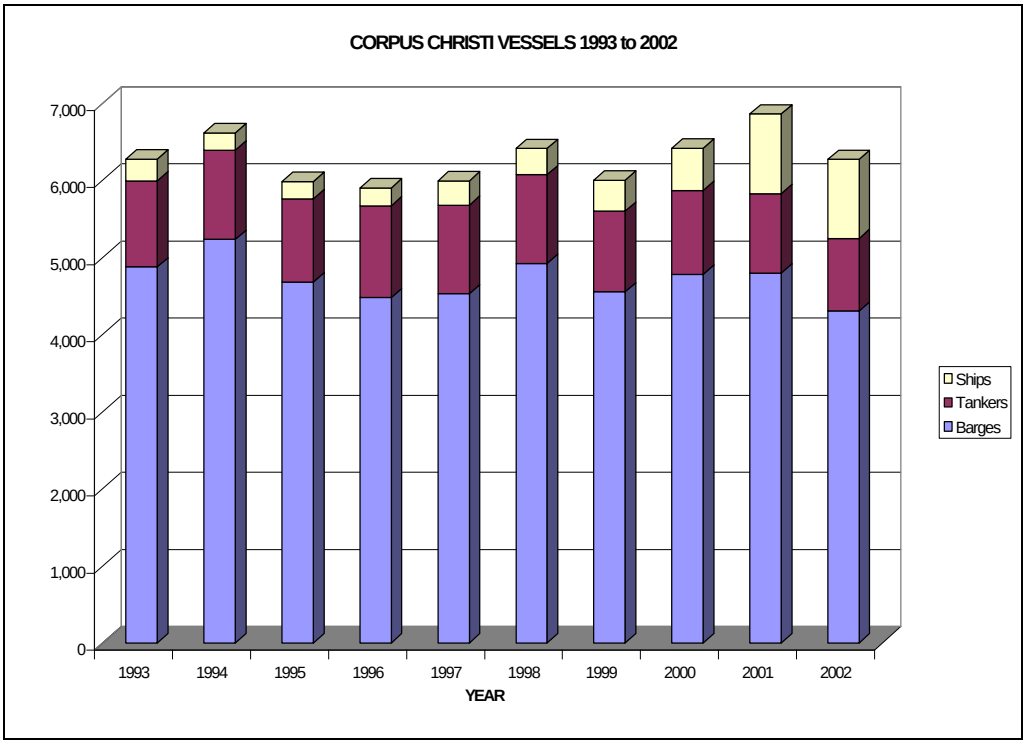

Figure 4.12-1
Vessel Movements in Corpus Christi Bay

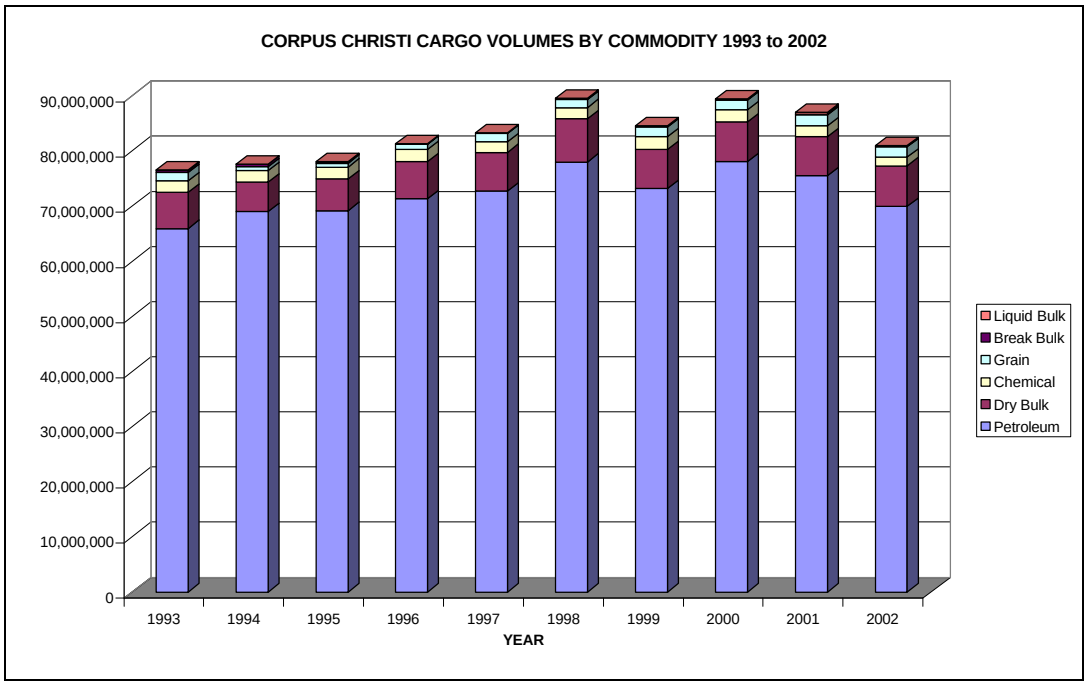

Figure 4.12-2
Ship Cargo Volumes (Short Tons) by Commodity, Corpus Christi

Table 4.12.5.2-2 lists recorded vessel traffic in Corpus Christi Bay according to draft (COE, 2001). Approximately 89 percent of the vessel traffic in Corpus Christi Bay is made up of vessels with a draft of less than 18 feet. This traffic enters and leaves Corpus Christi Bay primarily by means of the GIWW, and not via the main shipping channels. Approximately 11 percent of the existing traffic is deep draft vessels that are limited to the shipping channels.

Of the 17 nautical miles of route that LNG tankers would use to reach the Ingleside Energy Center LNG Terminal, approximately 1.0 nautical mile directly south of Port Ingleside would be along a channel where both the Corpus Christi Channel and the GIWW are collocated. In this area, both deep draft and shallow draft vessels must share the same route, and barge traffic transiting from the Bay ports (mainly Corpus Christi) to the GIWW, and vice versa, potentially conflicts with the proposed LNG traffic.

In addition, Naval Station Ingleside is home to approximately 25 mine sweepers and is a port of call for other naval vessels. The base is a training center and the mine sweepers practice in the Gulf and in the Jewell Fulton Channel off La Quinta Channel on a weekly schedule. While the Navy ship schedules are classified, Naval Station Ingleside has indicated to similar LNG projects proposed in the vicinity that it would coordinate the training schedule around the LNG ships provided the Navy is closely advised of the LNG ship schedules.

TABLE 4.12.5.2-2

Corpus Christi Ship Traffic by Vessel Draft

Draft/Vessel Type	Number of Vessel Transits by Year						
	1997	**1998**	**1999**	**2000**	**2001**	**Total**	**Percent**
> 18 feet							
Tug/Tow	38	47	38	27	70	220	0.4
Tanker	993	942	888	916	837	4,576	7.9
Cargo/Pax	257	333	385	356	305	1,636	2.8
Subtotal	**1,288**	**1,322**	**1,311**	**1,299**	**1,212**	**6,432**	**11.1**
< 18 feet							
Tug/Tow	7,849	8,001	6,971	7,368	7,321	37,510	64.8
Tanker	94	91	99	95	78	457	0.8
Cargo/Pax	2,827	2,408	2,548	2,929	2,752	13,464	23.3
Subtotal	**10,770**	**10,500**	**9,618**	**10,392**	**10,151**	**51,431**	**88.9**
Total	**12,058**	**11,822**	**10,929**	**11,691**	**11,363**	**57,863**	**100**

Source: COE, 2001.

The Port Aransas ferry, connecting Harbor Island with Port Aransas, operates 24 hours a day, 365 days a year and crosses the ship channel perpendicularly. Scheduled crossings typically last from 3 to 10 minutes according to weather and channel traffic conditions. However, automobile traffic has increased over recent years and the number of unscheduled crossings has risen accordingly. Daily delays currently exist due to ship traffic and weather conditions. According to existing traffic demand, vehicles may have to wait as much as 20 minutes to board the ferry. Additional discussion is provided in section 4.12.5.4.

Transportation of oil rigs and production platforms constructed at Kiewit Offshore Services will occasionally be moved through the ship channel. Although movement of these components often result in channel closure, they are infrequent and scheduled far enough in advance to allow coordination between the Coast Guard and the Pilots to minimize traffic disruptions.

Future Traffic

The Marine Traffic Analysis Report performed by ENSR Corporation for Ingleside San Patricio provided data on existing vessel traffic that shows a variable pattern of shipping volume. If it is assumed that future vessel traffic remains steady, the addition of up to 140 LNG ships per year that would call on the Ingleside Energy Center LNG Terminal would result in an 10.8 percent increase in large vessel traffic, and a 1.2 percent increase in total vessel traffic.

However, there are a number of other proposed facilities along the La Quinta Ship Channel which could increase large, deep draft vessel traffic. The PCCA has proposed a container terminal, the La Quinta Container Terminal (Terminal), located at the end of the La Quinta Channel. The draft environmental document for the Terminal estimates 262 to 363 additional vessels per year. Additionally, Cheniere Corpus Christi LNG, L.P. has proposed the Cheniere Corpus Christi LNG Project (Docket No. CP04-37-000) which would add an estimated 300 additional LNG vessels per year. Vista del Sol LNG Terminal L.P. has proposed an LNG terminal (Docket No. CP04-395-000) estimated to require 100 LNG vessels per year. Based on the number of vessel transits per year shown in table 4.12.5.2-2, current traffic levels average 3.5 vessels (with a draft greater than 18 feet) per day. If all the proposed facilities were built, the increased traffic would average six vessels per day.

Traffic studies performed for the Vista del Sol LNG Project (Docket No. CP04-395-000) also provided a growth forecast for non-LNG vessels having drafts deeper than 18 feet. The estimate was calculated by assuming an aggressive growth trend based on a 1-percent linear growth from the busiest year (1998) on record to the year 2008. Based on this method, the Corpus Christi and La Quinta Channels would have a demand of approximately 2,014 vessels per year. If all of the LNG facilities are constructed, the traffic levels would average 11.5 vessels per day.

In an effort to minimize impacts on ship traffic, the Port of Corpus Christi is developing a Vessel Traffic Information System (VTIS), which would include the use of radar, closed circuit video, an automated identification system, and a computerized traffic information system. The VTIS is scheduled to be operational in the spring of 2005, well before any of the proposed LNG terminals would begin operation. The utilization of this system, coupled with the current traffic management system used at the port, would provide improved traffic control to minimize the impacts that would result from increases in ship traffic (PCCA, 2004).

Ship Traffic in the Navigation Channels

There are a number of factors that influence the movement of ship traffic in the Corpus Christi Bay Channels. These include:

- *Jetty Entrance Channel and Cross-Current* – The COE-designated entrance channel extends from the end of the Port Aransas Channel jetties to the sea buoy. The jetty entrance includes the critical maneuvering area from just outside to just inside the ends of

the jetty where ships transition from exposure to cross-currents in the open Gulf to being in protected waters.

The navigable channel narrows from 700 to 800 feet (Aransas Pass Channel) to 600 feet in the Jetty Channel. On occasion, "long-shore" or "littoral" currents occur along the Texas coast. These wind-generated currents in conjunction with tidal effects can flow in either direction and are perpendicular to the port shipping channels. These currents require ships to approach the jetty entrance at an angle of up to 10 degrees. Currently pilots restrict entrance of typical deep-draft ships (820 feet in length with 125-foot beam and drafts up to 40 feet) calling at Corpus Christi ports when the crosscurrent exceeds 5.0 knots (approximately 5 percent of the time).

Entrance of the largest ships (900 feet in length with beams up to 145 feet and drafts up to 42 feet) calling at Corpus Christi is possible only when the crosscurrent is negligible or 70 to 75 percent of the time.

- *Corpus Christi Channel Draft* – The main channel is maintained at a nominal depth of -45 feet MLT, meaning that the COE dredges Corpus Christi Harbor Channel to -47 feet plus up to 2 feet more for over depth allowance. This allows for the channel to shoal up to -45 feet MLT before it is dredged again. Under normal tides there is usually 2 feet, typically providing a minimum of 47 feet of water. The largest LNG ships currently planned would have a draft of about 39.4 feet. If a 10 percent under keel clearance were desired, a depth of about 44.4 feet would be required for these vessels. The 47-foot effective depth of the Corpus Christi Channel would accommodate these LNG ships.
- *Day Transit and One–way Traffic* – Existing practice is for vessels 130,000 metric tons or over, or greater than 900 feet in length, to transit the channel only during daylight hours. According to the Pilots and the Coast Guard, LNG ship transit would only be allowed during daylight hours since the proposed LNG traffic would exceed the daylight only tonnage and/or length restrictions.

  One-way traffic is currently enforced within the Corpus Christi Shipping Channel based on the combined beam and combined draft of passing vessels. In addition, the moving safety zone around LNG vessels would prohibit any passing of these vessels. As a result, a convoying system is necessary in order to maximize the number of vessels traveling into and out of port on any given day. In this instance, all inbound traffic would travel as a group, with approximately 15 minutes to one hour between vessels. After the last of the inbound vessels is in port, all outbound shipments would commence with incremental spacing until all these vessels are out of port. This cycle then repeats. The need to convoy would primarily occur during periods where multiple ships are prepared to travel at any one time.
- *Tugs* – LNG ships delivering cargo to the proposed terminal would have tug support for all phases of arrival and departure, channel navigation, and for standby and fire fighting duties during LNG unloading operations. There are currently four harbor tugs provided by G&H Towing. Two of these have approximately 3,900 hp and the remaining two have approximately 3,000 hp. The Pilots have indicated that only larger tugs (70-ton bollard pull) would be permitted for the movement of LNG vessels within the shipping channel, and the current fleet of tugs would not be able to safely accommodate the transit

of LNG vessels to the proposed facilities. Ingleside San Patricio has indicated that it would arrange for three dedicated tractor tugs designed with adequate bollard pull to service the inbound and outbound movements expected at its facility.

- *Moving Safety Zone* – The Coast Guard currently imposes a 500-yard radius moving safety zone around incoming and outgoing LPG carriers while transiting the Corpus Christi Shipping Channel. Based on discussions with the Coast Guard, Ingleside San Patricio assumes that a similar zone would be enforced for LNG ships. The Coast Guard would determine the actual size of the safety zone after conducting a security review. This moving safety zone could result in delays to other ships.
- *Reduced Visibility* – Fog has the potential to eliminate all vessel movements for days at a time and is the primary source of weather-related channel traffic restrictions. Fog is worst between November and April, with a peak in January of approximately six days average for the month. The average number of heavy fog days is 29 days per year. The Pilots indicate that the fog mainly affects the coastal reaches of the channel and that while the fog may break inland, there are days in which it does not clear along the coast. As such, fog may sometimes stop vessel movements for 24 hours or more. The most frequent channel closures due to fog span 12 to 18 hours during the months of January and February.
- *High Winds* – Winds speeds of 10-12 knots are reported for the Corpus Christi area throughout the year. Winds in excess of 33 knots are reported 2 or 3 percent of the time between November and February, and less than 1 percent of the time for the remainder of the year. LNG ships present a relatively high wind sail area and as such are more susceptible to delays due to wind. The Coast Guard may establish a specific limit for LNG ship movement and berthing in high winds (typically 25 knots). The Pilots do not have a predetermined maximum wind speed for closing the channel; however, all traffic is usually stopped if high winds create unsafe transit conditions. The Pilots have indicated that the wind associated with offshore squalls which crop up on short order tend to produce choppy swells. It is sometimes the case where weather of this variety prompts a channel shutdown until seas subside. Weather related shutdowns are subjective in nature and are declared by the Pilots on a case-by-case basis.
- *Pilot Availability* – The Pilots operate with 12 pilots working on a rotating schedule with six pilots on call at any time. Based on size and tonnage, LNG ships would likely be categorized as a two-pilot vessel. The Pilots have stated that they have enough manpower to handle all the traffic at the Bay ports and would recruit and train more pilots as required to handle the additional LNG traffic and, if required, future container traffic if the La Quinta Container Terminal is constructed. The increase in pilot workload would be facilitated by allocating the newly trained pilots to smaller vessels, thereby ensuring that the more senior and experienced pilots handle the LNG ships.

Ship Navigation

Front-end engineering design for the marine facilities was performed by Goldston Engineering and Black & Veatch Pritchard, Inc. in May 2004. The work included planning of the proposed LNG slip; a determination of dredging requirements; a surge analysis; and a tug handling analysis for LNG ships ranging from 138,000 m^3 to 254,000 m^3. Suggestions by the Pilots were

incorporated into the design of the slip and the turning basin to ensure that the facilities would be suitable for LNG ships of these capacities. However, a study of the feasibility and safety of LNG vessel entry through the Port Aransas Channel jetties, as well as the transit to the turning area, was not included.

In contrast, the application submitted by Vista del Sol LNG Terminal L.P. for its proposed LNG terminal (Docket No. CP04-395-000) included a navigation study simulating the transit of a conceptual 250,000 m^3 capacity spherical LNG carrier from the Port Aransas Channel jetties to the proposed Vista del Sol facility. In several simulations, the LNG ship left the charted channel while making the inbound turn from the Corpus Christi Channel into the La Quinta Channel. Consequently, Vista del Sol proposed additional dredging of about 0.5 million cubic yards in this area. With the further dredging, the simulation concluded that the conceptual 250,000 m^3 LNG carrier could safely navigate through the ship channels to the proposed terminal. As the Ingleside Energy Center LNG terminal would be located near the proposed Vista del Sol facility and would share the same shipping channels, the potential use of 254,000 m^3 LNG ships requires that Ingleside San Patricio evaluate the need for dredging in these channels (see section 2.4.1.1). In the draft EIS, we requested that Ingleside San Patricio provide an evaluation of the quantity of dredging required to accommodate the maneuvering of LNG vessels up to 254,000 m^3 capacity through the Corpus Christi and La Quinta Channels. To date, Ingleside San Patricio has not responded to this request. Therefore, **we recommend that:**

- **Ingleside San Patricio should evaluate the need for additional dredging, and the quantity of dredging that would be required, to accommodate the maneuvering of LNG vessels up to 254,000 m^3 capacity through the Corpus Christi and La Quinta Channels. This study should be done in consultation with the COE, Coast Guard, and the Aransas Corpus Christi Pilots Association. Ingleside San Patricio should file the results of this evaluation with the Secretary for the review and approval of the Director of OEP prior to the use of LNG ships over 140,000 m^3 in capacity.**

4.12.5.2 Requirements for LNG Ship Operations in Corpus Christi Bay

The arrival, transit, cargo transfer, and departure of LNG ships in Corpus Christi Bay would adhere to the procedures of a Liquefied Natural Gas Vessel Management and Emergency Plan to be developed by the Coast Guard Marine Safety Office, Corpus Christi, Texas. In addition, Ingleside San Patricio would develop Operations and Emergency manuals in consultation with the Coast Guard. These procedures would be developed to ensure the safety and security of all operations associated with LNG ship transit and unloading. The manuals would contain specific requirements for the LNG ship, pre-arrival notification, transit through shipping channels, the waterfront facility, cargo transfer operations, Coast Guard inspection and monitoring activities, and emergency operations. The Corpus Christi Coast Guard Marine Safety Office would monitor each LNG ship in accordance with these manuals.

Some of the anticipated key provisions of the manuals would be the establishment of a moving safety and/or security zone for all inbound, outbound, and moored LNG ships; the use of a minimum of three tugs to assist in the ship channels and to maneuver the ship into the berth; and one tug to remain with the LNG ship while it is moored at the berth.

The Coast Guard regulations in 33 CFR 127 apply to the marine transfer area of waterfront facilities between the LNG ship and the last manifold or valve located immediately before a storage tank. Further, title 33 CFR 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, firefighting, and security of LNG waterfront facilities. The safety systems, including communications, emergency shutdown, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Ingleside San Patricio would be required to submit two copies of its Operations and Emergency Manuals to the Captain of the Port.

Title 33 CFR 127 separates cargo transfer operations into three distinct phases: Preliminary Transfer Inspection (Section 127.315); Declaration of Inspection (Section 127.317); and LNG Transfer (Section 127.319). These different sections require specific actions to be completed prior to and during the transfer. Additionally, there are specific actions required in the case of a release of LNG (Section 127.321).

In accordance with 33 CFR 127.007, Ingleside San Patricio submitted its Letter of Intent (LOI) to the Coast Guard on November 1, 2004. On February 1, 2005, the Coast Guard issued the proposed facility a Letter of Recommendation stating that the Corpus Christi and La Quinta Ship Channels are suitable for LNG transport. This determination is contingent upon the following stipulations:

- Ingleside San Patricio must provide three tractor tugs of sufficient horsepower designated for the sole purpose of safely maneuvering LNG vessels;
- at least one of these tugs remain in standby during LNG unloading operations;
- Ingleside San Patricio must maintain the vessel berthing area directly adjacent to the pier at a sufficient depth to safely accommodate the underkeel clearance of all LNG vessels;
- the requirements of 33 CFR Part 127 are met to the satisfaction of the Captain of the Port of Corpus Christi;
- appropriate LNG awareness/responder training is provided for all expected federal, state, and local emergency responders; and;
- excellent communication is maintained to ensure all security, vessel traffic, and safety issues are addressed immediately.

While the Letter of Recommendation addresses the suitability of Corpus Christi and La Quinta Ship Channels for LNG ship transportation, it does not constitute a final authority to commence LNG operations. Issues related to the public impact of safety or security zones would be addressed later in the development of the Coast Guard's *LNG Vessel Management and Emergency Plan*. In addition, the Coast Guard would establish safety and/or security zones under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the Caption of the Port are permitted in the safety zone.

Due to numerous planned and proposed LNG import terminals at various ports across the United States and the maritime security implications of LNG marine traffic on a port, the Coast Guard is currently preparing nationwide guidance to standardize the Coast Guard's approach in assessing the suitability of a waterway for LNG marine traffic. The purpose of this guidance is to provide Coast Guard Captains of the Port/Federal Maritime Security Coordinators, members of the LNG industry, and port stakeholders with guidance on assessing the suitability of a waterway for LNG

marine traffic that takes into account conventional navigation safety/waterway management issues contemplated by the existing Letter of Intent/Letter of Recommendation process, but in addition, will also take into account maritime security implications.

In order to update Ingleside San Patricio's Letter of Recommendation to account for the security requirement, the Coast Guard would require input from Ingleside San Patricio, port stakeholders, law enforcement officials, emergency response officials, and other local officials. Therefore, **we recommend that:**

- **Ingleside San Patricio should submit a waterway suitability assessment to the cognizant Captain of the Port/Federal Maritime Security Coordinator for review and validation and provide a copy to the FERC staff.**

We also recognize that the initial assessment would be prepared well before import operations would commence, and that the port's overall operation/security picture may change over that time period. New port activities may commence, infrastructure may be added, or population density may change. Improvements in technology to detect, deter and defend against intentional acts may also develop. Therefore, **we recommend that:**

- **Ingleside San Patricio should annually review its waterway suitability assessment for the project; update the assessment to reflect changing conditions; provide the updated assessment to the cognizant Captain of the Port/Federal Maritime Security Coordinator for review and validation; and provide a copy to the FERC staff.**

4.12.5.3 Impact of Vessel Security Requirements

Measures to ensure the safety and security of LNG vessels in the Corpus Christi and La Quinta Channels would be determined by the Coast Guard with the input of port stakeholders from federal, state, local, and commercial sectors. These measures complement the Maritime Transportation Security Act regulations enacted on July 1, 2004. The Coast Guard would then identify protocols which would become the basis for appropriate security measures for each Maritime Security threat level. Although the specific requirements would not be defined until this process is complete, general requirements that may be applied can be evaluated for the potential impact on other users of the waterway and on the adjacent shoreside public.

Impacts to the Port Aransas ferry schedule and delays in ferry service could occur due to the presence of LNG ships crossing the ferry's route. Depending on the presence of tugs, an LNG vessel would transit through the channel at 3.0 knots (with tug assist) or 8.0 knots (without tug assist). Assuming a typical LNG vessel safety zone (to be determined by the Coast Guard), the ferry could be delayed 20 minutes to an hour by a passing LNG carrier. Ingleside San Patricio filed a letter from the Pilots stating that the Pilots felt that impacts to the ferry could be minimized. In addition, the mayor and city manager of the City of Port Aransas, the Port of Corpus Christi, and the Coast Guard have indicated that the LNG ships calling on the Ingleside Energy Center LNG Terminal would have similar impacts to the ferry service as naval ships which enter the channel. To accommodate these restrictions, Ingleside San Patricio should provide arrangements for Port Aransas ferry operators to be notified of passing LNG ships so the ferry schedule could be adjusted accordingly. Therefore, **we recommend that:**

- **Prior to initial site preparation, Ingleside San Patricio demonstrate that suitable procedures and coordination exist between Ingleside San Patricio, the Pilots, and the TDOT to minimize delays to ferry operations from LNG carrier transits.**

4.12.5.4 LNG Ship Safety

Since 1959, LNG has been transported by ship without a major release of cargo or a major accident involving an LNG ship. Starting in 1971, LNG began arriving at the Distrigas facility in Everett, Massachusetts. To date, more than 450 cargoes, with volumes ranging from 60,000 to 138,000 m^3, have been delivered into the Port of Boston without incident. During 2003, a total of 506 bcf (204 cargoes) of LNG was imported into the United States. For 30 years, LNG shipping operations have been safely conducted in the United States.

The world's LNG ship fleet numbers 151, with an additional 57 ships contracted for delivery by 2006. During the last 40 years, LNG ships have made over 33,000 voyages and safely transported over 2.72 billion cubic meters of LNG. This includes over 1,500 voyages to or from U.S. ports. Currently, all of the ships in the LNG fleet operate under a foreign flag with foreign crews. A foreign flag ship must have a Certificate of Compliance inspection by the Coast Guard to ensure compliance with International safety standards.

History

During the 33,000 voyages that have been completed since the inception of LNG maritime transportation, there have been only eight significant incidents involving LNG ships, none of which resulted in spills due to rupturing of the cargo tanks. These incidents are described below:

- ***Pollenger*** had an LNG spill onto the steel cover of cargo tank number one during unloading at Everett, Massachusetts in April 1979. The spill caused cracking of the steel plate.
- ***Mostafa Ben Boulaid*** had a check valve fail when unloading at Cove Point, Maryland in April 1979, releasing a small quantity of LNG onto the ship and causing some minor fracture of the deck plating. Activation of the ship's safety systems (*i.e.*, the emergency shutdown system and water spray system), along with excellent response of the crew, kept the incident from propagating, thus minimizing any serious damage.
- ***El Paso Paul Kayser*** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the United States. Extensive bottom damage to the ballast tanks resulted; however, the cargo tanks were not damaged, and no cargo was released. The complete cargo of LNG was subsequently transferred to another LNG ship and delivered to its U.S. destination.
- ***LNG Libra's*** propeller shaft fractured while the ship was en route to Japan with a full cargo in October 1980. The ship was taken under tow, and the cargo was safely transferred to another LNG ship and delivered to its destination.
- ***LNG Taurus*** grounded in December 1980 near the entrance to Taboata Harbor, Japan. The grounding resulted in extensive bottom damage, but the cargo tanks were not affected. The ship was refloated and the cargo unloaded.

- ***Isabella*** had LNG spill onto its deck due to a cargo tank overflow in June 1985, causing severe cracking of the steelwork. The spill had been attributed to a cargo valve failure during discharging of cargo.
- ***Tellier*** was blown from its docking berth at Skikda, Algeria in February 1989 during severe winds causing damage to the loading arms and the ship and shore piping. The cargo loading had been secured just before the wind struck, but the loading arms had not been drained. Consequently, the LNG remaining in the loading arms spilled onto the deck causing fracture of some plating.
- ***Norman Lady*** was struck by the USS Oklahoma City nuclear submarine while rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 m^3 LNG tanker, which had just unloaded its cargo at Barcelona, Spain, sustained only minor damage to the outer layer of its double hull but not to its cargo tanks.

There have also been some incidents that involved the release of small quantities of LNG, such as minor leaks from seals and gaskets, some of which required that operations be temporarily stopped in order to rectify the malfunction.

Vessel Construction

In 1980, at the initial peak of LNG import activity in the U.S., the Coast Guard published the report *Liquefied Natural Gas and Liquefied Petroleum Gas – Views and Practices – Policy and Safety*. The report summarized the Coast Guard's extensive research into the safety hazards of LNG and its view that "...the nature of both LNG and LPG presents an acceptable risk for transportation in maritime commerce." This is due to the fact that LNG ships are well constructed, robust vessels designed to withstand low-energy type incidents that are prevalent in harbors and during docking operations. Moreover, safety measures, both equipment and training, are planned and designed into these LNG ships to prevent or control all types of potential incidents.

The insulation of cargo tanks on LNG carriers is a complex assembly of many layers. The relief valve capacity of cargo tanks is designed to compensate for over-pressure caused by fire. The potential that impingement by a cryogenic liquid could cause brittle fracture of the ship's hull was known to the Coast Guard in the mid-1970s when the U.S. regulation for LNG carriers in 49 CFR 154 were being developed. Accordingly, the regulations require the use of special crack-arresting in strategic locations throughout the vessel's hull. LNG carriers used in U.S. waters must also be constructed in accordance with the IMO Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk. This standard requires that the vessel inner hull adjacent to the cargo tanks be protected against contact from liquid cargo through a combination of proper material selection, adequate insulation, and use of heating systems.

As required by the IMO conventions and design standards, hold spaces and insulation areas on an LNG carrier are equipped with gas detection and low temperature alarms. These devices monitor for leaks of LNG into the insulation between primary and secondary LNG cargo tank barriers. In addition, hazard detection systems are also provided to monitor the hull structure adjacent to the cargo tank, compressor rooms, motor rooms, cargo control rooms, enclosed spaces in the cargo area, specific ventilation hoods and gas ducts, and air locks.

LNG carriers are equipped with a firewater system with the ability to supply at least two jets of water to any part of the deck in the cargo area and parts of the cargo containment and tank covers above-deck. A water spray system is also available for cooling, fire prevention, and crew protection in specific areas. In addition, certain areas of LNG carriers are fitted with dry chemical powder-type extinguishing systems and CO_2 smothering systems for fighting fires.

Unlike many conventional crude oil tankers, all LNG ships used to deliver LNG to this proposed project would have double-hull construction, with the inner and outer hulls separated by about 10 feet. Furthermore, the cargo tanks are normally separated from the inner hull by a layer of insulation approximately 1-foot thick. As a result, many grounding incidents severe enough to cause a cargo spill on a single-bottom oil tanker would be unable to penetrate both inner and outer hulls of an LNG ship. An earlier Federal Power Commission (predecessor to the FERC) study estimated that the double-bottom of an LNG ship would be sufficient to prevent cargo tank penetration in about 85 percent of the cases that penetrated a single-bottom oil tanker.

The probability of an LNG ship sustaining cargo tank damage in a collision would depend on several factors – the displacement and construction of both the struck and striking vessels, the velocity of the striking vessel and its angle of impact with the struck vessel, and the location of the point of impact. The previous Federal Power Commission study estimated the additional protection afforded by the double-hull would be effective in low energy collisions, overall it would prevent cargo tank penetration in about 25 percent of the cases that penetrated a single-hull oil tanker.

In 1995, to assist the Coast Guard in San Juan, Puerto Rico, EcoEléctrica L.P. prepared an analysis of the damage that could result from an oil tanker striking an LNG ship at berth (FERC, 1996). The analysis assumed a 125,000 m^3 LNG ship and an 82,000 dead weight ton tanker carrying number 6 fuel oil without tug assistance. The analysis determined the minimum striking speed to penetrate the cargo tanks of an LNG ship for a range of potential collision angles. The resulting minimum striking speeds are presented in table 4.12.5.5-1 for the two principal cargo systems.

TABLE 4.12.5.5-1

Minimum Striking Speed to Penetrate LNG Cargo Tanks

Angle of Impact	Minimum Striking Speed (knots)	
	Spherical Tanks	Membrane Tanks
Greater than 60 Degrees	4.5	3
45 Degrees	6.3	4
30 Degrees	9	6
15 Degrees	18	12

For membrane tanks, the critical beam-on striking speed is 3.0 knots, and for spherical tanks, the critical on-beam speed is 4.5 knots. For both containment types, lower angles of impact result in much greater minimum striking speeds to penetrate LNG cargo tanks. In the July/August 2002 issue of the "LNG Journal," the SIGTTO General Manager provides a table that shows the critical speed necessary for a 20,000-ton vessel to puncture the outer hull of an LNG carrier is

7.3 knots. For a 93,000-ton ship, the impact speed is 3.2 knots. In neither case does such an impact result in damage to the LNG cargo containment system or the release of LNG.

Hazards

In the event of a collision or allision of sufficient magnitude to rupture an LNG cargo tank, it is likely that sparks or flames would ignite the flammable vapors at the spill site. In a grounding of sufficient magnitude to rupture an LNG cargo tank, the damage would occur under water and the potential for ignition would be less than for collisions or allisions. In this case, an LNG spill would rapidly vaporize on water and form a potentially flammable cloud. If not ignited, the flammable vapor cloud would drift downwind until the effects of dispersion would dilute the vapors below the lower flammable limit for methane. The maximum range of potentially flammable vapors (*i.e.,* the distance to the lower flammable limit) is a function of the volume of LNG spilled, the rate of the spill, and the prevailing meteorological conditions. If the flammable vapor cloud encountered an ignition source, the cloud would burn back to the spill site.

The final EIS for the Calcasieu LNG Project (Lake Charles, LA) (September 1976) analyzed the maximum range of a flammable vapor cloud and hazardous radiation levels from an instantaneous one-tank spill. As was consistent with risk analyses at that time and for nearly 25 years thereafter, the instantaneous spillage of one cargo tank was considered to be the "worst case" scenario. Physical constraints on maximum vessel speeds and maximum depths of penetration required to rupture one LNG cargo tank render the possibility of an instantaneous release of more than one cargo tank to be implausible. This is not to imply that the loss of multiple cargo tanks could never occur, but that the extent of the hazard would not exceed that of the instantaneous spillage of one tank.

For an instantaneous one-tank spill with ignition, the final EIS for the Calcasieu LNG Project estimated that a hazardous thermal radiation level of 5,300 Btu/hr-ft^2 would extend 3,595 feet from the center of the spill. For an instantaneous one-tank spill without ignition, the Final EIS for the Yukon Pacific LNG Project (FERC, March 1995) estimated that potentially flammable vapors could travel up to 3.3 miles with a 10-mph wind and typical atmospheric stability.

In October 2001, the use of a one-tank instantaneous release as the "worst case" scenario was re-examined by Quest Consultants, Inc (Quest) as part of an effort by the DOE to determine the hazards associated with reopening the Distrigas LNG import terminal following the terrorist attacks of September 11, 2001. It was determined that time-release spills through 1-meter and 5-meter diameter holes would more accurately simulate credible "worst case" damage scenarios. Maximum flammable vapor cloud and radiation hazards were calculated for the two spill scenarios. For a spill on water with ignition, the maximum distance to a radiant flux level of 1,500 Btu/ft^2-hr was estimated to be 1,770 feet. For a spill on water without ignition, a flammable vapor cloud of 2.5 miles was estimated. In November 2003, in response to comments concerning its October 2001 study, Quest clarified that its study only applied to LNG spills resulting from a collision with a large ship in Boston's Outer Harbor where waves would restrict the spreading of LNG on water.

During the past year, there has been an emergence of studies by various parties to define the "worst case" scenario that would result from a deliberate, terrorist attack on an LNG vessel and the subsequent release of cargo. Distances have been estimated to range from 1,770 to 4,200 feet

for a thermal radiation level of 1,500 Btu/ft^2-hr. Part of the reason for the apparent discrepancies is the lack of large-scale historical incidents, and the need to extrapolate small-scale field test data to a worst case event. This inevitably leads to differing conservative assumptions among the various parties. For example, some models calculate a time-release cargo discharge through 1-meter or 5-meter diameter holes, while others assume that the cargo tank empties instantaneously.

As a result, the FERC commissioned a study by ABSG Consultants to search and review the literature on experimental LNG spills and on consequence methodologies that are applicable to modeling incidents of LNG spills on water. Further, the goal of the study was to identify appropriate methods for estimating flammable vapor and thermal radiation hazard distances for potential LNG vessel cargo releases during transit and while at berth. The resulting study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, was released for public comment on May 14, 2004. On June 18, 2004, staff's responses to comments on the consequence assessment methods were issued. As discussed in greater detail in staff's responses, various components of the consequence assessment methodologies were revised based on comments received. The revised methodology provides procedures for calculating: (1) the rate of release of LNG from a cargo tank penetration for various sized holes; (2) the spreading of an unconfined LNG pool on water for both continuous spills and rapid (nearly instantaneous) releases; (3) the rate of vapor generation from an unconfined spill on water; (4) thermal radiation distances for LNG pool fires on water; and (5) and flammable vapor dispersion distances.

A detailed evaluation of the consequences of a terrorist attack on a modern membrane LNG tanker was prepared by Lloyds Register North America for the Weaver's Cove LNG Project and filed as CEII. The study evaluated the consequences of attacks on an LNG tanker by missiles and explosives. Finite element analysis was used to evaluate the effect of various sized charges on both the outer and inner hulls. A 1-meter diameter hole of the inner hull at the waterline was found to be the "worst case" scenario for hazard consequence assessments. This finding is consistent with the attack on the double-hull oil tanker *Limberg* which caused greater than a 5-meter diameter hole on the outer hull, but only minor damage to the inner hull. A failure modes and effects analysis was used to understand internal LNG release characteristics, and a residual strength analysis used to investigate damage scenarios for a loaded LNG tanker.

In December 2004, the DOE released a study by Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water* (Sandia Report). The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills.

The Sandia Report also included guidance on risk management for intentional spills, based on the findings that the most significant impacts to public safety and property exist within

approximately 500 meters (1,640 feet) of a spill due to thermal hazards from a fire, with lower public health and safety impacts beyond 1,600 meters (5,250 feet). Large, unignited LNG vapor releases were found to be unlikely, but could extend to 2,500 meters (8,200 feet) for a nominal intentional spill.

Cascading damage due to brittle fracture from exposure to cryogenic liquid or fire-induced damage to foam insulation was evaluated and, while possible under certain conditions, is not likely to involve more than two or three cargo tanks. Cascading events are not expected to increase the overall fire hazard by more than 20 to 30 percent (1,920 to 2,080 meters [6,300 to 6,825 feet]), but would increase the expected fire duration. Rapid phase transitions are possible for large spills but the effects would be localized near the spill source and should not cause extensive structural damage.

The methodology described in the ABSG Consulting study and revised in staff's responses to comments was used to calculate the thermal radiation and flammable vapor dispersion distances for several holes ranging in diameter from 1 meter to 3.9 meters. Based on the penetration of the largest cargo tank of a 140,000 m^3 LNG ship, a potential spill of 23,000 m^3 is estimated for the volume of LNG above the waterline. The estimated pool spread results and thermal radiation hazard distances are identified in table 4.12.5.5-2 below. Thermal radiation calculations are based on an ambient temperature of 50°F, a relative humidity of 50 percent, and a 20-mile per hour wind speed.

TABLE 4.12.5.5-2

LNG Spills on Water

LNG Release and Spread				
Hole Area	0.8 square meters	5 square meters	7 square meters	12 square meters
Hole Diameter	1.0 meter	2.5 meters	3.0 meters	3.9 meters
Spill Time	94 minutes	15 minutes	10.5 minutes	6.1 minutes
Pool Fire Calculations				
Maximum Pool Radius	340 feet	817 feet	936 feet	1,103 feet
Fire Duration	94 minutes	15 minutes	10.8 minutes	6.5 minutes
Distance to:				
1,600 BTU/ft^2-hr	2,200 feet	4,340 feet	4,815 feet	5,476 feet
3,000 BTU/ft^2-hr	1,710 feet	3,330 feet	3,705 feet	4,206 feet
10,000 BTU/ft^2-hr	1,040 feet	1,970 feet	2,176 feet	2,459 feet

Flammable vapor dispersion calculations were based on an ambient temperature of 50ºF, 50 percent relative humidity, a 4.5-mph wind speed and atmospheric stability Class F. Based on a 1-meter diameter hole, an unignited release would result in an estimated pool radius of 421 feet. The unignited vapor cloud would extend to 8,672 feet to the LFL and 12,070 feet to one-half the LFL. It is important to identify certain key assumptions of conditions that must exist in order to achieve the maximum vapor cloud distances. First it would be necessary for an

event to create a 1-meter diameter hole by penetrating the outer hull, the inner hull, and cargo containment without ignition. Far more credible is that the event creating a 1-meter diameter hole would also result in a number of ignition sources which would lead to an LNG pool fire and subsequent thermal radiation hazards. It is also unlikely that a flammable vapor cloud could achieve its maximum distance over land surfaces without encountering an ignition source, and subsequently burning back to the source. Flammable vapor dispersion for larger holes was not performed since, realistically, the cloud would not even extend to the maximum distance for a 1-meter diameter hole before encountering an ignition source.

Although large portions of the Corpus Christi and La Quinta Channels have no development or communities adjacent to the channel, the communities of Port Aransas, Port Ingleside, and Ingleside-on-the-Bay are within 4,340 to 4,815 feet of the ship channels. These communities are already familiar with oil, chemical, and LPG vessels passing at close range. The operational restrictions that would be imposed by the Pilots on LNG vessel movements through this area, as well as requirements that the Coast Guard would impose in its operating plan, would minimize the possibility of a hazardous event occurring in this portion of the Corpus Christi and La Quinta Channels.

By focusing on the "worst case" scenario for LNG transportation, there is a tendency to dismiss the potential hazards for other fuels and products commonly transported on our waterways. Some of the previously identified studies that calculate long hazard distances for LNG cargo fires also estimate similarly long distances for gasoline, propane, and jet fuel cargo fires. Also, it should not be assumed that the hazard distances identified are the assured outcome of an LNG vessel accident or attack, given the conservatisms in the models and the level of damage required to yield such large scale releases. Further, these estimated "worst case" scenarios should not be misconstrued as defining an exclusionary zone. Rather the "worst case" scenarios provide guidance in developing the operating restrictions for LNG vessel movements in Corpus Christi and La Quinta Channels, as well as in establishing potential impact areas for emergency response and evacuation planning.

4.12.5.5 Conclusions on Marine Traffic Safety

The operational safety of LNG ships is under the jurisdiction of the Coast Guard. LNG ships have safely transited another Gulf Coast Waterway, the Calcasieu Ship Channel in Louisiana, for the past 20 years and worldwide for 50 years. The operational restrictions imposed by the Coast Guard and the Pilots would minimize the potential for a hazardous event occurring in the Corpus Christi Bay area and affecting the safety of the nearby public.

A variety of factors, some of which are unavoidable (such as the inherent narrowness of the channels), currently cause a certain level of delay for vessels using the Corpus Christi and La Quinta Channels. The operation of LNG ships should have a similar impact as other large vessels, and should cause no more disruption than similar vessel traffic. Limiting factors, such as tug availability, would be addressed by Ingleside San Patricio's plans to arrange for three dedicated tractor tugs at its facility. In addition, the Pilots have stated that they have enough manpower to handle all the traffic at the Bay ports and would recruit and train more pilots as required to handle additional LNG traffic.

4.12.6 Terrorism and Security Issues

The security requirements for the onshore component of the proposed project are governed by 49 CFR 193, Subpart J - Security. This subpart includes requirements for conducting security inspections and patrols, liaison with local law enforcement officials, design and construction of protective enclosures, lighting, monitoring, alternative power sources, and warning signs. Requirements for maintaining safety of the marine terminal are in 33 CFR 127. Requirements for maintaining security of the marine terminal are in 33 CFR 105.

In the aftermath of the terrorist attacks that occurred on September 11, 2001, terrorism has become a very real issue for the facilities under the Commission's jurisdiction. The FERC, like other federal agencies, is faced with a dilemma in how much information can be offered to the public while still providing a significant level of protection to the facility. Consequently, the FERC has removed energy facility design plans and location information from its website to ensure that sensitive information filed under CEII is not readily available (RM02-4-000 and PL02-1-000 issued February 20, 2003).

Since September 11, 2001, the FERC has been involved with other federal agencies in developing a coordinated approach to protecting the energy facilities of the United States. The FERC continues to coordinate with these agencies, specifically with the Coast Guard to address this issue. The Coast Guard now requires arriving ships to provide them with a 96-hour advance notice of arrival that includes key information about the vessel and its crew which allows the Coast Guard to conduct a terrorism risk assessment and put in place appropriate mitigation before the ship reaches the ship channel. In addition, interstate natural gas companies are actively involved with several industry groups to chart how best to address security measures in the current environment. A Security Task Force has been created and is addressing ways to improve pipeline security practices, strengthen communications within the industry and the interface with government, and extend public outreach efforts.

In September 2002, the DOT's OPS issued non-public guidelines to LNG operators that direct them to develop new security procedures for onshore facilities. Operators were required to prepare a security plan within six months that responds to the five threat levels defined by the Office of Homeland Security. The OPS conducts subsequent on-site reviews of the security procedures.

On October 22, 2003, the Coast Guard issued a series of six final rules, which promulgated the maritime security requirements of the Marine Transportation Security Act of 2002: Implementation of National Maritime Security Initiatives; Area Maritime Security; Vessel Security; Facility Security; Continental Shelf Facility Security; and the Automatic Identification System. The entire series of rulemakings establishes a new subchapter H in 33 CFR. In support of the rulemakings, the Coast Guard applied a risk-based decision making process to comprehensively evaluate the relative risks of various target and attack mode combinations and scenarios for those vessel types and port facilities that pose a risk of a security incident. This approach provides a more realistic estimation of risk than a simple “worst-case outcome” assessment. Risk management principles acknowledges that while risk generally cannot be eliminated, it can be reduced by adjusting operations to lower consequences, threats, or vulnerability, recognizing that it is easier to reduce vulnerabilities by adding security measures.

On December 29, 2003, all terminal owners or operators subject to 33 CFR 105 were required to submit a *Facility Security Assessment and Facility Security Plan* to the Coast Guard Captain of the Port for review and approval. The Facility Security Plans were required to be implemented no later than July 1, 2004 or for facilities constructed after July 1, 2004, 60 days prior to operations. Some of the principal owner or operator responsibilities include:

- designating a FSO with a general knowledge of current security threats and patterns, risk assessment methodology, and the responsibility for implementing the Facility Security Plan and Assessment and performing an annual audit for the life of the project;
- conducting a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures;
- developing a Facility Security Plan based on the Facility Security Assessment, with procedures for responding to transportation security incidents, notification and coordination with local, state, and federal authorities, prevent unauthorized access; measures and equipment to prevent or deter dangerous substances and devices; training; and evacuation;
- implementing scalable security measures to provide increasing levels of security at increasing MARSEC levels for facility access control, restricted areas, cargo handling, vessel stores and bunkers, and monitoring;
- conducting security exercises at least once each calendar year and drills at least every three months; and
- reporting of all breaches of security and security incidents.

Increased security awareness has occurred throughout the industry and the nation. President Bush established the Office of Homeland Security with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the United States. The Commission, in cooperation with other federal agencies and industry trade groups, has joined in the efforts to protect the energy infrastructure, including the more than 300,000 miles of interstate natural gas transmission pipeline and associated LNG facilities.

Safety and security are important considerations in any Commission action. The attacks of September 11, 2001 have changed the way pipeline operators as well as regulators must consider terrorism, both in approving new projects and in operating existing facilities. However, the likelihood of future acts of terrorism or sabotage occurring at the proposed LNG import terminal, or at any of the myriad natural gas pipeline or energy facilities throughout the U.S. is unpredictable given the disparate motives and abilities of terrorist groups. The continuing need to construct facilities to support the future natural gas pipeline infrastructure is not diminished from the threat of any such unpredictable acts.

4.12.7 Pipeline Reliability and Safety

The transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture. Methane, the primary component of natural gas, is colorless, odorless,

and tasteless. It is not toxic, but is classified as a simple asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000°F and is flammable at concentrations between 5.0 percent and 15.0 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. It is buoyant at atmospheric temperatures and disperses rapidly in air.

Safety Standards

The DOT is mandated to provide pipeline safety under Title 49, U.S.C. Chapter 601. The Research and Special Programs Administration's (RSPA's) OPS, administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards which set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. The RSPA ensures that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level. Section 5(a) of the Natural Gas Pipeline Safety Act provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards, while Section 5(b) permits a state agency that does not qualify under Section 5(a) to perform certain inspection and monitoring functions. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement action. The majority of the states have either 5(a) certifications or 5(b) agreements, while nine states act as interstate agents.

The DOT pipeline standards are published in Parts 190-199 of Title 49 of the CFR. Part 192 of 49 CFR specifically addresses natural gas pipeline safety issues.

Under a Memorandum of Understanding on Natural Gas Transportation Facilities (Memorandum) dated January 15, 1993 between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a certificate is requested in accordance with federal safety standards and plans for maintenance and inspection, or shall certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with Section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards other than the DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipeline under the Commission's jurisdiction. The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

The pipeline and aboveground facilities associated with the Ingleside Energy Center LNG Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, and specifies more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined as follows:

Class 1 Location with 10 or fewer buildings intended for human occupancy.

Class 2 Location with more than 10 but less than 46 buildings intended for human occupancy.

Class 3 Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people during normal use.

Class 4 Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. All pipelines installed in navigable rivers, streams, and harbors must have a minimum cover of 48 inches in soil or 24 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock.

Class locations also specify the maximum distance to a sectionalizing block valve (*e.g.*, 10.0 miles in Class 1, 7.5 miles in Class 2, 4.0 miles in Class 3, and 2.5 miles in Class 4). Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. The majority of the proposed pipeline route would cross open land that is sparsely populated. The entire 26.4 miles of proposed pipeline route would be located in Class 1 areas; however, major roadway crossing would carry a design factor of Class 2. No portions of the proposed route would be located in Class 3 or 4 areas. In addition, all pipeline interconnects, and pipeline facilities within the fenced enclosures of the meter stations, launcher and receiver, and MLVs would be designed and constructed to meet Class 3 requirements.

If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location above existing design for the pipeline, Ingleside reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness, if required to comply with the DOT code of regulations for the new class location.

In 2002, Congress recently passed an act to strengthen the Nations Pipeline safety laws. The pipeline Safety Improvement Act of 2002 (HR 3609) was passed by Congress on

November 15, 2002, and signed into law by the President in December 2002. No later than December 17, 2004, gas transmission operators must develop and follow a written integrity management program that contains all the elements described in Section 192.911 and addresses the risks on each covered transmission pipeline segment. Specifically, the law establishes an integrity management program which applies to all high consequence areas (HCAs). The DOT (68 FR 69778, 69 FR 18228, and 69 FR 29903) defines HCAs as they relate to the different class zones, potential impact circles, or areas containing an identified site as defined in Section 192.903 of the DOT regulations.

OPS published a series of rules from August 6, 2002 to May 26, 2004 (69 FR 29903), that defines HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate in 49 USC 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCA may be defined in one or two ways. In the first method an HCA includes:

- current class three and four locations;
- any area in Class 1 or 2 where the potential impact radius[14] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle;[15] or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.[16]

In the second method an HCA includes any area within a potential impact circle which contains:

- 20 or more buildings intended for human occupancy; or
- an identified site.

Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at Section 192.911. Of the 26.4 miles of proposed pipeline route, approximately 2.9 miles would be classified as a high consequence area. The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every seven years. Ingleside has not identified any HCAs along the proposed pipeline route.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. The proposed

[14] The potential impact radius is calculated as the product of 0.69 and the square root of the MAOP of the pipeline in psi multiplied by the pipeline diameter in inches.

[15] The potential impact circle is a circle of radius equal to the potential impact radius.

[16] An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least five days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

pipeline would be continuously monitored and controlled via computer and local logic controllers at the manned control center at the LNG terminal site. A locally based, full time staff would be assigned to operate and maintain the natural gas pipeline. The staff would be fully trained in pipeline operations, maintenance, and normal, abnormal, and emergency procedures.

The pipeline would be patrolled and inspected on the ground on a periodic basis per DOT requirements or better. The frequency of these inspections would be affected by activity along the pipeline route such as construction or possible encroachment. These inspections would identify conditions indicative of pipeline leaks, evidence of pipeline damage or deterioration, damage to erosion controls, loss of cover, third party activities or conditions which may presently or in the future affect pipeline integrity, safety, or operation of the pipeline. The pipeline system would participate in the state "One Call" system.

Under Section 192.615, each pipeline operator must also establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency shutdown of system and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

Part 192 requires that each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials. Ingleside San Patricio would provide the appropriate training to local emergency service personnel before the pipeline is placed in service. No additional specialized local fire protection equipment would be required to handle pipeline emergencies.

Pipeline Accident Data

Since February 9, 1970, 49 CFR 191 has required all operators of transmission and gathering systems to notify the DOT of any reportable incident and to submit a report on form F7100.2 within 20 days. Reportable incidents are defined as any leaks that:

- caused a death or personal injury requiring hospitalization;
- required taking any segment of transmission line out of service;
- resulted in gas ignition;

- caused estimated damage to the property of the operator, or others, or both, of a total of $5,000 or more;
- required immediate repair on a transmission line;
- occurred while testing with gas or another medium; or
- in the judgment of the operator was significant, even though it did not meet the above criteria.

The DOT changed reporting requirements after June 1984 to reduce the amount of data collected. Since that date, operators must only report incidents that involve property damage of more than $50,000, injury, death, release of gas, or that are otherwise considered significant by the operator. Table 4.12.7-1 presents a summary of incident data for the 1970 to 1984 period, as well as more recent incident data for 1986 through 2002, recognizing the difference in reporting requirements. The 14.5-year period from 1970 through June 1984, which provides a larger universe of data and more basic report information than subsequent years, has been subject to detailed analysis, as discussed in the following sections.[17]

TABLE 4.12.7-1

Natural Gas Service Incidents by Cause

Cause	Incidents per 1,000 Miles of Pipeline (percentage)	
	1970-1984	**1986-2002**
Outside Force	0.70 (53.8)	0.10 (38.4)
Corrosion	0.22 (16.9)	0.06 (23.1)
Construction or Material Defect	0.27 (20.8)	0.04 (15.4)
Other	0.11 (8.5)	0.06 (23.1)
Total	**1.30**	**0.26**

During the 14.5-year period, 5,862 service incidents were reported over the more than 300,000 total miles of natural gas transmission and gathering systems nationwide. Service incidents, defined as failures that occur during pipeline operation, have remained fairly constant over this period with no clear upward or downward trend in annual totals. In addition, 2,013 test failures were reported. Correction of test failures removed defects from the pipeline before operation.

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.7-1 provides a percentage distribution of the causal factors as well as the annual frequency of each factor per 1,000 miles of pipeline in service.

The dominant incident cause is outside forces, constituting 53.8 percent of all service incidents. Outside forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards;

[17] Jones, D.J., G.S. Kramer, D.N. Gideon, and R.J. Eiber, 1986. "An Analysis of Reportable Incidents for Natural Gas Transportation and Gathering Lines 1970 Through June 1984." NG-18 Report No. 158, Pipeline Research Committee of the American Gas Association.

weather effects such as winds, storms, and thermal strains; and willful damage. Table 4.12.7-2 shows that human error in equipment usage was responsible for approximately 75 percent of outside forces incidents. Since April 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "One Call" program is a service used by public utilities and some private sector companies (*e.g.*, oil pipelines and cable television) to provide preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts. The 1986 through 2002 data show that the portion of incidents caused by outside forces has decreased to 39 percent.

TABLE 4.12.7-2

Outside Forces Incidents by Cause (1970-1984)

Cause	Percent
Equipment Operated by Outside Party	67.1
Equipment Operated by or for Operator	7.3
Earth Movement	13.3
Weather	10.8
Other	1.5

The pipelines included in the data set in table 4.12.7-2 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed before that time have a significantly higher rate, partially due to corrosion. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process. Further, new pipe generally uses more advanced coatings and cathodic protection to reduce corrosion potential.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, the older pipelines contain a disproportionate number of smaller diameter pipelines, which have a greater rate of outside forces incidents. Small diameter pipelines are more easily crushed or broken by mechanical equipment or earth movements.

Table 4.12.7-3 clearly demonstrates the effectiveness of corrosion control in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of failure compared to unprotected or partially protected pipe. The data shows that bare, cathodically protected pipe actually has a higher corrosion rate than unprotected pipe. This anomaly reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 4.12.7-3 **External Corrosion by Level of Control (1970-1984)**	
Corrosion Control	**Incidents per 1,000 Miles per Year**
None-bare Pipe	0.42
Cathodic Protection Only	0.97
Coated Only	0.40
Coated and Cathodic Protection	0.11

Impacts on Public Safety

The service incident data summarized in table 4.12.7-1 include pipeline failures of all magnitudes with widely varying consequences. Approximately two-thirds of the incidents were classified as leaks, and the remaining third classified as ruptures, implying a more serious failure.

Table 4.12.7-4 presents the average annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 2002. Fatalities between 1970 and June 1984 have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Of the total 5.0 nationwide average, fatalities among the public averaged 2.6 per year over this period. The simplified reporting requirements in effect after June 1984 do not differentiate between employees and nonemployees. However, the data show that the total annual average for the period 1984 through 2002 decreased to 3.9 fatalities per year. Subtracting two major offshore incidents in 1989, which do not reflect the risk to the onshore public, yields a total annual rate of 3.0 fatalities per year for this period.

TABLE 4.12.7-4

Annual Average Fatalities - Natural Gas Transmission and Gathering Systems a/, b/

Year	Employees	Nonemployees	Total
1970-June 1984	2.4	2.6	5.0
1984-2002 c/	-	-	3.9
1984-2002 c/	-	-	3.0 d/

a/ 1970 through June 1984 - American Gas Association, 1986.
b/ DOT Hazardous Materials Information System.
c/ Employee/nonemployee breakdown not available after June 1984.
d/ Without 18 offshore fatalities occurring in 1989 – 11 fatalities resulted from a fishing vessel striking an offshore pipeline and seven fatalities resulted from explosion on an offshore production platform.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.7-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Nevertheless, the average 2.6 public fatalities per year is relatively small considering the more than 300,000 miles of transmission and gathering lines in service nationwide.

Furthermore, the fatality rate is approximately two orders of magnitude (100 times) lower than the fatalities from natural hazards such as lightning, tornadoes, floods, earthquakes, etc.

The available data show that natural gas pipelines continue to be a safe, reliable means of energy transportation. Based on approximately 308,000 miles in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines in service is 0.01 per year per 1,000 miles of pipeline. Using this rate, the Ingleside Energy Center LNG Project might result in a public fatality every 4,300 years. This would represent a slight increase in risk to the nearby public.

TABLE 4.12.7-5

Nationwide Accidental Deaths a/

Type of Accident	Fatalities
All Accidents	90,523
Motor Vehicles	43,649
Falls	14,985
Drowning	3,488
Poisoning	9,510
Fires and Burns	3,791
Suffocation by Ingested Object	3,206
Tornado, Flood, Earthquake, etc. (1984-93 average)	181
All Liquid and Gas Pipelines (1986-2003 average) b/	22
Gas Transmission and Gathering Lines, Nonemployees Only (1970-84 average) c/	2.6

a/ All data, unless otherwise noted, reflects 1996 statistics from the U.S. Department of Commerce, Bureau of the Census, "Statistical Abstract of the United States 118th Edition."
b/ U.S. Department of Transportation, Office of Pipeline Safety, www.ops.dot.gov/stats.
c/ American Gas Association, 1986.

4.13 CUMULATIVE IMPACTS

Cumulative impacts result when effects associated with a proposed project are superimposed upon, or added to, other impacts associated with past, present, or reasonably foreseeable future projects within the area affected by the proposed Project. Although the individual impacts of the separate projects may be minor, the collective effects from the projects taken together could be significant.

For this analysis, we looked at potential impacts from known projects existing or proposed between the City of Ingleside and the west end of the La Quinta Channel at Portland, Texas. Existing environmental conditions in the Project area reflect changes based on past activities. Historically, Corpus Christi developed as a farming, ranching, and trading center. The dredging of the deepwater channel past Mustang Island into Corpus Christi Bay in 1926 was the impetus behind much of the industrial, commercial, recreational, and residential development in the greater Corpus Christi Bay area. The city of Corpus Christi is now a major shipping point (in 2004 there were a total of 7,237 ship/barge movements within the Port of Corpus Christi) and an important center of petroleum and natural gas processing as well as the hub of a region with thousands of producing wells. Other industries manufacture fabricated metals, electronic

equipment, processed agricultural goods, and aircraft repair and maintenance. Existing conditions in much of the general Project area, particularly along the pipeline route, consists of flat agricultural land with cropland and pasture, and open rangeland. Much of the area in the immediate vicinity of the proposed LNG terminal along the La Quinta Channel has been developed for industrial activities (e.g., chemical production facilities, manufacturing, metal refineries). As such, the coastal marsh and subtidal habitats in Corpus Christi Bay has been disturbed by previous industrial development and marine access to it, particularly along the La Quinta Channel.

We analyzed the cumulative impacts associated with the proposed project by adding its associated environmental affects with other past, present, or reasonably foreseeable future projects that would affect the same resources. This analysis included the other two proposed LNG import terminals located along the Corpus Christi Bay, Cheniere Corpus Christi and Vista del Sol, in addition to several other projects. To ensure that our analysis was complete and included local and regional issues, we conducted agency consultations and participated in interagency meetings to identify issues that should be addressed in this EIS. This included an interagency meeting in Galveston, Texas on May 18, 2004 to discuss the alternatives and cumulative impacts analysis of the projects. The interagency meeting included the COE, Coast Guard, NOAA Fisheries, FWS, EPA, DOT, TRRC, TGLO, and TPWD.

Table 4.13-1 provides a list of projects considered in our cumulative impact analysis. Projects included in our analysis are those known or reasonably foreseeable future projects with potential impacts to the same resources for which some effect has been evaluated for the Ingleside Energy Center LNG Project. Projects include proposed LNG projects currently being reviewed or approved by the FERC and projects identified by the COE (COE, 2003a). Following is a brief description of the seven projects listed in table 4.13-1, in addition to the Ingleside Energy Center LNG Project, and included in our analysis.

Figure 4.13-1 displays the locations of the three proposed LNG import terminals, the La Quinta Container Terminal Project and the five graving docks/fabrication sites that are under consideration for several GBS LNG projects in the Gulf of Mexico. Given the benefits of the location and its coastal geography, we anticipate the Port of Corpus Christi will continue to attract a variety of industrial, commercial, recreational, and residential developments. Without specific proposals to evaluate, the impacts of these developments are not reasonably foreseeable activities for which we can analyze in this EIS.

Vista del Sol LNG Project

Vista del Sol filed its application with the FERC on August 6, 2004 under Docket No. CP04-395-000 and CP04-405-000. The Vista del Sol LNG terminal would be located along the La Quinta Channel, about 1 mile northwest of the Ingleside Energy Center LNG Terminal, and would consist of two LNG ship berths, three LNG storage tanks, and about 25.3 miles of 36-inch-diameter sendout pipeline. The terminal would be capable of receiving up to 100 LNG ships per year, or the equivalent of about one LNG tanker every four days. It would have a maximum sendout capacity of 1.4 bcfd. The LNG terminal would be located within a 311-acre site along the La Quinta Channel, between the communities of Ingleside and Gregory, in San Patricio County, Texas, and adjacent to the Sherwin Alumina Company plant to the north, and the Occidental and DuPont chemical plants to the east and south.

TABLE 4.13-1

Cumulative Impacts of Projects in Corpus Christi Region

	Project								
	Ingleside Energy Center LNG Project	Vista del Sol LNG Project	Cheniere Corpus Christi LNG Project	Corpus Christi Ship Channel Improvement	La Quinta Container Terminal	Kiewit Offshore Services a/	GBS LNG Projects Graving Docks b/	Naval Station Ingleside c/	**TOTAL**
RESOURCE IMPACTS									
Water Resources									
Dredge Volume (mcy)	3.6 d/	6.3	4.4	41.0	32.0	3.8	3.3	13.6	108
Perennial Waterbodies Crossed (no.)	9	20	2	NA	NA	NA	NA	UNK	31
Fish and Wildlife Habitat (ac)									
Flats/Salt Marsh	4.4	7.8	6.9	NA	4.0	0.0	0.6	113.2	136.9
Freshwater Wetlands	0.03	0.01	1.3	NA	0	2.1	0.0	38.6	42.04
Shallow Bay Bottom Habitat	40	54.9	72	40	27.1	0.0	0.0	225	459
Gulf of Mexico Bottom Habitat	NA	NA	NA	526	NA	NA	NA	NA	526
Submerged Aquatic Vegetation	1.1 b/	16.7	6.0	5	2.4	0.2	0.0	1.1	32.5
EFH (subtotal of flats/salt marsh, shallow bay bottom habitat, and SAV)	45.5	79.4	84.9	45.0	33.5	0.2	0.6	339.3	628.4
Land Use									
Agricultural Lands - Permanent Impact (ac)	0.8	152.1	4.7	NA	1,114	NA	NA	UNK	1,271.6
Socioeconomics									
Jobs (construction, temp., no. jobs)	550	649	900	370	1,274	1,150 e/	553 f/	535	5,981
Wages (construction, temp., millions)	$42.0	$110.5	$81.0	$1.1	$36.6	$75.7 e/	NA	UNK	$346.9
Jobs (avg. annual, no. jobs)	34	72	75	71	3,742	0.0	0.0	3,900	7,894
Wages (avg. annual, millions)	$2.3	$3.5	$3.6	$0.02	$233.4	0.0	0.0	$150.0	$392.8
Tax revenue (per year)	$10.0	$3.2	$4.6	UNK	$21.8	UNK	UNK	UNK	$39.6
Transportation (operation)									
Construction vehicles (no. per day)	1,100	1,612	1,280	NA	3,200 g/	630	UNK	UNK	7,192
Operational Ship calls (no. per year)	140	100	300	NA	363	17	UNK	UNK	920
Proposed Mitigation (acres to be created)									
Upland Habitat	NA	NA	NA	120	NA	NA	UNK	NA	120
Shallow Water Habitat	UNK	260	NA	NA	27.1	NA	UNK	5.5	292.6
Submerged Aquatic Vegetation	UNK	UNK	26.5	15	7.2	NA	UNK	11.6	60.3
Wetlands (salt marsh, brackish, fresh)	UNK	UNK	NA	NA	7.9	NA	UNK	42.0	49.9

a/ Includes the graving dock/fabrication sites under consideration by Compass Port, Pearl Crossing, and Beacon Port LNG(public information is not currently available for the Beacon Port LNG Project).
b/ Includes the graving dock/fabrication sites under consideration by Port Pelican and Gulf Landing.
c/ Includes Mine Warfare Center of Excellence as reported in COE, 2003a.
d/ Includes nonjurisdictional facility.
e/ Includes data for Compass Port (800 jobs; $23.7) and Pearl Crossing (350 jobs; $52.0).
f/ Includes data for Port Pelican at the McDermott site.
g/ During operation of the La Quinta Container Terminal.
NA = Not Applicable UNK = Unknown

Non-Internet Public

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED INGLESIDE ENERGY CENTER LNG TERMINAL AND PIPELINE PROJECT
Docket Nos. CP05-11-000, et al.

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Figure 4.13-1
Proposed Activities Near the Ingleside Energy Center LNG Project

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

The Vista del Sol terminal would be designed to accommodate future expansion that would include an additional berth and two more LNG tanks. The expanded facility would be capable of unloading up to 200 LNG ships per year. Vista del Sol proposes to have the project constructed and operational in mid-2008. The final EIS was published in April 2005.

Cheniere Corpus Christi LNG Project

The recently authorized Cheniere Corpus Christi LNG Project (Docket No. CP04-37, CP04-44, and CP04-45), would consist of two ship docks, unloading facilities, three LNG storage tanks, and about 23 miles of 48-inch-diameter sendout pipeline with interconnections to eight existing interstate and intrastate pipelines. The marine terminal would be capable of receiving up to 300 LNG ships per year. The project would have an output of 2.6 bcfd and would be located adjacent on the west side of the Sherwin Alumina Company plant on the northern shoreline of the La Quinta Channel, east of the City of Portland and south of Gregory, in San Patricio County, Texas. The LNG terminal would occupy a 360-acre site.

Corpus Christi Ship Channel Improvement Project

The Galveston District of the COE proposes to deepen the Corpus Christi Ship Channel to improve the efficiency and safety of the deep-draft navigation system and protect the quality of the coastal and estuarine resources in the area. The COE's plan consists of deepening the Corpus Christi Ship Channel to 52 feet; widening the Upper Bay and Lower Bay reaches to 530 feet; adding parallel 12-foot-deep, 200-foot-wide barge lanes within the Upper Bay portion of the channel; and extending the La Quinta Channel for 1.4 miles at a depth of 39 feet and a width of 300 feet. The project would be implemented over approximately a four-year period, beginning sometime after 2004.

La Quinta Container Terminal

The PCCA proposes to construct the La Quinta Container Terminal to help meet the need for an additional container facility along the Texas Gulf shore and provide economic diversification for the Corpus Christi regional economy. The project would consist of a 254-acre marine terminal with three berths and a 3,700-foot-long wharf; a 65-acre intermodal yard for loading/unloading of rail cars; a 65-acre landside access corridor to connect that terminal with major roads and railways; a 115-acre vegetated buffer zone; a 160-acre DMPA to accommodate dredged material disposal (if needed); 250 acres of ancillary facilities for warehousing, a distribution center, and trucking operations; and 204 additional acres for drainage, utilities, and open space. The project would be about 3 miles northwest of the Ingleside Energy Center LNG Terminal, at the western end of the La Quinta Channel. The PCCA proposes to have the project in operation by 2008.

Kiewit Offshore Services

KOS, located north of the intersection of the La Quinta Channel and Jewel Fulton Canal, recently widened a portion of the La Quinta Channel and increased the depth of its dock to allow for the transport of oversized offshore oil and gas platforms. The project required hydraulic dredging of approximately 1.3 mcy of sediments. Much of the widening was done at the bottom of the existing channel without affecting the width of the top of the channel, which limited the new disturbance of shallow bottom habitat. As a result of the dredging project, the Kiewit facility will be able to handle some of the world's largest oil and gas platforms, such as the BP

platform Thunder Horse that arrived at Kiewit's facility in September 2004, and is expected to be towed from its facility to a point in the Gulf of Mexico in early 2005.

The Compass Port and Pearl Crossing deepwater LNG terminal projects recently identified the KOS site as their preferred location for an onshore graving dock/fabrication site. Another GBS LNG project, Beacon Port, has also identified this area as a potential location for its graving dock/fabrication site; however, public information is not available for this project. Beacon Port (ConocoPhillips) filed an application for license on January 19, 2005. The application has not been determined complete, and is currently being revised by the applicant (Maritime Administration, 2005).

The fabrication of the GBSs would require a 101-acre fabrication site including a purpose-built casting basin, a 38-acre upland disposal site for the spoil removed during creation of the casting basin, and a road between the construction area and the disposal area. The Compass Port and Pearl Crossing projects estimate that 3.8 and 2.5 mcy of material would need to be dredged for construction of a graving dock/fabrication site, respectively. Soil would be excavated for the casting basin and material would be excavated from the settling/retention pond.

The 101-acre graving dock/fabrication site would be within the existing boundaries of the KOS yard. The spoil disposal site would be located adjacent to an existing tank farm north of the KOS yard and east of the Occidental Chemical manufacturing complex. A new drainage ditch would have to be constructed along the eastern edge of the property to convey water to Kinney Bayou from the groundwater settling pond planned for the fabrication site. Both the graving dock/fabrication site and the spoil disposal area are currently covered by coastal grasslands and scrub/shrub vegetation. Four emergent herbaceous wetlands totaling 2.11 acres were identified at the graving dock/fabrication site, and six emergent herbaceous and mixed scrub/shrub wetlands, totaling 15.2 acres, were found during the wetland delineation of the disposal area. These wetlands were determined by the COE to be nonjurisdictional.

Once completed, the GBSs would be towed through the La Quinta and Corpus Christi Ship Channels to the Gulf of Mexico, with their final destination being the Compass Port site about 11 miles south of Dauphin Island, Alabama or the Pearl Crossing site about 41 miles southeast of Johnsons Bayou, Cameron Parish, Louisiana. When the GBSs are ready to be towed from the KOS site, the bund wall would be removed, requiring additional dredging of 0.7 mcy. This dredged material would be disposed of at either DMPA No. 4, DMPA No. 13, or on Berry Island (at Ingleside Point). If the Compass Port project is approved, the current schedule calls for site preparation in 2005, and the completed GBSs would be towed out in 2009. Pearl Crossings anticipates that its facility would be operational in the last quarter of 2008.

Other Corpus Christi Bay Area GBS LNG Project Graving Dock/Fabrication Sites

In addition to Compass Port and Pearl Crossing's proposed use of the KOS site, two other deepwater LNG terminal projects are currently considering graving dock/fabrication sites in the Corpus Christi Bay area for the construction of offshore, GBS LNG terminals. The projects include the Port Pelican and Gulf Landing LNG terminals. Graving dock/fabrication locations currently under consideration include the Welder, McDermott (Port Pelican's preferred site near Port Aransas), Gulf Marine, and Zachry sites.

It is estimated that about 1.3 mcy of dredging would be required for Port Pelican's preferred McDermott site and it is expected that dredged material would be disposed of at DMPA No. 4. About 0.6 acre of flats/salt marsh would be affected by activities associated with construction at the McDermott graving dock/fabrication site and it is expected that mitigation would include the creation of coastal marsh habitat. Gulf Landing's graving dock/fabrication site would require about 2.0 mcy of dredging. Since it is unknown which of the above sites Gulf Landing would use as its graving dock/fabrication site, impacts to wetlands cannot be determined. Other sites outside of the Corpus Christi Bay area are also under construction to support the Port Pelican, and Gulf Landing LNG terminals, including the Big Bend Fabrication Yard near Freeport, Texas. The potential timeframes for these projects would be between 2005 and 2008.

Naval Station Ingleside

The U.S. Navy opened its Naval Station at Ingleside in 1990. Originally designed to be a home port for a training aircraft carrier and battleship group, when those ships were decommissioned the Navy designated the Naval Station at Ingleside as its "Mine Warfare Center of Excellence." The station maintains a Magnetic Silencing Facility, and is now home port to 14 Avenger class and 10 Osprey class vessels. The Navy constructed a 1,100-foot-long pier, and two quay walls. Creation of the Naval Station required the dredging of navigation channels and turning basins along the eastern shoreline of Corpus Christi Bay, from the La Quinta Channel to Harbor Island. Maintenance dredging is expected to occur every five years for the life of the project.

In addition to the projects listed in table 4.13-1, the Packery Channel and Improvement Project is a federal project that would require the construction of two rock jetties, a basin, and the deepening and widening of the existing channel across Padre Island near Upper Laguna Madre. The City of Corpus Christi is planning on associated recreational development in the area that would allow for increased tourism, recreational boating, and recreational fishing since the project would provide for more varied access to Corpus Christi Bay.

4.13.1 Soils and Sediments

As noted in table 4.13-1, several of the existing or proposed projects along the Corpus Christi and La Quinta Channels involve dredging activities. About 73 mcy (68 percent) of the total volume of dredged material will be dredged as a result of the Corpus Christi Ship Channel Improvements Project and the La Quinta Container Terminal. The remaining 32 percent of the future dredging would result from the other eight future projects. The Ingleside Energy Center LNG Project would create about 3 percent of the dredged material expected to be produced for these future projects. Maintenance dredging of the ship channels in Corpus Christi Bay would be performed annually while the Ingleside Energy Center LNG Project would require the removal of dredged material every 10 to 12 years. Materials excavated during maintenance dredging are expected to be deposited at Alcoa's tailing ponds.

4.13.2 Water Resources

The proposed Ingleside Energy Center LNG Project would involve the dredging of a maneuvering area and ship berth in the La Quinta Channel. In addition, the construction of the proposed pipeline would require the crossing of 12 waterbodies.

Cumulative effects on marine water resources affected by the proposed Ingleside Energy Center LNG Project and the projects mentioned above would be limited to La Quinta Channel and the Corpus Christi Ship Channel. All eight of the projects are located along these channels and involve dredging to expand or maintain the channel(s). Increased turbidity and sedimentation from initial dredging during the construction of new channels and turning basins, and during future maintenance dredging, would temporarily decrease water quality in the immediate vicinity of each project. If dredging associated with the Ingleside Energy Center LNG Project were to occur concurrently with the other dredging projects, the reduction in water quality could be exacerbated. However, the negative effects of dredging in and adjacent to the existing La Quinta and Corpus Christi Channels would be temporary, and water quality would be expected to return to ambient conditions soon after completion of activities.

The natural gas pipelines associated with the three proposed LNG projects would cross a total of 31 perennial waterbodies. Each company would implement crossing methods and erosion and sediment control measures from our Plan and Procedures and would comply with local, state, and federal permit requirements for each crossing. Impacts from pipeline construction across surface waters are generally short term, and no long term or cumulative effects on these waterbodies would be expected following restoration of the pipeline rights-of-way.

4.13.3 Wetlands and Submerged Aquatic Vegetation

In total, the projects included in our analysis would permanently impact an estimated 136.9 acres of tidal flats and salt marsh, 32.5 acres of submerged aquatic vegetation, and 42.04 acres of freshwater wetlands. The majority of impacts on tidal flats (113.2 acres) and upland wetlands (38.6 acres) would be associated with the Naval Station at Ingleside, according to the COE (2003). Combined, the three proposed LNG terminals along the La Quinta Channel would permanently impact about 19.1 acres of tidal flats and coastal marsh, and 23.8 acres of seagrass beds. In the case of the sendout pipelines for the Ingleside Energy Center, Vista del Sol, and Cheniere Corpus Christi LNG projects, impacts on freshwater wetlands would be temporary; these wetlands would be restored after construction, with no net wetland loss.

Each of the project proponents would be required by the terms and conditions of their respective Section 404 permits to provide compensatory mitigation for unavoidable wetland impacts. The known wetland or aquatic vegetation mitigation plans combined for the projects listed in table 4.13-1 would create about 60.3 acres of submerged aquatic vegetation, 49.9 acres of salt marsh, brackish, or freshwater wetlands, and 292.6 acres of shallow water habitat.

4.13.4 Vegetation and Wildlife

Ingleside San Patricio's LNG terminal would affect 74 acres of terrestrial habitat identified as industrial land. The upland portions of the other proposed LNG terminal sites are located on industrial land, agricultural land, or grasslands and scrub-shrub habitat. Combined, the Ingleside Energy Center LNG terminal, Cheniere Corpus Christi LNG terminal, and Vista del Sol LNG terminal projects would permanently impact about 124.5 acres of open land including shrub/scrub habitat and rangeland. We do not consider industrial or agricultural land to be high quality wildlife habitat. For the small amounts of native upland vegetation that would be lost by the combined construction of these projects, similar habitats are widely distributed nearby. During construction activities mobile species would be able to relocate to adjacent habitat and

then reoccupy open project lands after they have been restored. Therefore, we believe cumulative impacts on terrestrial wildlife would be short-term and not significant.

Right-of-way clearing and grading and other pipeline construction activities associated with the pipeline construction and operation can result in the removal of vegetation, alteration of wildlife habitat, displacement of wildlife, and other secondary effects such as increased population stress, predation, and establishment of invasive plant species. However, the majority of lands crossed by the proposed pipelines consist of agricultural and grazing land. The agricultural and grazing practices currently occurring in the project area have substantially altered the vegetative landscape. The cumulative impact of the pipeline portions of the projects on vegetation would be minimal because, except for the proposed meter stations, the agricultural and grazing lands crossed would be restored to their preconstruction conditions and uses.

4.13.5 Aquatic Resources

In total, the projects included in our analysis would impact an estimated 459 acres of shallow bottom habitat, 526 acres of Gulf of Mexico bottom habitat, and 32.5 acres of submerged aquatic vegetation. Nearly all of this area would be affected by dredging proposed to create or deepen shipping channels, maneuvering areas, or docks. As a result of this dredging, shallow bottom habitat would be converted to deeper water, and maintained as such through periodic maintenance dredging. Most other impacts associated with dredging would be short term, such as localized increased turbidity during dredging operations. Impact on submerged aquatic vegetation would be addressed through compensatory mitigation (see above).

Approximately 628.4 acres of designated EFH would be affected by the projects listed in table 4.13-1. Of the total potential acreage of impacted EFH, by far the largest contributor to the loss is the Naval Station Ingleside project. Impact on EFH as a whole is addressed for each individual project, and impact on vegetated components of EFH (submerged aquatic vegetation and salt marsh) would be addressed through compensatory mitigation during Section 404 permitting.

4.13.6 Land Use, Recreation, and Visual Resources

The Ingleside Energy Center and Cheniere Corpus Christi LNG terminals would be located on tracts of open or industrial land, while the Vista del Sol LNG terminal and La Quinta Container Terminal would be within tracts dominated by agricultural land use. Combined, these projects would result in the permanent alteration of about 1,271.6 acres of agricultural lands. About 406,000 acres in San Patricio County were classified as farmland in 1997 according to the U.S. Census, therefore, the proposed projects would not significantly contribute to cumulative effects on land use.

The PCCA would build a berm as a buffer between its proposed La Quinta Container Terminal and residential neighborhoods to the west and north. The nearest house to the container terminal would be approximately 3,800 feet away. Respectively, the Ingleside Energy Center, Vista del Sol, and Cheniere Corpus Christi LNG terminals would be at least 1.1 miles, 0.5 mile, and 1.6 miles away from residences, respectively, and there would be no cumulative impact on these residences.

The projects with proposed new infrastructure facilities would have some visual impact on the immediate surroundings. However, cumulatively, the projects would be consistent with ongoing industrial activities and existing facilities along the Corpus Christi and La Quinta Channels, and would not significantly alter the visual landscape of the area.

Fishing, boating, and bird watching activities occur within, and from the shores of, Corpus Christi Bay. The proposed projects could have cumulative negative affects on recreational activities associated with boating and fishing, primarily during the period of active construction and dredging. Dredging causes temporary turbidity that may have short-term impacts on local fisheries. The COE (2003) is of the opinion that the proposed dredging projects would benefit recreational boating by improving channel access. The potential increase of 540 LNG ships per year from the three proposed LNG terminal projects combined could also have impacts on recreational boating. However, most small crafts would use the Intracoastal Waterway Channel, and would not use the La Quinta Channel where the majority of the LNG ship traffic would be concentrated. The three LNG terminal projects and the proposed container terminal are all located on lands dedicated to industrial and agricultural uses and are not near beaches, parks, or other developed recreational facilities. Therefore, we do not believe that the projects would have a cumulative impact on recreation.

4.13.7 Socioeconomics

Combined, the projects listed on table 4.13-1 would generate almost 5,981 temporary construction jobs. Many of these workers would reside locally. The influx of non-local laborers would only represent an increase of about 1 percent for the total population of San Patricio and Nueces Counties (assuming half the construction workers are non-local). The 27,078 potentially vacant or rental units available in the two counties would offer enough housing for non-local workers. Likewise, the counties have the necessary infrastructure to provide public services and utilities to support the projects. No identified minority or low-income populations would be disproportionately impacted by the projects.

There would be positive cumulative economic benefits from these projects. Wages to construction workers for all the projects combined would total about $347 million. Taxes generated from operation of the Ingleside Energy Center, Vista del Sol, and Cheniere Corpus Christi LNG terminals would total about $18 million annually, and full development of the La Quinta Container Terminal would add another $22 million in state and local tax revenues.

Permanent employment would also increase as a result of the operation of these projects, with the cumulative benefit of potentially lowering local unemployment rates. Operation of the three proposed LNG terminals would employ a total of about 181 people, while the La Quinta Container Terminal would employ 3,742 people and 3,900 people would be stationed at the Ingleside Naval Station including ship assigned and shore based personnel. The Corpus Christi Ship Channel Improvement would employ 71 people.

4.13.8 Transportation

4.13.8.1 Land Transportation

Combined, the Ingleside San Patricio, Vista del Sol, and Cheniere Corpus Christi LNG projects would generate a total of about 3,992 vehicle trips per day during peak construction periods. If all three LNG terminals were to be constructed at the same time, traffic would increase on U.S. Highway 181, State Route 361, and State Route 35 by up to 10 percent, based on the current daily traffic volume of 39,000 vehicles. However, exact coincidence of the timing of all projects is unlikely and could be mitigated by staggering shift startup across the construction sites to minimize traffic congestion and reduce potential cumulative impacts to a level that is not significant.

Operation of the La Quinta Container Terminal would result in an estimated 3,200 vehicle trips daily entering and exiting the terminal site. The PCCA believes its La Quinta Container Terminal would not have a significant impact on local traffic flow because area highways are currently uncongested and able to handle increased traffic, and the TDOT is planning future highway improvements.

Where installation of the proposed pipeline occurs at road crossings, road traffic could be temporarily disrupted or delayed. Traffic congestion along the proposed pipeline route is not expected to be a major problem even if several projects are being constructed at once. Moreover, it is unlikely that each project would reach peak traffic conditions simultaneously. Because construction workers frequently share rides and travel to and from work during off-peak hours, potential cumulative impacts on traffic from pipeline construction are expected to be temporary and short-term. Once the pipeline construction is complete, there would be no negligible impacts on traffic from operation or maintenance.

4.13.8.2 Marine Transportation

In addition to the Ingleside Energy Center LNG Project, estimates of potential increased traffic by large ships are available for the Kiewit Offshore Services, La Quinta Container Terminal, Vista del Sol LNG Project, and Cheniere Corpus Christi LNG Project. Based on available information, the planned or proposed projects along the La Quinta Channel would result in an additional 920 ship calls per year to the Corpus Christi and La Quinta Ship Channels (table 4.13.8.2-1). In 2003, there were a total of 19, 262 dockings of commercial ships, tankers, and barges at the Port of Corpus Christi, so the projected additional ship traffic represents less than a 5 percent increase in total port traffic. Between Ingleside and the La Quinta Turning Basin there were a total of 1,793 dockings in 2003, so the projected additional ship traffic would be about a 50 percent increase in traffic within the La Quinta Channel. The Pilots indicated that the port could handle this additional ship traffic. In its February 1, 2005 Letter of Recommendation, the Coast Guard found the navigable waterways suitable for LNG transport.

With the traffic management and mitigation measures discussed in section 4.12.5.2, the operation of LNG ships should have a similar impact as other large vessels, and should cause no more disruption than the vessel traffic increases planned by other channel users. Increasing ship traffic may result in some delays in operation of the Port Aransas Ferry service.

TABLE 4.13.8.2-1

Estimated Number of Ship Calls for Proposed Projects in Corpus Christi Bay

Project	Project LNG Capacity (MMcfd)	Estimated Number of Ship Calls per Year
Ingleside Energy Center LNG	1,000	140
Vista del Sol LNG	1,000	100
Cheniere Corpus Christi LNG	2,000	300
PCCA Container Terminal	Not Applicable	363
Kiewit Offshore Services	Not Applicable	8
Total	**4,000**	**911**

4.13.9 Air Quality and Noise

Construction of the proposed Project and some of the reasonably foreseeable projects and activities listed in table 4.13-1 would involve the use of heavy equipment that produces noise, air contaminants, and dust. Operation of the proposed Project (including the LNG terminal and ships delivering LNG to the terminal) and some of the reasonably foreseeable projects would also contribute cumulatively to ongoing air emissions and noise. Table 4.13.9-1 lists the air emissions associated with the construction and operation of projects along the La Quinta Channel in relationship to existing air emissions in Nueces and San Patricio counties. Although the region is currently in attainment with air quality standards, increases in point industrial sources could have a deleterious effect on local and regional air quality. If all of the proposed projects are built, there would be a large increase in SO_2 emissions and a slight increase in overall county emissions of NO_x (during construction and operation) and PM_{10} (during construction). However, these increases are contributed primarily by marine sources and not terrestrial point sources. Of the three LNG terminals proposed in the La Quinta Channel, Ingleside would have the least impact to local air quality. Each of the individual projects would need to apply to the TCEQ for an air quality permit, which may require controls to limit the emission of certain criteria pollutants or hazardous air pollutants.

Noise produced during construction of the listed projects could create short-term annoyances to some residences, and could have short-term impacts on some aquatic species. Noise impacts during the construction phase would be localized and would attenuate quickly as the distance from the noise source increases. Therefore, cumulative noise impacts associated with construction of all of the projects are not anticipated to be significant, even in the unlikely event that multiple projects occur at the same time and in the same location.

TABLE 4.13.9-1

Cumulative Impacts on Air Quality for Proposed Projects Along the La Quinta Channel

Project	Air Emissions (tons per year)				
	CO	NO_x	VOC	PM_{10}	SO_2
Existing Sources in Nueces and San Patricio Counties a/	129,120	62,081	35,096	42,975	13,999
Construction of Proposed Projects (2005-2008)					
Cheniere Corpus Christi LNG Project	43	173	16	15	30
Vista del Sol LNG Project	788	1,535	95	1,474	783
Ingleside Energy Center LNG Project	64	144	33	6	9
Corpus Christi Ship Channel – Channel Improvements Project	107	466	14	14	157
La Quinta Container Terminal	75	122	12	360	31
Kiewit site b/					
Compass Port graving dock facility	124	239	34	71	3
Pearl Crossing graving dock facility	167	450	34	88	229
Total construction (percent of existing sources)	**1,368 (1.0)**	**3,129 (5.0)**	**238 (0.7)**	**2,028 (4.7)**	**1,242 (8.9)**
Operation of Proposed Projects (>2009)					
Cheniere Corpus Christi LNG Project c/	571	956	74	35	287
Vista del Sol LNG Project c/	91	671	58	43	576
Ingleside Energy Center LNG Project c/	57	213	29	27	510
Corpus Christi Ship Channel – Channel Improvements Project	20	87	3	3	29
La Quinta Container Terminal	432	1,017	112	47	701
Kiewit site	0	0	0	0	0
Total operation (percent of existing sources)	**1,171 (0.9)**	**2,944 (4.7)**	**276 (0.8)**	**155 (0.4)**	**2,103 (15.0)**

a/ From USEPA AIRDATA: http://www.epa.gov/air/data/geosel.html
b/ Annual air emissions are based on the approximately 3-year-long construction schedule for GBS fabrication emissions. Public information is not available for the Beacon Port LNG project, which would also use the Kiewit site for construction of its GBS.
c/ Air emissions from mobile and stationary sources.

4.13.10 Conclusions about Cumulative Impacts

A determination of significance for the cumulative impacts for a specific resource is problematic because well-defined threshold values are typically undetermined. However, the majority of cumulative impacts we have identified for the proposed Ingleside Energy Center LNG Project would be temporary and minor. Consequently, their addition to other reasonably foreseeable impacts in the region does not result in an overall permanent increase of impacts.

Construction of the Ingleside Energy Center LNG Terminal Project would cumulatively contribute to converting agricultural and/or open lands along the La Quinta Channel to an increasingly industrial landscape. The permanent conversion of scrub/shrub community to an herbaceous community along the proposed pipeline route in combination with other past, present, or reasonably foreseeable future projects, could potentially fragment some wildlife

habitat. Additionally, the Project would contribute to increased ship traffic along the ship channels of Corpus Christi Bay.

Additionally, the Project would contribute to increased ship traffic along the ship channels of Corpus Christi Bay. Although many of the projects in the area would result in the degradation of some wetland and seagrass habitats, compensatory mitigation programs for each of these projects would be designed to provide a net benefit to the ecosystem. As many of the Project stakeholders have commented on, the Ingleside Energy Center LNG Project would cumulatively benefit the local economy through job creation and wages, purchases of goods and materials, tax revenues, and by providing a new source of competitively priced natural gas.