4.0 ENVIRONMENTAL ANALYSIS

The environmental consequences of constructing and operating the proposed Port Arthur LNG Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impact generally occurs during construction with the resource returning to preconstruction condition almost immediately afterward. Short-term impact could continue for up to 3 years following construction. Impact was considered long term if the resource would require more than 3 years to recover. A permanent impact could occur as a result of any activity that modifies a resource to the extent that it would not return to preconstruction conditions during the life of the project, such as the construction of an LNG terminal. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment.

In this section, we discuss the affected environment, general construction and operational impact, and proposed mitigation for each resource. Sempra, as part of its proposal, agreed to implement certain measures to reduce impact. We evaluated Sempra's proposed mitigation to determine whether additional measures are necessary to reduce impact. These additional measures appear as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific conditions to authorizations that the Commission may issue to Sempra.

Conclusions in this EIS are based on our analysis of the environmental impact and the following assumptions:

- Sempra would comply with all applicable laws and regulations;
- the proposed facilities would be constructed as described in chapter 2.0 of this document; and
- Sempra would implement the mitigation measures included in the application and supplemental filings to the FERC.

4.1 GEOLOGIC RESOURCES

4.1.1 Geologic Setting

The proposed LNG terminal and pipelines would be located within the West Gulf Coastal Plain physiographic region. The ground surface in the project area consists mainly of Chenier plain and coastal plain sediments deposited by fluvial, tidal, littoral (beach or shoreline) and deltaic processes during the Holocene epoch, or the period between present day and 5,000 years ago (Fisher et al. 1973). The sediments consist of sands, silts, and clays which form nearly flat plains with almost imperceptible slopes to the southeast. The depth to bedrock ranges from a few hundred to several thousand feet.

The terrain at the terminal site is a few feet above sea level. Some of the surficial material at the site consists of dredged material from the nearby water ways.

Two types of landforms characterize the Chenier plain: broad marshes containing organic clays and peat, and long, narrow relict beach features called "cheniers" that appear as ridges parallel to the coast. Chenier ridges form as a result of cyclic shoreline advance and retreat, and are typically mixtures of silt, sand, and shell fragments. They are slightly elevated features that attain elevations of 5 to 10 feet above sea level.

The LNG terminal site is at the western edge of the Chenier plain. The Chenier plain is found primarily in southwest Louisiana, and consists of a 15- to 20-mile-long strip of Holocene deposits that extend from Vermillion Bay to Sabine Lake and the associated SNWW.

At the LNG terminal site, the sedimentary units within the upper 70 to 100 feet of the surface contain normally consolidated clays, overlying slightly to generally over-consolidated soils to a depth of about 170 feet below the ground surface (Fugro South, Inc. 2004). Intermittent sand layers of varying thickness also occur within the soil stratigraphy. Shell fragments and shell hash occur throughout the sand, silt, and clay layers. Organic materials ranging from below 10 percent to 28 percent organic content also occur at various depths. Within the LNG terminal site, dredged materials consisting of clay, silty clay, silts, and clayey silts overlay the natural terrain to a depth ranging from 10 to 14 feet.

The pipeline routes would cross the West Gulf Coastal Plain physiographic region. The area is underlain by thick deposits of sand, silt, and clay. Bedrock occurs well below the trenching depth.

Because no bedrock occurs at or near the surface of the LNG site, and the pipelines would not cross areas where bedrock is at or near the surface, no blasting would be required for construction of the LNG terminal or pipelines.

4.1.2 Mineral Resources

Mineral resources in the project area include: sand and gravel; salt; oil; gas; and sulfur (USGS 2004). In addition, there are numerous oil and gas production, gathering, and transmission pipelines in the project area. No surface mines have been identified within the project area. The nearest salt dome is about 15 miles from the project area. Due to its distance, no impact to the project or to the salt dome would be anticipated.

There is no oil or gas production from the terminal site. However, there is an abandoned well on the site. The well on the terminal site was directionally drilled to the oil field under Sabine Lake in 2000. The well was abandoned in 2001 as a dry hole. This well is in the area that would be dredged to create the ship berth.

There are several gas and oil fields in the vicinity of the pipeline routes. The Vinton Oil Field lies approximately 0.5 mile to the west of MP 36 and the Edgerly Oil Field is within 0.25 mile of MP 48 on the 70-Mile-Long Pipeline route. The Sulfur Oil Field lies about 1.5 miles southwest of the 70-Mile-Long Pipeline route in Calcasieu Parish; however, the nearest known well associated with the Sulfur Oil Field lies about 0.5 mile southwest of MP 52.4 along the proposed route. The Sulfur Oil Field has largely been depleted and serves as a storage field. The Bayou Choupique Oil and Gas Field is approximately 12.5 miles south of MP 48.

Construction of the LNG terminal and pipelines would not affect any known mineral resources. However, the Project would affect at least two abandoned wells. Although no other abandoned wells have been identified, because of the history of the project area, other abandoned wells may be discovered during surveying and construction of the Project. Sempra has not indicated what steps it would take if construction would impact an abandoned well therefore **we recommend that:**

- **Sempra develop a plan for construction in the vicinity of the known abandoned wells on the terminal site. This plan should include a discussion of maintaining the integrity of the plugs. In addition, Sempra should develop a plan of action if any unidentified wells are discovered during construction. Both of these plans should be filed with the Secretary for review and written approval by the Director of OEP prior to the start of construction of the terminal.**

With the implementation of these recommended mitigation measures, we conclude that the Project would have minimal impact on existing production wells, and known or unknown abandoned wells.

Sempra intends to maintain a 25-foot center-to-center separation with the planned Cameron Project pipeline (which also is owned by Sempra) from MP 53.6 to MP 70, and a minimum of a 40-foot center-to-center separation with all foreign pipelines. For those foreign pipelines that must be crossed, Sempra would work with the pipeline owners/operators to develop a crossing plan. The 70-Mile-Long Pipeline would cross an existing 16-inch-diameter pipeline in Sabine Lake at MP 5.6. Sempra proposes to lower the existing pipeline then lay the new pipeline over the top of it. The existing pipeline would be lowered by excavating a deeper trench adjacent to it, with the actual length and depth of the trench determined by the tension of the existing pipeline. Sempra would begin excavating a deeper trench adjacent to the existing pipeline, continuing as necessary until the existing pipeline settles into the new trench, which would allow the new pipeline to be installed over the top of it with adequate separation.

In upland areas, Sempra would cross foreign pipelines and other utilities as near to perpendicular as possible to minimize existing pipeline excavation and suspension. The existing pipeline would be supported as necessary using skids or floats, maintaining a minimum clearing distance of 1 foot below the existing pipeline, and inspecting, repairing and testing of cathodic protection coating on the existing pipeline as necessary. The foreign pipeline or utility company would be notified in advance of pipeline construction so that its representatives can observe the construction of the foreign line crossing. With use of these measures, we conclude that construction of the proposed pipelines would not adversely affect adjacent pipelines or other utilities encountered along the proposed pipeline routes.

4.1.3 Geologic Hazards

The following section provides a summary of the site conditions with respect to seismicity and faulting, soil liquefaction, subsidence, flooding and storm damage, and shoreline erosion.

4.1.3.1 Seismicity and Faulting

Common geologic features to the Gulf Coast sedimentary environment are growth faults and faults associated with salt domes. These growth fault systems trend for considerable distances, roughly paralleling the coastline (Stevenson and McCulloh 2001). Growth faults in southern Texas and Louisiana formed during periods of accelerated basin subsidence. Active movement within most fault zones is thought to have occurred during periods of rapid localized sediment deposition prior to the Pleistocene epoch. Most faults in the Project area are considered to be active following reactivation in the recent geologic past due primarily to oil and gas exploration and pumping. The growth fault systems nearest the LNG terminal site are the Frio Fault Zone and the Vicksburg Fault Zone, both of which are located at least 10 miles from the site. Salt domes are located near Port Neches, Hildebrand Bayou, and Salt Bayou, all of which are located approximately 15 miles or more from the proposed LNG terminal site (Kosterr et al. 1989). As a result of observations throughout the region following many years of oil and gas exploration, movement along fault systems is related to a process of gradual creep as opposed to sudden seismic events. No detected earthquakes have been attributed to the mapped growth fault systems (Stevenson and McCulloh 2001).

The Texas and Louisiana Gulf Coast is located in Seismic Zone 0 of the Uniform Building Code's Seismic Risk Map (International Conference of Building Officials 1997). Seismically engineered structures are practically nonexistent within the Gulf Coast province. Similar to the entire Gulf Coast region, there is no record of damaging earthquakes historically affecting the areas along the pipeline route in southwestern Louisiana. The Gulf Coast from Florida to east Texas periodically experiences small

earthquakes, but they rarely cause damage. The area also infrequently experiences long-period, low-amplitude ground motion from rare distant earthquakes along the New Madrid fault in southeast Missouri (ABS 2004). Due to the low risk of seismic activity, seismic hazards would not be considered significant to the Project. Sempra contractors conducted a site-specific analysis for the LNG terminal site, which revealed that in view of the low ground motion likely to impact the facility and the greater hazards possible from high wind (hurricanes), that possible earthquake loads need not control the design of structures at the site (ABS 2004).

Similarly, for the pipeline facilities, the combination of the low risk of seismic activity in the region, absence of significant faulting, and pipeline construction materials that have tolerances for moderate ground movement would result in a minimal overall hazard associated with seismicity and faulting.

4.1.3.2 Soil Liquefaction

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading (Johansson 2000). Liquefaction occurs in saturated soils; that is, soils in which the space between individual particles is completely filled with water. When liquefaction occurs, the strength of the soil decreases and the ability of a soil deposit to support foundations for buildings and bridges is reduced. Soils composed of particles that are all 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.

The subsoil profiles developed from site-specific geotechnical investigations at the LNG terminal location indicate the presence of strata with silty sands and sands with silt that are dense to very dense. These sand layers could be liquefiable under sufficiently strong ground motions. However, due to the relatively low levels of ground motion estimated for the site, the calculated factors of safety against liquefaction are high, even for the soil layers that are most likely to liquefy. Therefore, it is expected that the LNG terminal site has a relatively low potential for seismically induced liquefaction.

Although some sandy soils underlie portions of the pipeline routes, the potential for soil liquefaction to occur under the relatively small seismic events that may occur at locations along the routes is low. No adverse effects to pipeline construction or operation are anticipated from soil liquefaction.

4.1.3.3 Subsidence

Subsidence hazards involve either the sudden collapse of the ground to form a depression or the slow subsidence or compaction of the sediments near the earth's surface (Nelson 2004). When fluids that exist in the pore spaces or fractures of rock are under pressure and are withdrawn from below the surface, a decrease in fluid pressure may occur resulting in the removal of support and possible collapse. As a result of sediment compaction, oil and gas extraction, and groundwater pumping, subsidence occurs throughout the Gulf Coast region. The results of Sempra's geotechnical investigation at the proposed terminal location (PSI 2004) indicate that subsurface conditions at the site are generally suitable for the LNG terminal facilities, provided that adequate site preparation and foundation design and construction methods are implemented.

Because subsidence is a likely occurrence in the general area of the LNG terminal site, it would be taken into consideration during the design of the facilities. Sempra proposes to install all key LNG terminal facilities on piles at depths such that the facilities would not be susceptible to subsidence. Foundations and other critical facilities would be monitored to ensure that they remain within acceptable limits. Site preparation activities also would be carefully monitored to ensure adherence to the geotechnical design.

Surface subsidence would be controlled by monitoring settlement and systematic reworking and possible lime stabilization of the fill materials during placement and compaction.

Pile supported foundations would protect equipment and interconnecting piping from differential movements. Earthen containment embankments would be earth supported and would be constructed with a wide base (using 2H:1V or 3H:1V slopes, depending on height) to ensure stability. Earth supported elements, such as the storm surge barrier and plant roads, would require periodic maintenance to mitigate the long term effects of differential movements.

Subsidence is a likely occurrence along the pipeline routes, as well, and would be taken into consideration during design. Subsidence would not be likely to affect the integrity of the proposed pipelines, but required periodic monitoring of the pipeline rights-of-way during operation would help to identify subsidence-related situations that might require maintenance. Sempra would ensure that the integrity of the pipelines is not compromised through issues related to subsidence. Because site-specific geotechnical mitigation has been incorporated into the LNG terminal design and would include our additional recommendations as contained in section 4.13, we conclude that subsidence would not be a significant hazard to the proposed facilities.

4.1.3.4 Flooding/Storm Damage

The Gulf Coast experiences hurricanes and tropical weather systems that produce storm surges, high rainfall amounts and flooding, shoreline erosion, high winds, and interruptions to travel. According to the FEMA Flood Insurance Rate Maps (FEMA 1992) for Jefferson County, Texas, the 100-year flood elevation for the area proposed for the LNG terminal is 12 feet with reference to the National Geodetic Vertical Datum of 1929 (NGVD29) and 12.04 feet with reference to the North American Vertical Datum of 1988 (NAVD88). Of the numerous hurricanes to have hit the Texas coast over the last 100 years, Hurricane Carla in 1961 produced the highest storm surge at Sabine Pass (9.4 feet NGVD29) and Port Arthur (7.6 feet NGVD29) (FEMA 1983). In 1998, Hurricane Frances resulted in significant coastal flooding and tides as high as 5.4 feet above MSL at Cameron and Sabine Pass (Roth 2003). In 2005, Hurricane Rita caused significant damage along the Louisiana/Texas border, including the Port Arthur area. A storm surge of 5 to 10 feet was observed along the coast and on Sabine Lake as a result of Hurricane Rita (http://www.srh.noaa.gov/lch/rita/rita_report.htm).

Under significant weather events, such as hurricanes and tropical storms, the LNG terminal facilities would be subjected to severe flooding, storm surge, high winds, erosion along the shoreline and docking facilities, and potential site access interruptions. Each of the LNG terminal components would have to be designed to withstand these forces so that factors such as wind shear, flooding and water damage, and erosion of land area have minimal affects on the operation and safety of the facilities. Sempra had a Storm Surge Study conducted for the proposed LNG terminal location and has incorporated certain design elements into its facility to address potential flooding and storm damage at the Project site. Flooding and storm damage are not expected to pose a hazard to the proposed pipeline facilities.

Because the structural and mechanical elements have been designed into the LNG terminal facilities to withstand coastal flooding and storms, we conclude that flooding due to storm events is not likely to adversely affect the Project facilities.

4.1.3.5 Shoreline Erosion

The Texas and Louisiana Gulf Coast is experiencing the highest rates of coastal erosion and wetland loss in the U.S. (Ruple 1993). Average coastal erosion rates are 4.2 meters per year in Louisiana and 1.8 meters per year along the northern Gulf of Mexico shoreline. However, the most serious erosion and

land loss is occurring in the eastern part of the coastal area, east of Atchafalaya Bay (USGS 2003), and Sabine Pass itself does not appear to be subject to the same degree of land loss overall (USGS 2003). Localized erosion along the banks of the Sabine Pass-Port Arthur navigation channels and the proposed marine terminal basin would be a concern due to natural processes and erosion induced by wakes from large ships that regularly use the channels. Tidal action along the Port Arthur Ship Canal is minor, but erosion associated with wave action has been problematic in the past, especially during abnormally high tide conditions as demonstrated by the continued TxDOT efforts to counteract the effects of erosion on SH 87 with rip-rap.

Measures to minimize shoreline erosion include armoring of the shoreline slopes of the marine basin and minimizing the speeds of vessels in the channels. Sempra proposes to provide additional bank stabilization along the Port Arthur Ship Canal adjacent to the LNG terminal berth, while TxDOT has plans to stabilize about 1,000 feet of the opposite shoreline parallel to the Port Arthur Ship Canal and SH 82. We conclude that shoreline erosion due to natural processes or ship traffic would not adversely impact the LNG facility or the adjacent shoreline

4.2 SOILS AND SEDIMENTS

4.2.1 Soil Composition and Limitations

4.2.1.1 Soil Series and Taxonomic Units

Construction of the proposed LNG terminal would affect a total of approximately 263.2 acres of land on the proposed LNG terminal site in Jefferson County. Operation would affect a total of 198.2 acres. Construction of the proposed pipelines would disturb a total of approximately 1,194.2 acres of land, including temporary extra workspace. **Table 4.2.1.1-1** identifies the soil series or taxonomic units that would be permanently affected by the LNG terminal and temporarily affected by construction of the proposed pipeline facilities.

4.2.1.2 Soil Limitations

We evaluated the soils that could affect construction and operation of the Project or could increase the potential for soil impacts. Limitations were reviewed with respect to the LNG terminal as well as the routes of the proposed pipelines. **Table 4.2.1.2-1** provides a summary of soil limitations. Generally, these soils have a high compaction potential, but no severe erosion (because the land is flat) or poor revegetation potential. No blasting would be required for the Project.

4.2.2 Erosion Control Plans

Sempra has committed to comply with our Plan and Procedures during construction and operation of the proposed Project. The Plan and Procedures include provisions for erosion control and revegetation, protection of wetlands and waterbodies, and special construction techniques in agricultural areas and areas of saturated soils. Sempra has requested use of a 125-foot-wide construction right-of-way through certain wetland (primarily marsh) areas. However, our Procedures specify a 75-foot-wide construction right-of-way in wetlands. See section 4.4.2 regarding the requested 125-foot-wide construction right-of-way in wetlands.

TABLE 4.2.1.1-1

Soils Affected by the Port Arthur LNG Project Facilities

Facility/ Soil Series or Taxonomic Unit	Percent of Affected Area [(a)]	Prime Farmland	Hydric	Comments
LNG Terminal				
Ijam Clay	79.5	No	Yes	Primarily dredge material
Bancker Mucky Peat	20.5	No	Yes	Along edge of Ship Canal
3-Mile-Long Pipeline				
Ijam Clay	55.0	No	Yes	Primarily dredge material
Bancker Mucky Peat	15.0	No	Yes	Edge of Ship Canal and south bank of Keith Lake Cut
70-Mile-Long Pipeline				
Placedo–Harris–Ijam	0.9	No	Yes	0.6 mile crossed
Ijam–Harris	2.0	No	Yes	1.4 miles crossed
Bancker–Water–Creole	8.3	No	Yes	5.8 miles crossed
Gentilly–Ged–Water	4.6	No	Yes	3.2 miles crossed
Crowley–Mowata–Vidrine	10.6	Yes	No	7.4 miles crossed
Ged–Allemands–Water	0.3	No	Yes	0.2 mile crossed
Morey–Leton–Mowata	22.1	Yes	No	15.5 miles crossed
Kinder–Messer–Guyton	8.1	Yes	Yes	5.7 miles crossed
Guyton–Iuka–Cahaba	7.9	Yes	Yes	5.5 miles crossed
Brimstone–Kinder–Messer	4.6	No	Yes	3.2 miles crossed
Caddo–Glenmora–Messer	4.7	Yes	No	3.3 miles crossed
Arat–Barbary–Udifluvents	1.1	No	Yes	0.8 mile crossed

(a) Does not include areas where the pipelines would cross Sabine Lake and Keith Lake.

TABLE 4.2.1.2-1

Soil Series or Taxonomic Unit and Major Soil Limitations

Soil Series or Taxonomic Unit	Compaction Potential	Subsidence Range[(a)]	Shrink Swell Potential	Water Erosion	Wind Erodibility[(b),(c)]
Ijam soils	Yes	[(d)]	High	Low	8
Placedo-Harris-Ijam	Yes	1-4	High	Low	8
Ijam-Harris	Yes	[(d)]	High	Low	4
Bancker-Water-Creole	Yes	5-15	Low	Low	4
Gentilly Ged-Water	Yes	[(d)]	Very High	Low	4
Crowley-Mowata-Vidrine	Yes	[(d)]	Low	Low	5
Ged-Allamands-Water	Yes	[(d)]	Low	Low	4
Morey-Leton-Mowata	Yes	[(d)]	Moderate	Low	6
Kinder-Messer-Guyton	No	[(d)]	Moderate	Low	5
Guyton-Luka-Cahaba	No	[(d)]	Low	Low	5
Brimstone-Kinder-Messer	Yes	[(d)]	Low	Low	5
Caddo-Glenmorra-Messer	No	[(d)]	Low	Low	6
Arat-Barbary-Udifluvents	Yes	6-15	Low	Low	4

(a) Range in total millimeters per year of subsidence that can be expected when drained.
(b) STATSGO Data.
(c) 1 (greatest, 310 tons/acre/year); 8 (lowest, signifies that erosion is not a problem).
(d) Data reported for organic soils only.

Our Plan specifies that, unless the landowner or land management agency specifically approves otherwise and to prevent the mixing of topsoil with subsoil, that topsoil should be stripped from either the full work area or from the trench and subsoil storage area in actively cultivated or rotated croplands and pastures. Only one parcel of cultivated cropland is crossed by the project, between MPs 66.8 and 66.9. At the landowner's request, Sempra would strip the topsoil only over the trench. Because the landowner has requested this method of topsoil segregation, it would be allowed under the Plan.

Sempra, in adhering to the Plan, would be required to ensure that at least one Environmental Inspector (EI) is on duty for each construction spread during construction and restoration. The EIs would be responsible for ensuring compliance with the requirements of the Plan and Procedures and would have the authority to stop construction activities that violate the environmental conditions of the Certificate, state and federal environmental permit conditions, or landowner requirements; and to order appropriate corrective action. Sempra also, in adhering to the Plan, would commence cleanup operations immediately following backfilling the trench; including final grading, topsoil replacement, and installation of permanent erosion control structures. Excess rock would be removed from at least the top 12 inches in all actively cultivated or rotated cropland and pastures, hayfields, and residential areas, as well as other areas at the landowner's request. All construction debris would be removed; permanent erosion control devices, including trench breakers and slope breakers, would be installed; and topsoil and subsoil would be tested for compaction, and decompacted, as necessary, in coordination with landowners. Sempra would be responsible for ensuring revegetation of soils disturbed by project-related activities, except as otherwise noted in the Plan, including the application of soil additives and reseeding.

Because our Plan and Procedures have been developed in coordination with many resource agencies throughout the U.S. over the course of many years, we believe that adherence to them, along with any approved variances that would provide equal or greater protection would minimize erosion during construction and operation of the Project.

4.2.3 Soil Resources

4.2.3.1 Prime Farmland

The U.S. Department of Agriculture (USDA) defines prime farmland as "land that is best suited to food, feed, fiber, and oilseed crops" (USDA 1995). This designation includes cultivated land, pasture, woodland, or other lands that are either used for food or fiber crops or are available for these uses. 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., artificial drainage).

No prime farmland soils are found on the LNG terminal site or along the 3-Mile-Long Pipeline route. The 70-Mile-Long Pipeline would cross soil associations that contain soil series (Caddo, Crowley, Guyton, Kinder, and Morey) classified as prime farmland (see **table 4.2.1.1-1**). The pipelines would cross approximately 38.0 miles of prime farmland soils, or 54 percent of the total route. Only one annually cultivated field, between MPs 66.8 and 66.9, in Beauregard Parish would be crossed and it is mapped as having prime farmland soils (USDA 2002). Sempra has requested a variance to the Plan to strip topsoil only over the trench in this cultivated field. Because Sempra requested this variance based upon the request of the landowner, the variance is approved. In all other areas, impacts to croplands would be mitigated by segregating topsoil in accordance with the Plan or landowner requests. Construction of a pipeline would not preclude the use of the land as cropland, although the types of crops

may be restricted. We believe that adherence to our Plan would provide adequate protection for prime farmland soils, and no long term effects are anticipated.

4.2.3.2 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" (Federal Register, 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 undisturbed state would meet the definition of a hydric soil. These soils are typically associated with wetlands, including the areas of poorly drained soils now underlain by dredge materials throughout the LNG terminal site and along portions of the pipeline routes.

The LNG terminal site, 3-Mile-Long Pipeline, and the 70-Mile-Long Pipeline all are underlain by or would cross hydric soils (see **table 4.2.1.1-1**). Hydric soils are prone to compaction and rutting due to extended periods of saturation and high clay content. If construction of the pipelines occurs when these soils are saturated, heavy equipment operation would be impaired, and compaction and rutting could occur. Further, high groundwater levels that accompany hydric soils could create a buoyancy hazard for the pipelines. Special construction techniques such as concrete coating and other weighting methods would be used to overcome buoyancy hazards during operation of the pipelines. Sempra also plans to restore all wetlands back to their original contours and elevations (see section 4.4.3).

4.2.3.3 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 that have high shrink-swell potential 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.

Due to the presence of predominantly saturated clay and silt soils throughout the Project area, essentially all land that would be disturbed for development of the LNG terminal has the potential to experience some level of soil compaction. However, the potential impacts associated with compaction on the LNG terminal site would be minimal given that the site would be highly developed with systems designed to manage stormwater runoff that could be increased by compacted soils resulting from construction.

Based on soil texture and drainage characteristics, approximately half of the soils that would be disturbed by pipeline construction activities have the potential to experience some level of soil compaction. Sempra would minimize compaction and rutting by avoiding, to the extent practical, construction during wet weather. Additionally, to minimize unavoidable soil compaction, Sempra would adhere to the measures outlined in our Plan, which include testing topsoil and subsoil for compaction at regular intervals in agricultural areas. Any severely compacted agricultural areas would be tilled with a paraplow or other deep tillage tool or planting and plowing-in a green manure crop also may be used to improve soil bulk density. With implementation of the compaction minimization measures contained in the Plan, we conclude that impacts due to soil compaction would be minimized.

4.2.3.4 Erosion

Erosion is a continuing natural process that can be accelerated by human disturbance. Factors that influence the degree of 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, result in discharge of sediment to waterbodies and wetlands. Soil loss due to erosion also could reduce soil fertility and impair revegetation.

Since the LNG terminal site is currently well vegetated and is nearly level, the potential for erosion of soils and discharge of sediments off the site would be relatively low during construction. However, areas along the construction perimeter and areas of concentrated surface flow patterns would have greater potential for erosion. Since Sempra has adopted our Plan and Procedures for erosion and sedimentation control during construction, these concerns would be minimal.

Erosion of the slopes within the slip is not anticipated under normal conditions due to hydraulic mechanisms. Sempra would provide additional bank stabilization along the Port Arthur Ship Canal adjacent to the LNG terminal berth as well as along approximately 1,000 feet of the opposite shoreline parallel to the Port Arthur Ship Canal and SH 82. Erosion of the banks of the LNG terminal marine berth would be controlled with rip-rap and other slope stabilization techniques. Prop wash due to bow thrusters may cause some localized erosion of the dredged slope of the turning basin over the life of the Project, but the potential impacts would be minimal.

For the pipeline construction, Sempra would utilize erosion control structures, temporary seeding and revegetation, and erosion control fabric in accordance with our Plan and Procedures. For stream crossings, Sempra would use the stream crossing methods contained in the Procedures, their site-specific crossing plans, and the erosion and sediment control practices specified in the 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 conditions permitting. Sempra has committed to restoration within 10 days of backfilling the trench, weather conditions permitting. We conclude that implementation of these measures would minimize overall soil erosion resulting from construction of the Project.

4.2.3.5 Revegetation

Successful restoration and revegetation in areas that are not permanently developed is important to maintain ecosystem productivity and to protect the underlying soil from potential damage, such as erosion. Soils on the LNG terminal site and along the pipeline routes are currently well vegetated, and none are predicted to have a low revegetation potential following construction. Sempra would implement the requirements in the Plan for revegetation of disturbed land areas following construction; including seeding of disturbed areas with native vegetation as recommended by soil conservation authorities and local landowners and monitoring disturbed areas for up to 3 years to ensure the success of revegetation. We conclude that, if upland revegetation is conducted in accordance with these measures, areas disturbed by construction would be successfully revegetated.

In addition, Sempra is coordinating with the COE and other federal and state agencies to develop an appropriate wetland restoration plan for wetlands affected by the pipeline construction rights-of-way. However, we believe that Sempra's Preliminary Wetland Mitigation Plan does not adequately address the potential impacts (see sections 4.4.2 and 4.4.3).

4.2.3.6 Soil Contamination

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 and volumes of spills and leaks. Sempra has developed a preliminary SPCC Plan for the Project (see **appendix D**). This plan identifies cleanup procedures in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents.

To determine if contaminated soils associated with hazardous wastes sites or other solid waste sites occur within 0.25 mile of the LNG terminal and pipeline corridors, Sempra conducted a regulatory database search. The LNG terminal site and Sempra's proposed DMPA are not listed in any of the environmental databases searched (Environmental Data Resources, Inc. 2004) and no listed sites were found within 0.25 mile of the LNG terminal site, the proposed DMPA, or the pipeline routes. Sempra conducted a field reconnaissance of the LNG terminal site, DMPA 1-2, and portions of the pipeline routes to identify any potential hazardous waste sites or problems. No unusual odors, waste pits, vent pipes, ground stains or any other indicators of potential hazardous waste disposal areas were observed. One plugged and abandoned oil or gas well is present within the LNG terminal berthing area. We have provided recommendations for how Sempra should deal with this and other potentially unknown wells within 0.25 mile of the proposed Project work areas (see section 4.1.2). In addition, Sempra has prepared an Unanticipated Hazardous Waste Discovery Plan (UHWDP) (see **appendix E**), to which they have committed, in the event that unanticipated soil contamination is discovered during construction.

We conclude that implementation of our recommended measures (section 4.1.2), and the measures outlined in Sempra's SPCC Plan and UHWDP, would help to ensure that soil contamination would not be a concern for the Project.

4.2.4 Subsurface Sediments

As described in section 4.1.1, Geologic Setting, the region in which the LNG terminal would be located contains several thousand feet of deltaic and alluvial deposits consisting of interlayered clays and sands. Recent deposits located close to the Gulf Coast, including the area of the LNG terminal, consist of alluvium, deltaic, littoral, and marsh deposits. These deposits can be weak and unsuitable for supporting major structures on shallow foundations.

Significant loading on these sediments would occur during construction, hydrostatic testing, and operation of the LNG storage tanks. As a result, based upon their geotechnical evaluations of the site, Sempra may use several techniques to stabilize and enhance the shear strength of the soils and sediments in various locations for the aboveground facilities. In soils and sediments underlying the LNG storage tanks, including surface-deposited dredged materials, Sempra would remove all surface vegetation, roots, organic material and other miscellaneous debris. After the area is leveled to near final grade, and during dry weather, Sempra would proof-roll the exposed soil to locate any soft or loose areas. Sandy clay soils free of organic or other deleterious materials would be used as structural fill, and would be compacted to American Society for Testing and Materials (ASTM) standards.

As an alternative to the use of structural fill, Sempra may use tested and approved portions of the on-site clay soils preconditioned with lime and fly-ash. Because the first layer of structural fill may be difficult to compact if the soft underlying soils are exposed or the soils become wet, geo-textile fabric may be used to reduce this difficulty and to aid in the process of structural fill placement and compaction. Sempra's geotechnical contractor likely would be on-site during fill placement and compaction operations to ensure proper fill and compaction procedure.

Additionally, all major equipment and structures including the LNG storage tanks, LNG process equipment, pipe racks, and the marine terminal facilities would be supported on deep driven pile foundations. The LNG tanks would be supported by a network of pre-cast concrete, driven piles extending to a depth of approximately 35 to 40 feet below natural grade. Depending upon the size of

piles used, the number of piles needed to support each tank ranges from about 1,000 to 2,300. The settlement of the LNG tanks after construction would be on the order of 11 to 12 inches as a result of consolidation of the soils; however, differential settlement of the LNG storage tanks, as a result of the pile cap and pile stiffness, has been predicted to be minimal.

Our analysis indicates that issues of concern and potential hazards associated with soft sediments, ground subsidence, and hydric soils underlying areas that would be developed by Sempra for the LNG terminal would be adequately addressed with its engineering design, including our recommendations in section 4.13. Due to the relatively shallow construction depth of the pipelines, we conclude that the pipelines would not have an effect on deep sediment loading or stability.

4.3 WATER RESOURCES

4.3.1 Groundwater

4.3.1.1 Existing Environment

The proposed LNG terminal and associated pipelines would be located above the coastal lowlands aquifer system. The coastal lowlands aquifer system underlies most of the Gulf Coastal Plains, extending from southern Texas to the Florida panhandle, is one of the most extensively used aquifer systems in the southern U.S., and yields large quantities of water for agricultural, commercial, industrial, and public/domestic supplies (Renken 1998).

In the State of Texas, the coastal lowlands aquifer system is often referred to as the Gulf Coast Aquifer. The Gulf Coast Aquifer system consists of four individual aquifers with the Chicot and Evangeline, aquifers being the two shallowest. The Chicot and Evangeline Aquifers underlie the LNG site and the Project pipelines along their entire length. The approximate depth to the base of the Chicot Aquifer is 800 to 1,200 feet; the approximate depth to the base of the Evangeline Aquifer is 2,600 to 4,000 feet. These two aquifers along with the deeper Jasper and Catahoula aquifers are hydrologically connected to form the entire aquifer system.

The Chicot aquifer consists of Pleistocene interbedded sands, silt, gravel, and clay deposited in fluvial, deltaic, and near-shore marine environments. The landward boundary of the aquifer consists of outcrop areas where the aquifer system feathers out at the point of contact with the underlying Vicksburg-Jackson confining unit (Renken 1998). The Gulf-ward boundary is near the coastline where the groundwater becomes increasingly saline and the upper boundary is the land surface (Ryder 1996). Recharge into the Chicot Aquifer mainly occurs in sandy outcrops north of the proposed 70-Mile-Long Pipeline route.

The Texas Water Development Board (TWDB) defines major aquifers as those aquifers supplying large quantities of water in large areas of Texas, and minor aquifers as those aquifers supplying either large quantities of water in small areas or relatively small quantities in large areas (TWDB 1995). Although TWDB has designated the Gulf Coast Aquifer as a "major aquifer," for regulatory purposes, the coastal area extending approximately 10 miles inland (areas with generally brackish groundwater) has not been included in the "Gulf Coast Aquifer" major aquifer unit. As a result, the proposed LNG terminal site, the 3-Mile-Long Pipeline, and the southern portion of the 70-Mile-Long Pipeline would not be located above a TWDB-defined major aquifer. The Texas portion of the pipeline north of Sabine Lake (in Orange County), however, would be located above the TWDB-defined "major" Gulf Coast Aquifer.

The brackish to saline quality of much of the groundwater in the Jefferson County area limits its uses. Consequently, industries, agricultural users, and large municipalities obtain most of their fresh water from surface water sources. Wells existing in Jefferson County are prevalent in the northern and western

portions of the county, where groundwater salinity can be lower than on the eastern and southern (more coastal) portion of the county. Depth to groundwater in Jefferson County ranges from approximately 10 to 50 feet below ground surface. An on-site soil boring indicates that groundwater at the LNG terminal site is more than 25 feet below ground surface (i.e., groundwater was not encountered in a 25-foot-deep borehole).

In southwestern Louisiana, the Chicot aquifer is the most heavily pumped aquifer system and provides approximately 800 million gallons per day (gpd) for a variety of uses (LSU AgCenter 2001). The primary use is for agriculture (68 percent), in particular rice irrigation. Other uses include public supply (11 percent), industrial (9 percent), aquaculture (8 percent), power generation (2 percent), and other (2 percent) (LSU AgCenter 2001). In central and western areas of Calcasieu and Cameron Parishes, the Chicot aquifer is subdivided into three water-bearing sand units, the "200-foot," "500-foot," and "700-foot" sands. In general, water quality is better in the "500-foot" and "700-foot" sands and is suitable for domestic use in Calcasieu Parish and in eastern Cameron Parish. In the vicinity of the pipeline in Calcasieu Parish, the Chicot Aquifer ranges in total dissolved solids (TDS) concentrations from 150 mg/L to 300 mg/L [fresh] (LDEQ 2002). In the western part of Cameron Parish, all three sand layers are affected by saltwater intrusion (Nyman 1989). As a result, development within western and northwestern Cameron Parish is limited due in part to the scarcity of available fresh groundwater (Lovelace 1999).

Sole-source aquifers are defined by the EPA and include aquifers that contribute to more than 50 percent of the drinking water to a specific area and for which there are no reasonably available alternative sources of water, should the aquifer become contaminated. EPA has designated the Chicot Aquifer as a sole-source aquifer in southwestern Louisiana; however, the sole-source designation has not been applied to the Texas portion of the aquifer. Therefore, the LNG terminal, the 3-Mile-Long Pipeline, and portions of the 70-Mile-Long Pipeline located in Texas would not be above an EPA-designated sole source aquifer. Portions of the 70-Mile-Long Pipeline located in Louisiana would be above an EPA-designated sole source aquifer.

The State of Louisiana Wellhead Protection and Source Water Protection Program has established protection areas around each public water supply well or well field in the State of Louisiana. These wellhead protection areas are usually a 1,000-foot to a 1-mile radius surrounding the public supply well, depending on well depth and age (LDEQ 2004).

There are no known groundwater withdrawal areas in the Gulf Coast Aquifer or wellhead protection areas designated by Texas in the vicinity of the proposed terminal or within 150 feet of the proposed pipeline routes. The nearest registered well in the vicinity of the terminal is located 2.7 miles north-northwest of the site (TWDB 2003). Sempra states that only one well (in Louisiana at MP 46.8) is located within the proposed construction right-of-way along the 70-Mile-Long Pipeline. This well is 41.4 feet from the proposed center line and would be within the proposed temporary workspace.

The 70-Mile-Long Pipeline route does not pass through any assigned wellhead protection areas. The residents of the Glen Meadows Trailer Park have a water well near MP 41 (LDEQ 2004), but it is more than 600 feet from the temporary construction right-of-way. The Houston River Water Works District 11 withdraws water from the Houston River Canal to the west of the Highway 27, approximately 1.6 miles east of the point where the pipeline route would cross the canal (MP 52.9). This is not an assigned protection area, but has been identified during the Source Water Assessment Program and may be assigned specific protection measures in the future.

LNG Terminal

Construction activities that could potentially affect groundwater resources include excavation for installation of building foundations, installation of piles for LNG ship unloading facilities and LNG tanks, and the accidental release of fuels, lubricants, and/or hazardous materials during construction. The primary threat to groundwater from the operation of the LNG terminal would be the accidental release of fuels, lubricants, and/or hazardous materials in use at the operational facility.

Sempra does not plan to use groundwater as a water supply during the construction or operation of the LNG terminal. Since groundwater withdrawals are not anticipated, potential resultant changes in flow patterns and/or lowering of the local groundwater table as a result of such withdrawals would not occur.

The various LNG facility buildings would have shallow foundations (i.e., likely above the local water table) and the excavation and installation of these foundations would not be expected to significantly impact local groundwater. Based on the soil and geologic characteristics, and the absence of consolidated bedrock near the surface of the Project area, no blasting is anticipated for construction of the LNG terminal; therefore, no impact from blasting is expected.

It is not anticipated that pile driving operations would have any detrimental effect on the groundwater or aquifers supporting water wells in the Project area. The nearest registered water supply well is 2.7 miles from the LNG terminal site. Geotechnical investigations at the site revealed the sub-soils to be predominantly clays of low hydraulic conductivity. There is a 25-foot-thick stratum of dense to very dense silty fine sand at about a 155-foot-depth below existing grade. The sand stratum is not of very high hydraulic conductivity and, therefore, is not considered to be a good aquifer. Sempra expects that driven piles would terminate above the sand stratum, i.e., into the fat clay of very low hydraulic conductivity. Even if a few piles were driven into the sand stratum, neither the soil nor the water from the shallow depth would be carried into the sand stratum by the pile. In addition, the clayey sub-soil above the sand stratum is not known to have any contaminants.

Sempra has developed and filed a preliminary SPCC Plan for the construction of the LNG terminal to address the issue of potential spills and/or releases of fuels, lubricants or hazardous materials. Sempra's preliminary SPCC Plan is consistent with spill prevention and response procedures presented in Section IV.A of our Procedures and describes in detail the preventative measures to avoid spill or leaks and mitigative measures utilized to minimize potential impacts should a spill or leak occur. Upon finalization, the plan would designate refueling areas; spill response procedures, spill response materials, and training; mitigative measures/response; hazardous liquids quantities, storage, and disposal. By following the SPCC Plan, the potential impacts on soils, groundwater, and water wells due to spills or leaks during terminal construction would be minimized. Included in Sempra's plan is the prohibition of refueling activities and storage of hazardous liquids within at least 200-foot radius of all private wells and at least a 400-foot radius of all municipal or community water supply wells.

With implementation of the measures stated above, we believe that the activities associated with the construction and operation of the LNG terminal would result in no significant impacts to local groundwater resources.

Pipelines

Sempra has incorporated protection, mitigation, and enhancement measures for groundwater resources into the Project's design. The groundwater underlying most of the pipeline routes is not used as a fresh water resource. Near the coastline of Texas, potable groundwater is found at depths of 3,000 feet. However, the estimated depth to nonpotable groundwater is 0 to 3 feet. While the construction of the

Project's pipelines is not likely to affect groundwater, Sempra has committed to implement extensive measures to avoid or minimize potential impacts to groundwater at and within the vicinity of the project's pipeline routes. These measures include resource identification, oversight, development of SPCC and storm water management plans, as well as use of the approved construction procedures, as outlined in our Plan and Procedures. Operation of the pipelines is not expected to have any measurable effect on groundwater resources.

Sempra does not anticipate any blasting during construction of either of the send-out pipelines. Nevertheless, Sempra has committed to conducting pre- and post-construction testing of well yield and water quality for the well at MP 46.8 and for all other private or domestic water wells or springs found to be within 150 feet of the temporary construction right-of-way for each of the Project's pipeline routes. If adverse effects to a groundwater supply were to occur that were shown to be a result of the Project's construction activity, Sempra would provide a temporary source of water to those affected and would compensate for damages or repair the water supply.

It is estimated that shallow groundwater could occur within the first 3 feet of depth. However, Sempra does not anticipate the need for any groundwater dewatering along either the 3-mile-long or 70-Mile-Long Pipeline routes, especially in the areas where the push construction technique would be used. In the event that it became necessary to remove water from the pipeline trench during construction, the water would be pumped through filter bags prior to being discharged.

Refueling of vehicles and storage of fuel, oil, and other fluids during construction could create a potential long-term contamination hazard to aquifers. Spills or leaks of hazardous liquids could contaminate groundwater and affect users of the aquifer. Soil contamination could add pollutants to the groundwater long after the spill has occurred. This type of impact could be avoided or minimized by restricting the location of refueling and storage facilities and by requiring immediate cleanup in the event of a spill or leak. Sempra has committed to prohibiting refueling activities and storage of hazardous liquids within at least a 200-foot radius of all private wells and at least a 400-foot radius of all municipal or community water supply wells.

With implementation of the measures stated above, we believe that the activities associated with the construction and operation of the pipelines would result in no significant impacts to local groundwater resources.

4.3.2 Floodplains

FEMA Flood Insurance Rate Maps for the LNG site for Jefferson County, Texas, indicate that the LNG site falls within a 100-year flood hazard zone susceptible to coastal flooding associated with the Gulf of Mexico, with a 100-year flood elevation of 12 feet (datum: NGVD29). Sempra conducted a storm surge evaluation for the project, which concluded that, based on a review of past studies and literature sources and an analysis of available measured water level data in the vicinity of the LNG project site, the extreme still water elevation for a 100-year recurrence level storm surge is 10 feet NGVD29.

The LNG terminal components would be designed to withstand storm forces so that factors such as flooding, water damage, and land erosion would have minimal affects on the operation and safety of the facilities. Sempra has incorporated certain design elements into its facilities to address potential flooding and storm damage at the LNG terminal site. LNG process areas, including areas housing critical and non-critical equipment, along with LNG piping and installations, would be constructed to a built-up or raised grade elevation of 15.96 feet NGVD29. An earthen dike would be constructed around the LNG

storage tank area, with a top of dike elevation of 11.96 feet NGVD29. The base of the tank would be set at an elevation greater than 11.96 feet NGVD29.

Because the structural and mechanical elements have been designed into the LNG terminal facilities to withstand coastal flooding and storms, we conclude that flooding due to storm events is not likely to adversely affect the Project facilities. No hazards associated with flooding or storm damage are associated with the pipeline facilities.

4.3.3 Surface Water

The proposed LNG terminal site, the SNWW, and tributaries that flow into the SNWW are located within the U.S. Geological Survey (USGS)-designated Sabine Lake watershed. The Sabine Lake watershed covers an area of 1,040 square miles in southwest Texas and southeast Louisiana. Waterbodies that would be crossed by the Project's pipelines are presented in **table 4.3.3-1**. The entire 3-Mile-Long Pipeline and approximately the first 45-mile-long segment of the 70-Mile-Long Pipeline (from the LNG terminal, through Sabine Lake, and north into Orange County, Texas, and Cameron and Calcasieu Parishes, Louisiana) also would be located within the Sabine Lake watershed. The final 25-mile segment of the 70-Mile-Long Pipeline (within Calcasieu and Beauregard Parishes, Louisiana) would be located within the 1,080-square-mile area Lower Calcasieu watershed and the 818-square-mile area West Fork Calcasieu watershed.

Sempra conducted a database search and identified no hazardous waste or other specially designated contaminated sites listed within the specified ASTM database search radii in any of the environmental databases searched (Environmental Data Resources, Inc. 2004) for either the terminal or the proposed pipelines. No outstanding natural resource waters or scenic rivers would be affected by either the LNG terminal or pipeline facilities.

TABLE 4.3.3-1

Surface Water Bodies Crossed by the Port Arthur LNG Project Pipelines

County or Parish, State/ Milepost	Water Body	Type[a]	Crossing Width (Feet)	State Water Quality Classification[b]	Fishery Type [c]	Proposed Construction Crossing Method [d]
3-Mile-Long Pipeline						
Jefferson, TX / 1.5	Keith Lake Cut	P	282	A,B,C,D	WWF	HDD
Jefferson / 2.0	Keith Lake	OW	3,450	A,B,C,D	WWF	OC
70-Mile-Long Pipeline						
Jefferson / 1.3	Port Arthur Ship Canal	OW	1,437	A,B,C,D	WWF	HDD
Jefferson / 1.9	Sabine Lake	OW	554	A,B,C,D,E	WWF	HDD
Jefferson / 2.0	Sabine Lake	OW	84,481	A,B,C,D,E	WWF	OC
Orange, TX / 18.0	West Pass Sabine River	OW	6,370	A,B,C,D,E	WWF	HDD/OC
Orange / 19.8	Unnamed	P	unknown	A,B,C,D	WWF	unknown
Orange / 20.1	Unnamed	P	unknown	A,B,C,D	WWF	unknown
Orange / 20.5	Unnamed	I	314	A,B,C,D	WWF	OC
Orange / 20.6	Unnamed	I	82	A,B,C,D	WWF	OC
Orange / 21.1	Shell Canal	P	198	A,B,C,D	WWF	OC
Orange / 21.8	Cow Bayou Canal	P	328	C,D	WWF	HDD
Orange / 22.5	Cow Bayou	P	492	C,D	WWF	HDD
Orange, TX / Cameron, LA/ 23.0	**Sabine River**	**P**	**1,468**	**A,B,C**	**WWF**	**HDD**
Cameron / 23.7	**Unnamed**	**I**	**143**	**A,B,C**	**WWF**	**OC**
Cameron / 23.8	**Unnamed**	**I**	**750**	**A,B,C**	**WWF**	**OC**
Cameron / 24.3	**Burton Shell Slip**	**P**	**100**	**A,B,C**	**WWF**	**OC**
Calcasieu, LA / 28.6	**Gulf Intracoastal Waterway**	**P**	**506**	**A,B,C**	**WWF**	**HDD**

TABLE 4.3.3-1

Surface Water Bodies Crossed by the Port Arthur LNG Project Pipelines

County or Parish, State/ Milepost	Water Body	Type[a]	Crossing Width (Feet)	State Water Quality Classification[b]	Fishery Type [c]	Proposed Construction Crossing Method [d]
Calcasieu / 31.0	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 32.5	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 33.1	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 33.2	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 34.5	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 35.0	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 35.3	Gray Canal	P	unknown	A,B	WWF	unknown
Calcasieu / 37.0	Canal	P	unknown	A,B	WWF	unknown
Calcasieu / 37.4	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 37.8	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 38.9	Unnamed	I	8	A,B	WWF	OC
Calcasieu / 39.1	Unnamed	P	unknown	A,B impaired	WWF	unknown
Calcasieu / 39.7	Unnamed	P	unknown	A,B	WWF	unknown
Calcasieu / 39.9	Unnamed	P	unknown	A,B	WWF	unknown
Calcasieu / 40.5	Hampton Coulee / Canal	P	unknown	A,B	WWF	unknown
Calcasieu / 40.8	Canal	P	unknown	A,B	WWF	unknown
Calcasieu / 40.9	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 41.4	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 41.8	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 42.0	Sabine Canal	P	unknown	A,B	WWF	unknown
Calcasieu / 42.3	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 43.1	Coon Gully	P	unknown	A,B	WWF	unknown
Calcasieu / 43.5	Unnamed	P	unknown	A,B	WWF	unknown
Calcasieu / 43.9	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 44.1	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 44.4	Unnamed	I	6	A,B, impaired	WWF	OC
Calcasieu / 45.0	Unnamed	I	5	A,B	WWF	OC
Calcasieu / 45.5	Unnamed	I	7	A,B	WWF	OC
Calcasieu / 45.6	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 45.8	Unnamed	I	3	A,B	WWF	OC
Calcasieu / 46.9	Unnamed	I	8	A,B	WWF	OC
Calcasieu / 47.6	Unnamed	P	4	A,B	WWF	OC
Calcasieu / 47.8	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 48.1	Pond	OW	160	A,B	WWF	OC[e]
Calcasieu / 48.8	Unnamed	P	12	A,B	WWF	OC
Calcasieu / 49.2	Unnamed	I	10	A,B	WWF	OC
Calcasieu / 50.0	Unnamed	P	6	A,B	WWF	OC
Calcasieu / 50.3	Unnamed	I	4	A,B	WWF	OC
Calcasieu / 50.9	Unnamed	P	3	A,B	WWF	OC
Calcasieu / 51.3	Unnamed	P	4	A,B	WWF	OC
Calcasieu / 51.3	Bayou Choupique	P	6	A,B	WWF	OC
Calcasieu / 51.5	Unnamed	P	unknown	A,B	WWF	unknown
Calcasieu / 51.6	Unnamed	P	6	A,B	WWF	OC
Calcasieu / 52.4	Unnamed	I	7	A,B	WWF	OC
Calcasieu / 52.7	Unnamed	I	12	A,B	WWF	OC
Calcasieu / 52.9	Houston River Canal	P	122	A,B	WWF	HDD
Calcasieu / 54.3	Unnamed	I	6	A,B	WWF	HDD
Calcasieu / 55.4	Houston River	P	85	A,B	WWF	HDD
Calcasieu / 55.6	Pond	OW	87	A,B	WWF	HDD
Calcasieu / 56.8	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 57.4	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 57.7	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 58.3	Unnamed	P	unknown	A,B	WWF	unknown
Calcasieu / 59.2	Little River	P	62	A,B	WWF	HDD
Calcasieu / 61.0	Unnamed	I	unknown	A,B	WWF	OC
Calcasieu / 61.2	Unnamed	I	8	A,B	WWF	OC
Calcasieu / 62.4	Canal	P	12	A,B,C	WWF	HDD
Calcasieu / 62.6	**Beckwith Creek**	**P**	**64**	**A,B,C**	**WWF**	**HDD**
Calcasieu / 63.7	Tributary to Calcasieu River	P	6	B,C	WWF	HDD

TABLE 4.3.3-1

Surface Water Bodies Crossed by the Port Arthur LNG Project Pipelines

County or Parish, State/ Milepost	Water Body	Type[a]	Crossing Width (Feet)	State Water Quality Classification[b]	Fishery Type [c]	Proposed Construction Crossing Method [d]
Calcasieu / 63.8	Hickory Branch of Calcasieu River	P	68	B,C	WWF	HDD
Calcasieu / 64.7	Hickory Branch Canal	I	20	B,C	WWF	OC
Beauregard, LA / 66.5	Unnamed	I	20	B,C	WWF	OC
Beauregard / 68.0	Indian Bayou	I	unknown	B,C	WWF	HDD
Beauregard / 68.3	Unnamed	I	5	A,B	WWF	OC
Beauregard / 69.1	Unnamed	I	6	A,B	WWF	OC
Beauregard / 69.4	Unnamed	I	4	A,B	WWF	OC
Beauregard / 69.7	Pond	OW	90	A,B	WWF	OC

NOTE: Table entries in **BOLD** are derived from published sources, not from civil surveys. Landowner denied survey access.

(a) Flow Regime:
I = Intermittent
P = Perennial
OW=Open Water

(b) Louisiana State Water Quality Classifications:
A = Primary Contact Recreation
B = Secondary Contact Recreation
C = Propagation of Fish and Wildlife
D = Drinking Water
E = Oyster Propagation
F = Agriculture
G = Outstanding Natural Resource Waters
H = Limited Aquatic Life and Wildlife Use
Texas State Water Quality Classifications:
A = Aquatic Life Use
B = Contact Recreation
C = General Use
D = Fish Consumption Use
E = Oyster Waters Use

(c) Fisheries Classification:
WWF = Warm Water Fishery

(d) Crossing Method: Sempra-proposed construction method to install pipeline across water body. Sempra proposes to cross all intermittent water bodies by open-cutting them, unless they contain flowing water at the time of construction. An appropriate crossing method would be determined at that time.
OC = Open Cut
HDD = Horizontal Directional Drill

(e) Crossing to be done by push method.

4.3.3.1 Construction Impacts

LNG Terminal

The primary perennial surface waterbody associated with the LNG terminal would be the Port Arthur Ship Canal portion of the SNWW. The SNWW/Port Arthur Ship Canal forms the eastern boundary of the LNG terminal site and an existing canal forms the western boundary. Keith Lake is located approximately 1.5 miles to the south of the terminal site. Round Lake, while not on the proposed LNG terminal site, is directly adjacent to the northern boundary of the site, and would be surrounded by the terminal site and Sempra's proposed DMPA (DMPA 1-2). Sabine Lake, located to the east of the SNWW/Port Arthur Ship Canal is approximately 0.85 mile from the site at its closest point and is separated from the Ship Canal by Pleasure Island. Aside from the SNWW/Port Arthur Ship Canal, there are no other on-site surface waterbodies that would be affected by the construction of the LNG terminal.

The SNWW/Port Arthur Ship Canal is a 75-mile-long, deep-draft navigation channel that services the ports of Port Arthur, Beaumont, and Orange. The SNWW lies on the western side of Sabine Lake and forms a deepwater channel between the Sabine and Neches Rivers and the Gulf of Mexico. The SNWW

is dredged to approximately 40 feet and separated from Sabine Lake by Pleasure Island. The SNWW is approximately 1,400 feet wide adjacent to the proposed terminal site.

The SNWW/Port Arthur Ship Canal between the northern portion of Sabine Lake to the confluence with Sabine Pass, south of Pleasure Island, has been designated by TCEQ as the "Sabine-Neches Canal Tidal," Segment 0703. This waterbody is tidally influenced and estuarine. The Sabine-Neches Canal Tidal waterbody is classified in the Texas Administrative Code (TAC) Surface Water Quality Standards (30 TAC Chapter 307) for high aquatic life use, contact recreation use, general use, and fish consumption. The aquatic life, contact recreation and general uses are listed as fully supported, while fish consumption use has not been assessed (TCEQ 2002).

The primary impact on surface waters from construction of the LNG terminal would be the turbidity associated with dredging of approximately 6.7 million yd^3 of mostly fat clays interbedded with lean clays, adjacent to the SNWW/Port Arthur Ship Canal to accommodate the marine terminal and turning basin. This waterbody is not listed in the Texas 2004 303(d) list of impaired waters and; therefore, contaminated sediments are not anticipated. However, dredging of the slip and turning basin would result in temporary siltation and sedimentation impacts similar to those that currently occur during maintenance dredging activities. Dredging activities would temporarily stir up sediment and degrade the water quality in the area of the dredging, which in turn, could extend out into the Port Arthur Ship Canal as the size of the slip increases. A hydraulic cutterhead dredge would be used to excavate the material, which generally creates less turbidity than other types of dredges, and the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity. Sempra anticipates that the pumps used to convey the material from the cutter heads, in a hydraulic dredging operation, would contain most of the suspended solids caused by the dredging and that they would be conveyed with the dredged material to the DMPA where the suspended solids would settle out prior to the excess water being discharged back to the waterbody. The suspended solids and turbidity levels eventually would decline to ambient levels following completion of dredging activities.

Turbidity resulting from dredging could reduce light penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton in the slip area. The suspension of organic materials and sediments could cause an increase in biological and chemical oxygen demand in the slip area. Lower dissolved oxygen concentrations could cause a temporary displacement of motile organisms and could stress or kill sessile benthic organisms within the affected area. However, because this would be a newly developed area, there would be a limited number of organisms in the area.

Sempra conducted an analysis of the turbidity that potentially would be generated by the dredging operation at the LNG terminal site, which concluded that the proposed dredging activities for the LNG terminal are unlikely to have extensive adverse effects in the Port Arthur Ship Canal (**appendix F**). The ambient turbidity levels in the water (generated by flows, waves and ship traffic) create a high background level of turbidity, thereby reducing the relative impact of increased dredging-related turbidity. Sempra would work closely with the COE to identify and incorporate the appropriate specifications and guidelines governing dredging activities into the dredging contract. Turbidity impacts related to dredging are expected to be short-term and to have minimal adverse effects on water quality and aquatic life.

The proposed berthing area consists of virgin sediments with minimal historical upland use. There is minimal reason to believe that contamination exists within the dredging prism. However, possible pathways for contamination would be offsite sources through air or waterborne deposition. Evidence of prior oil and gas exploration and transmission activities at the LNG terminal site, as well as prior dredged material placement activities, prompted Sempra to collect soil and sediment samples to determine if the material to be dredged as part of the Project could be used for beneficial reuse projects. Individual samples were collected from specific locations at three different depths. The analytical results from these

samples were composited to reflect the mixing of soils that would occur during the hydraulic dredging and placement of dredged materials in the DMPA prior to being made available for beneficial reuse. The results of the sampling and analyses are summarized in **table 4.3.3.1-1**.

TABLE 4.3.3.1-1

Composite Sample Results for Sediments at the Proposed LNG Terminal Site

Parameter	Composite Sample Result (mg/kg)	Thresholds Effects Level (mg/kg)[a]	Ecological Benchmark for Freshwater Sediment (mg/kg)[b]	Ecological Benchmark for Marine Sediment (mg/kg)[c]
Arsenic[d]	4.96	7.24	5.90	8.20
Cadmium[d]	Not Detected	0.676	0.596	1.20
Chromium[d]	17.9	52.3	37.3	81.0
Lead[d]	17.9	30.2	35.0	46.7
Mercury[d]	0.036	0.130	0.174	0.150
Silver[d]	Not Detected	0.733	1.00	1.00
Chrysene[d]	Not Detected	0.108	0.057	0.384
Pyrene[d]	Not Detected	0.153	0.053	0.665
Arclor 1016 (PCB)[e]	Not Detected	0.022	0.007	Not Available
Arclor 1254 (PCB)[e]	Not Detected	0.022	0.060	Not Available
Archlor 1260 (PCB)[e]	Not Detected	0.022	0.005	Not Available
Archlor 1248 (PCB)[e]	Not Detected	0.022	0.030	Not Available

(a) Data from the EPA's National Sediment Quality Survey (1996).
(b) Data from the Texas Commission on Environmental Quality's RG-263 (2001) Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas.
(c) Data from the Texas Commission on Environmental Quality's RG-263 (2001) Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas.
(d) Composite result from over 46 samples collected throughout site from zero to 24 feet below surface.
(e) Composite result from three samples collected from the channel.

The initial analyses indicate that the material would be suitable for beneficial reuse projects. Sempra has committed to conduct any additional testing required by the regulatory or permitting authorities and by the ultimate recipient of the material.

In the late 1990s, NOAA collected sediment samples from Sabine Lake and connecting waterways and performed laboratory toxicity tests as a means of evaluating the potential ecotoxicological effects in sediments (Long 1999). The overall survey encompassed an area of approximately 246 square kilometers (km^2) and included analyses of 66 sediment samples from Sabine Lake, the Neches and Sabine Rivers, the GIWW, the Port Arthur Ship Canal, and Sabine Pass. Toxicity was determined with a battery of acute and sub-lethal tests conducted on bulk (solid-phase) sediments, pore waters, and organic solvent extracts to determine the concentrations of many potentially toxic substances, including ammonia, trace metals, polynuclear aromatic hydrocarbons, and chlorinated organic compounds.

The study found that sediments in Sabine Lake and the vicinity did not appear to be severely degraded (Long 1999). Chemical concentrations rarely exceeded effects-based numerical guidelines, suggesting that toxicant-induced effects would not be expected in most areas. None of the samples was highly toxic in acute amphipod survival tests and a minority of samples was highly toxic in sub-lethal urchin fertilization tests. Sediments in the waterway channels were more contaminated than sediment from the Sabine Lake basin (Long 1999). Trace metals concentrations in sediments in the Sabine-Neches estuary have been reported as relatively low as compared to other estuaries along the Gulf Coast (Ravichandran et al. 1995).

Land disturbing activities required for the construction of the onshore LNG terminal facilities would be confined to the existing property, including the proposed dredge material placement area (DMPA 1-2). During construction of the LNG storage tanks and other terminal facilities, disturbed soils would be exposed to potential erosion. To minimize the impacts of erosion and sedimentation on surface waters, land disturbing and construction activities would be conducted in compliance with the NPDES permit for storm water discharges during construction activities. Storm water runoff from the disturbed portions of the site would be managed in accordance with a site-specific erosion and sedimentation control plan, a Storm Water Pollution Prevention Plan (SWPPP), and our Plan and Procedures. The plans other than our Plan and Procedures would be finalized upon completion of detailed engineering and design and provided to the permitting agencies for review. Sempra would install all necessary erosion and sedimentation control structures as required by the TCEQ and in compliance with our Plan and Procedures. Following appropriate treatment, all construction storm water from the LNG terminal site would be directed toward existing drainage ditches. Sempra does not anticipate having to modify existing ditches for the Project.

Spills, leaks, or other releases of hazardous materials during construction or operation of the terminal facilities could adversely impact water quality. Hazardous materials entering nearby waterbodies as a result of spilled materials being flushed into them with storm water runoff or entering the Port Arthur Ship Canal directly from leaks or spills from the construction area and equipment could have adverse effects on water quality and aquatic organisms. To minimize the potential for accidental releases of hazardous materials and to establish proper protocol concerning minimization, containment, remediation, and reporting of any releases that occur, Sempra would develop a site-specific SPCC Plan for both construction and operational phases of the Project.

Overall, with adherence to the mitigation measures and BMPs described above, we believe that construction of the proposed LNG terminal facilities would have minimal impacts on surface water quality.

Pipelines

Pipeline construction could affect surface waters in a variety of ways. Clearing and grading of stream banks, in-water trenching, trench dewatering, and backfilling could result in modifications to aquatic habitat, increased sedimentation, turbidity, decreased dissolved oxygen levels, increased stream warming, releases of chemical and nutrient pollutants from sediments, and accidental release of chemical contaminants such as fuels and lubricants. The greatest potential impacts for the waterbody crossings would result from suspension of sediments caused by in-stream trenching and backfilling. The extent of the impact would depend on sediment loads, stream velocity, and sediment particle size at the time of construction. These factors would determine the density, downstream extent, and persistence of the sediment plume. In general, impacts on the in-stream aquatic biota and the habitat value of the waterbody would be temporary and short-term during construction. Through the transport of sediment and recruitment of aquatic biota from upstream sources, these resources would be expected to return to preconstruction conditions soon after the completion of in-stream work, backfilling, and restoration.

The waterbodies that would be crossed by the proposed pipelines, including crossing width, state water quality classification, fishery type, and proposed construction method, are listed above in **table 4.3.3-1**. The 3-Mile-Long Pipeline would not cross any waterbodies that are listed in the Texas 2004 303(d) list of impaired waters (TCEQ 2004). Therefore, the presence of contaminated sediments is not anticipated. The 70-Mile-Long Pipeline would cross two waterbodies listed in the Louisiana 2004 303(d) list of impaired waters (LDEQ 2004). Both of these impaired waterbodies are located in Calcasieu Parish at MPs 39.1 and 44.4. These waterbodies are listed as impaired due to turbidity; however, not sediment contamination.

To minimize surface water impacts, Sempra would implement the construction and mitigation measures described in our Procedures. The Procedures prescribe additional temporary workspace setbacks as well as in-stream construction duration constraints and sediment control procedures. The Procedures also require preparation of site-specific crossing plans for waterbodies greater than 100 feet wide. Adherence to the Procedures would minimize short- and long-term impacts associated with crossing these waterbodies. Additionally, Sempra is proposing to use the HDD technique to cross several waterbodies in Texas and Louisiana.

Requested Variances to our Plan and Procedures. Sempra has committed to comply with our Plan and Procedures during construction and operation of the proposed Project. The Procedures include provisions for erosion control; protection of, and special construction techniques in, wetlands and waterbodies; and wetland and waterbody restoration and maintenance measures. However, Sempra has requested variances to our Plan and Procedures (see **table 4.3.3.1-2**). **Table 4.3.3.1-2** provides Sempra's variance requests (relative to the applicable sections of our Plan and Procedures) by pipeline and MP location, which include:

TABLE 4.3.3.1-2

Sempra's Requested Variances Relative to the FERC Plan and Procedures[(a)]

MP	Length/ Size	Variance	Applicable FERC Plan or Procedures Section	Basis For Request
3-Mile Pipeline to the NGPL Pipeline				
0.0 to 1.4	7,487	125 feet wide temporary construction right-of-way in wetlands	Procedures Section VI.A.3	Maintain soil hydration to minimize soil volume loss
2.0 to 2.6	3,800	150 feet wide temporary construction right-of-way in waterbody	No Variance Required under Procedures Section V.B.9	Allows use of shallow draft (Flexi Float) barges, Maintain soil stability in trench and spoil pile, required for work from shallow draft barges
1.0	300' x 600'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Allow for push construction technique, contingency for working around relocated SH 87
2.6	300' x 600'	Extra workspace in wetlands[(b)]	Procedures Section VI.B.1.a	Tie-in to NGPL Pipeline at point requested by TPWD
70-Mile Pipeline to the Transco Compressor Station No. 45				
2.0 to 19.2	89,473	150 feet wide temporary construction right-of-way in waterbody	No Variance Required under Procedures Section V.B.9	Maintain soil stability in trench and spoil pile, required for work from shallow draft barges
19.2 to 35.4	79,147	125 feet wide temporary construction right-of-way in wetlands	Procedures Section VI.A.3	Maintain soil hydration to minimize soil volume loss
66.8 to 66.9	500	Stripping topsoil over trench only in agricultural field	Plan Section IV.B.1	Requested by landowner
1.2	150' x 300'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD entry site for Port Arthur Canal crossing
2.0	500' x 500'	Extra workspace in wetlands[(c)]	Procedures Section VI.B.1.a	HDD exit for Port Arthur Canal crossing and tie-in to Sabine Lake crossing
19.2	200' x 300'	Extra workspace in wetlands, main line valve site in wetlands	Procedures Section VI.B.1.a Procedures Section VI.A.6	Construct main line valve setting on platform to minimize effects on bank between wetlands and Sabine Lake

TABLE 4.3.3.1-2

Sempra's Requested Variances Relative to the FERC Plan and Procedures[(a)]

MP	Length/ Size	Variance	Applicable FERC Plan or Procedures Section	Basis For Request
21.7	150' x 800'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD exit to avoid Cow Bayou Canal/associated sensitive areas
21.7	200' x 200'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP
21.9	150' x 600'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD entry to avoid Cow Bayou Canal/associated sensitive areas
21.9	300' x 300'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP
22.4	150' x 800'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD exit to avoid Cow Bayou/ associated sensitive areas
22.4	200' x 200'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP
22.6	150' x 600'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD entry to avoid Cow Bayou/ associated sensitive areas
22.6	300' x 300'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP
22.8	150' x 600'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD entry to cross Sabine River/associated sensitive areas
22.8	300' x 300'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP
23.3	150' x 800'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD exit to cross Sabine River/associated sensitive areas
23.3	200' x 200'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP
24.3	200' x 500'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Open cut of Burton Shell Slip at point recommended by agencies
24.3	200' x 500'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Open cut of Burton Shell Slip at point recommended by agencies
25.9	2,247,500 square feet	Extra workspace in wetlands	Procedures Section VI.B.1.a	Push site for push in two directions to minimize wetland effects. A portion of site is in uplands
28.5	1000' x 1500'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Combined push site and HDD entry to avoid GIWW
28.9	150' x 800'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD exit site to avoid GIWW
28.9	200' x 200'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP
29.9	200' x 200'	Extra workspace in wetlands, main line valve site in wetlands	Procedures Section VI.B.1.a Procedures Section VI.A.6	Main line valve installation per DOT guidelines
30.6	400' x 800'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Push site to minimize effects on wetlands
33.6	150' x 800'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Push site to minimize effects on wetlands
33.6	200' x 200'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Workspace in combination with other workspace at same MP

TABLE 4.3.3.1-2

Sempra's Requested Variances Relative to the FERC Plan and Procedures[(a)]

MP	Length/ Size	Variance	Applicable FERC Plan or Procedures Section	Basis For Request
35.3	200' x 600'	Extra workspace in wetlands, waterbody crossing	Procedures Section VI.B.1.a, V.B.9	Open cut of creek
38.5	150' x200'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Road bore exit for U.S. 90
49.2	125' x 800'	Extra workspace in wetlands, minor waterbody crossing	Procedures Section VI.B.1.a, V.B.7	Soil stockpile for waterbody crossing
49.4	125' x 800'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Road bore of Parish road
58.5	150' x 200'	Extra workspace in wetlands	Procedures Section VI.B.1.a	Road bore of road and railroad
63.7	150' x 300'	Extra workspace in wetlands	Procedures Section VI.B.1.a	HDD entry to avoid Calcasieu River
68.3	125' x 800'	Extra workspace in wetlands, minor waterbody crossing	Procedures Section VI.B.1.a, V.B.7	Soil stockpile for waterbody crossing
69.5	125' x 800'	Extra workspace in wetlands, minor waterbody crossing	Procedures Section VI.B.1.a, V.B.7	Soil stockpile for waterbody crossing

(a) Federal Energy Regulatory Commission (FERC) Wetland and Waterbody Construction and Mitigation Procedures (Procedures) and Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).
(b) Portion (512 feet of the 600 foot length) within Keith Lake.
(c) Within Sabine Lake.

- use of a 150-foot-wide construction right-of-way in a waterbody for the 3-Mile-Long Pipeline (MPs 2.0 to 2.6) and for the 70-Mile-Long Pipeline (MPs 2.0 to 19.2);
- use of a 125-foot-wide construction right-of-way in wetlands for the 3-Mile-Long Pipeline (MPs 0.0 to 1.4) and the 70-Mile-Long Pipeline (MPs 19.2 to 35.4);
- use of extra workspace in wetlands (many locations);
- locating aboveground facilities in wetlands (MPs 19.2 and 29.9); and
- stripping of topsoil over the trench only in an agricultural field (MP 66.8 to 66.9).

Our rationale for approving or denying each variance request is provided in **table 4.3.3.1-3**, and discussed, where appropriate, throughout the remainder of this section and section 4.4.

TABLE 4.3.3.1-3

Rationale for Approval or Denial of Sempra's Requested Variances Relative to the FERC Plan and Procedures[(a)]

MP	Length/ Size	Variance	Approved/ Denied	Basis For Approval/Denial
3-Mile-Long Pipeline				
0.0 to 1.4	7,487	125 feet wide temporary construction right-of-way in wetlands	Denied	Increased impact area in wetlands and lack of site-specific justification. We are approving expansion of the construction right-of-way width to 110 feet between MPs 0.0 and 1.0 and to 100 feet between MPs 1.0 and 1.4 (see section 4.4.2).
2.0 to 2.6	3,800	150 feet wide temporary construction right-of-way in waterbody	Approved	The Procedures do not specify an allowed right-of-way width across major waterbodies, although the nominal construction right-of-way width is implied. Approval would allow use of

TABLE 4.3.3.1-3

Rationale for Approval or Denial of Sempra's Requested Variances Relative to the FERC Plan and Procedures[a]

MP	Length/ Size	Variance	Approved/ Denied	Basis For Approval/Denial
				shallow draft (Flexi Float) barges and facilitate maintenance of soil stability in trench and of spoil pile. Use of the requested right-of-way width would still require COE approval.
1.0	300' x 600'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
2.6	300' x 600'	Extra workspace in wetlands[b]	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
70-Mile-Long Pipeline				
2.0 to 19.2	89,473	150 feet wide temporary construction right-of-way in waterbody	Approved	The Procedures do not specify an allowed right-of-way width across major waterbodies, although the nominal construction right-of-way width is implied. Approval would allow use of shallow draft (Flexi Float) barges and facilitate maintenance of soil stability in trench and of spoil pile. Use of the requested right-of-way width would still require COE approval.
19.2 to 35.4	79,147	125 feet wide temporary construction right-of-way in wetlands	Denied	Increased impact area in wetlands and lack of site-specific justification. We are approving expansion of the construction right-of-way width to 100 feet between MPs 1.0 and 1.4 (see section 4.4.2).
66.8 to 66.9	500	Stripping topsoil over trench only in agricultural field	Approved	Requested by landowner (see section 4.2.3.1).
1.2	150' x 300'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
2.0	500' x 500'	Extra workspace in wetlands[c]	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
19.2	200' x 300'	Extra workspace in wetlands, main line valve site in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
21.7	150' x 800'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
21.7	200' x 200'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
21.9	150' x 600'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
21.9	300' x 300'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
22.4	150' x 800'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
22.4	200' x 200'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
22.6	150' x 600'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
22.6	300' x 300'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).

TABLE 4.3.3.1-3

Rationale for Approval or Denial of Sempra's Requested Variances Relative to the FERC Plan and Procedures[(a)]

MP	Length/ Size	Variance	Approved/ Denied	Basis For Approval/Denial
22.8	150' x 600'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
22.8	300' x 300'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
23.3	150' x 800'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
23.3	200' x 200'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
24.3	200' x 500'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
24.3	200' x 500'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
25.9	2,247,500 square feet	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
28.5	1000' x 1500'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
28.9	150' x 800'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
28.9	200' x 200'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
29.9	200' x 200'	Extra workspace in wetlands, main line valve site in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
30.6	400' x 800'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
33.6	150' x 800'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
33.6	200' x 200'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
35.3	200' x 600'	Extra workspace in wetlands, waterbody crossing	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
38.5	150' x200'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
49.2	125' x 800'	Extra workspace in wetlands, minor waterbody crossing	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
49.4	125' x 800'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
58.5	150' x 200'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
63.7	150' x 300'	Extra workspace in wetlands	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).
68.3	125' x 800'	Extra workspace in wetlands, minor waterbody crossing	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).

TABLE 4.3.3.1-3

Rationale for Approval or Denial of Sempra's Requested Variances Relative to the FERC Plan and Procedures[(a)]

MP	Length/ Size	Variance	Approved/ Denied	Basis For Approval/Denial
69.5	125' x 800'	Extra workspace in wetlands, minor waterbody crossing	Approved	Extent of wetlands provides no other reasonable or practical location (see section 4.4.2).

(a) Federal Energy Regulatory Commission (FERC) Wetland and Waterbody Construction and Mitigation Procedures (Procedures) and Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).
(b) Portion (512 feet of the 600 foot length) within Keith Lake.
(c) Within Sabine Lake.

Keith Lake Cut and Keith Lake. Sempra proposes to construct the crossing of Keith Lake Cut using the HDD construction technique. We do not have any additional information regarding this crossing, including site-specific plans or proposed extra work spaces. We acknowledge that a HDD crossing of Keith Lake Cut would be environmentally preferable to an open cut crossing; however, we are unable to fully evaluate the impacts of the proposed construction methods for Keith Lake Cut without a site-specific construction plan. Therefore, **we recommend that:**

- **Sempra file with the Secretary detailed construction plans for the crossing of Keith Lake Cut. This should be a site-specific plan that includes scaled drawings identifying all areas that would be disturbed by construction. The Director of OEP must review and approve this plan in writing before construction of the 3-Mile-Long Pipeline.**

Sempra has proposed to use the open cut construction technique in Keith Lake rather than the HDD construction technique in response to technical limitations imposed by the route location and tie-in point with the existing natural gas pipelines. A HDD crossing of Keith Lake would be approximately 3,800 feet, which would require an area approximately 50 feet wide by 4,000 feet long for stringing and welding the pull section of the pipeline.

The termination or tie-in point of the pipeline across Keith Lake, following the route recommended by the FWS and NOAA Fisheries, would be constrained by several pipelines and SH 87, which Sempra states would preclude the location of an area for the pull section of the pipeline if a HDD were conducted from the north to the south. In order to avoid SH 87 for the pull section area, wetland disturbance would be required. Sempra states that the limited area available at the tie-in point also would preclude setting up a HDD site and drilling from the south to the north across Keith Lake. The existing pipelines likely would not allow Sempra to place a HDD site over their pipelines. Sempra states that, if it were possible to work around these limitations, additional wetlands would be disturbed by the area required for welding the pull section of pipe. Consequently, Sempra concluded that the push method was technically more feasible and likely less environmentally damaging than the HDD construction method. We concur with this assessment. However, we are unable to fully evaluate the impacts of the proposed construction methods for Keith Lake without site-specific construction plans. Therefore, **we recommend that:**

- **Sempra file with the Secretary detailed construction plans for the crossing of Keith Lake. This should be a site-specific plan that includes scaled drawings identifying all areas that would be disturbed by construction. The Director of OEP must review and approve this plan in writing before construction of the 3-Mile-Long Pipeline.**

HDDs. Sempra also has proposed to use the HDD technique to avoid environmentally sensitive areas along the proposed 70-Mile-Long Pipeline route, to the extent practical, and given the current limitations of the technology. The HDD construction technique involves drilling a pilot hole underneath the waterbody and banks, and then enlarging that hole through successive reamings until it is large enough to accommodate the pipe. Pipe sections long enough to span the entire crossing would be staged, welded, and hydrostatically tested along the construction work area and then pulled through the drilled hole. Sempra anticipates that the duration of HDD activities for these crossings would be from 15 to 20 weeks.

Use of HDD would eliminate or significantly reduce the potential that pipeline construction would affect these waterbodies (see **table 4.3.3-1**). Sempra has indicated that all but one of the HDD pipeline installation locations selected are adjacent to existing pipelines that were installed with the HDD technique and, as a result, a high rate of success is expected. In the event that an initial HDD attempt fails, the drill site would be moved (with the appropriate approvals) and the HDD attempted again. If a crossing could not be installed using the HDD technique, other construction techniques, such as open cutting, would be evaluated and, if determined to be the only remaining feasible option, Sempra would request the applicable variances, permits and approvals. Therefore, to further analyze potential impacts associated with these crossings, **we recommend that:**

- **Sempra file with the Secretary a plan for the crossing of each waterbody proposed as a HDD crossing in the event that the HDD is unsuccessful. These should be site-specific plans that include scaled drawings identifying all areas that would be disturbed by construction. Sempra should file these plans prior to construction along with the COE permit when it is obtained. The Director of OEP must review and approve these plans in writing before construction of the crossings.**

The final location of the mud pits and pipe assembly areas within the temporary workspaces would be determined by Sempra's HDD contractor. With the exception of the HDDs at Keith Lake Cut, the Little River at MP 59.2, Beckwith Creek at MP 62.6, a tributary to the Calcasieu River at MP 63.7, and the Hickory Branch of the Calcasieu River at MP 63.8, Sempra's site-specific HDD plans were developed by contractors who have previously successfully crossed the waterbodies using the HDD technique.

Sempra's proposed HDD crossing of the Port Arthur Ship Canal would exit in Sabine Lake at approximate MP 2.0. The crossing would be drilled from the west side to the east with the pipeline being pulled from the east to the west. Once the initial drill is completed, the hole would be enlarged with successive reamings prior to pulling the pipeline back under the Port Arthur Ship Canal to the drill site. The pipeline to be pulled would be floated or set on shallow draft barges in Sabine Lake. Once the pipeline had been pulled through the HDD crossing, the pipeline section would be allowed to rest on the bottom of the lake until the pipeline construction in Sabine Lake met up with the end of the pull section. At this point, two barges, each equipped with yokes, would raise the pull section of the pipeline out of the water to be welded with the pipeline being installed by open cut in Sabine Lake. After the two pipeline sections were welded, tested, and coated, they would be lowered back into the pipeline trench and backfilled.

Sempra's proposed HDD crossing of the West Pass of the Sabine River at MP 18.0, which would occur entirely within Sabine Lake, would require both HDD entry (MP 18.0) and exit (MP 18.6) points in the lake. Barges would be used for both the entry and exit points. The crossing would be drilled from the west side to the east, with the pipeline being pulled back from the east to the west. The pipeline to be pulled would be floated or set on shallow draft barges. The same technique for connecting the sections of the pipeline installed by HDD to the sections installed by open cut would be used as described in the previous paragraph.

Temporary siltation and sedimentation would occur at the HDD entry and exit points in Sabine Lake, primarily from the drilling mud associated with the initial drilling of the hole, the subsequent reaming of the hole, and the pulling of the pipeline through the hole. Based on estimates provided by Sempra's proposed HDD contractor, approximately 10 percent of the drilling mud used to drill the pilot hole and complete the subsequent reaming would exit the hole. However, because the exit point would be under water, the percentage could be reduced somewhat by the hydraulic head. HDD drilling is predicted to release approximately 4,540 pounds of bentonite under a worst-case scenario of 10 percent drilling mud loss. This would represent deposition over an estimated area of approximately 1,969 feet by 492 feet with an average thickness of 0.0004 inch. Based on modeling of the HDD plume, the affected radial area would be 1,640 feet or less. Modeling also predicted that drilling mud from the HDD operations would increase total suspended solids (TSS) by approximately 1 mg/L or less (or 3 nephelometric turbidity units [NTU]). In comparison to typical background turbidity levels of 40 NTU or higher in Sabine Lake; this represents a 2.5 percent increase in turbidity. This slight increase is lower than the discharge restriction of 10 percent turbidity change over background levels that was identified by the EPA for English Bay in the Calcasieu River Basin (EPA 2002). Under typical conditions it would take approximately 24 hours to drill the pilot hole in each of these drills and an additional 36 hours to complete the reamings for a 36-inch-diameter pipeline.

Sempra expects that most of the drilling mud that is left outside the hole would remain in or be placed in the trench adjacent to the exit hole location, then covered or backfilled with the stockpiled material removed during the trenching activity. Drilling mud is typically non-toxic, primarily naturally occurring bentonite, and would not be expected to chemically affect organisms in the lake; however, sessile organisms in the vicinity of the release would be smothered and killed. Sempra states that any of the drilling mud particles released into the lake would not result in a long term increase in the naturally occurring turbidity in the lake as the particles are of a grain size and composition generally similar to those materials that presently occur in the lake. Sempra has indicated that it would minimize the release of drilling fluid at the HDD exit holes in the lakes using best management practices, such as drawing back as much of the drilling mud as possible and altering the composition weight of the drilling mud. Sempra's turbidity plume modeling indicates the likely duration of the plumes would be approximately 60 hours.

Sempra has provided a general inadvertent return and containment plan in its application and comments on the draft EIS, indicating its intent to use best management practices, such as drawing back as much drilling mud as possible and altering the drilling mud composition weight. However, since site-specific plans for all of the HDD crossings have not yet been developed, **we recommend that:**

- **Sempra submit a Directional Drill Contingency Plan for each waterbody crossed by directional drilling. Each Directional Drill Contingency Plan should address how Sempra:**

  a. would handle any inadvertent release of drilling mud into the waterbody or areas adjacent to the waterbody, including specific procedures to contain inadvertent releases;
  b. would seal the abandoned drill hole; and
  c. would clean up any inadvertent releases.

  Sempra should file each plan with the Secretary for review and written approval by the Director of OEP <u>before construction</u> of each HDD.

Sempra has not developed site-specific plans for the crossing of the waterbodies at MPs 23.7, 23.8, and 24.3 (the Burton Shell Slip) because survey permission has not been granted by the respective landowners. The landowner of the unnamed pond at MP 48.1 has indicated that Sempra could drain the

pond to facilitate construction. However, Sempra's current plan is to use the push construction technique to cross this waterbody.

With the exception of the Houston River, the unnamed pond, Little River, Beckwith Creek, and the Calcasieu River, which are less than 100 feet wide, all of the other waterbodies crossed by HDD would be equal to or greater than 100 feet wide. Other waterbodies greater than 100 feet wide that would be open cut rather than crossed by HDD include Sabine Lake at MP 2.0, the unnamed waterbody at MP 20.5, Shell Canal at MP 21.1, unnamed waterbodies at MPs 23.7 and 23.8, the Burton Shell Slip at MP 24.3, and the unnamed pond at MP 48.1.

Sabine Lake. As noted above, Sempra plans to use open cut excavation techniques to install the pipeline across Sabine Lake from the HDD exit point at approximately MP 2.0 to the point that the pipeline would exit the lake (approximate MP 19.2). Sempra proposes to use a 150-foot-wide temporary construction right-of-way. As noted in **table 4.3.3.1-2**, Sempra has requested, and we have approved, a variance from our Procedures to allow both the wider right-of-way corridor and to allow for use of extra work spaces needed within the lake (wetland) area to support the construction of this portion of the pipeline route.

The construction sequence within the lake would be from north to south, from approximate MP 19.2 to MP 2.0, excluding the portion of the pipeline installed under the West Pass of the Sabine River by HDD between MPs 18.0 and 18.6. Shallow draft barges, which draw 4 feet of water or less, would be used. Each barge would be moved by a tug that draws 4 to 6 feet of water. Based on a preliminary bathymetric survey conducted over the proposed centerline of the pipeline in Sabine Lake, typical water depths (excluding the maintained channels and near-shore areas in the lake) vary from 5 feet at the north end to 7.2 feet in the south end, with depths on the order of 7.5 feet toward the northern part of the lake. However, Sempra has indicated that some dredging would be required to increase the depth where the existing water depth is less than 5 feet, including the areas between MPs 2.02 and 2.53 (average depth 3.85 feet), MPs 18.01 and 18.13 (average depth 2.77 feet), and MPs 18.62 and 19.22 (average depth 2.72). Sempra proposes to place the dredged material in a 40-foot-wide area along the side of the proposed 150-foot-wide construction right-of-way, to provide a 110-foot-wide, 5-foot-deep work area. The dredging would occur prior to the excavation of the trench, which would allow placing the trenched material on top of the dredged material. A barge mounted backhoe would be used to temporarily move a sufficient amount of material from the 150-foot-wide construction right-of-way to prevent the grounding of the barge.

One barge, approximately 50 feet wide by 160 feet long, equipped with a backhoe, would be used to excavate the pipeline trench. Material removed from the pipeline trench would be placed along the western side of the pipeline trench (on top of the dredged material in those areas that require dredging). Sempra anticipates that the equipment barges would provide an effective wind break to block the wind generated waves from affecting the stockpiled material. The material would be placed in piles approximately 12 to 14 feet in height. Caution lighting would be placed at maximum intervals of 500 feet, or closer together, as the amount of boat traffic in the area dictates. Openings to allow passage of small craft and recreational boating through the stockpiles would be left at intervals of 1,000 feet.

Following the first barge, approximately 2 days behind, a second barge, approximately 45 to 50 feet wide and 330 to 350 feet long, would be set up to string, weld, x-ray, coat, and lower the pipeline into the trench. Four welding stations would be set up on this barge. An x-ray station and a coating station would follow the welding stations. The barge used for pipe stringing, welding, coating, and lowering-in would be followed by a backfilling barge that would be approximately the same size as the first barge with the equipment used to dig the trench. This backfilling barge would be approximately 1 day behind the pipe laying barge. Sempra estimates that it would take approximately 8 months to cross Sabine Lake (from

initial dredging and trenching to final backfilling). Following construction, the new permanent right-of-way would be 50 feet wide, centered on the pipeline.

An existing pipeline would be crossed in Sabine Lake at MP 5.6. The crossing of this existing pipeline would be conducted by lowering the existing pipeline then laying the new pipeline over the existing pipeline. The existing pipeline would be lowered by excavating a trench adjacent to the line, with the actual length and depth of the trench determined by the tension of the existing pipeline. The proposed workspace of 150 feet wide by 2,000 feet long was selected by Sempra as the maximum area required for lowering the existing pipeline. Sempra would begin excavating a trench adjacent to, and deeper than, the existing pipeline, continuing as far eastward and westward as necessary for the existing pipeline to settle into the new trench, allowing the new pipeline to be installed.

At this time, Sempra has indicated that it is not aware of any existing pipelines in the marsh (MPs 19.2 to 35.4) that would be crossed by the proposed 70-Mile-Long Pipeline. However, portions of this route have not been surveyed due to lack of landowner survey permission. In the event that pre-construction surveys indicate the presence of existing pipelines in the marsh, Sempra proposes to use the same crossing technique described above for the pipeline crossing in Sabine Lake.

MLV at MP 19.2

Sempra proposes to install the MLV at the north end of Sabine Lake (MP 19.2) on a platform that would straddle the water and marsh border, such that the bank would not be disturbed from installation of the pipeline in a trench. Sempra has indicated that the average depth between MPs 18.62 and 19.2 is 2.72 feet, which would require that dredging be performed to enable access of the construction tugs and barges, as discussed above. Sempra would dredge enough material (approximately 29,632 cubic yards) to achieve a five foot water depth between these MPs. The dredged channel would be approximately 50 feet wide. Sempra proposes to temporarily place the dredged material to the side of the requested 150-foot-wide construction right-of-way, in a 40-foot-wide area designated for placement of the trench spoil (see **figure 2.2.2-1**, sheet 2 of 3). Construction equipment would work from a barge to excavate the pipeline trench, lay the pipe, and construct the MLV platform. The MLV platform would be constructed on 12-inch-square concrete piles, using approximately 6 to 8 piles. Piles would be driven from barge mounted equipment using a cap over the pile to minimize damage.

Temporary mats would be used to bridge the span from the barge to the temporary work space on shore. All equipment needed (yokes, barges, drag lines, and marsh hoes) to make the tie-in from the section of the pipeline in the marsh to the valve site would be offloaded from the barge and would work from mats in the marsh. Once the tie-in is complete, the equipment would be returned to the barge, the mats removed, and the bottom contours would be restored to current elevations. Sempra anticipates that almost all maintenance of this MLV site could be accomplished with shallow draft boats or air boats and that a permanently dredged channel would not be necessary to access it. In the event that major maintenance is required, necessitating dredging of a channel for access to the MLV site, Sempra would make application for the necessary permits at that time.

In order to connect the pipeline to the MLV at MP 19.2 as proposed, Sempra would have an aerial crossing of the shoreline and then open trench through the marsh. The FWS, TPWD and LDWF expressed concern that trenching through the undisturbed wetlands between MPs 19.2 and 19.9 could result in marsh loss and conversion to open water. The pipeline in this area would be within undisturbed estuarine intertidal emergent wetlands with highly organic marsh soils. These soils have the potential for conversion to open water, similar to the marsh area between MPs 23.2 and 25.8. The agencies recommended using an HDD from Sabine Lake to the leveed marsh/disposal area to the northeast of this marsh near MP 19.9 to avoid disturbing these wetlands. Sempra indicated that moving the valve any

further north than MP 19.2 would not meet the DOT requirements at 49 CFR Part 192.179 – Transmission line valves, section (a)(4) which states that each point on the pipeline in a Class 1 location must be within 10 miles (16 kilometers) of a valve. However, having a valve at MP 0.0 and one near MP 20.0 would allow any point on this portion of the pipeline to be no more than 10 miles away from a valve.

We believe that an HDD from Sabine Lake to a MLV located at the leveed area near MP 19.9 could potentially minimize the direct disruption to the sensitive wetland area near the banks while still meeting the DOT requirements. Sempra, however, indicated that moving the MLV any farther north would cause an access problem and require large quantities of wetlands to be permanently disturbed by building and operating a new access road. Sempra also indicated that an access road may not be allowed by the landowners since the access road construction and operation would conflict with a landowner and TPWD plan for creating wildlife habitat in this area. With the nearest proposed access road around MP 21, the heavy equipment for an HDD would have to be hauled along the ROW from the access road back to a large extra work space near MP 20. The extra weight of the equipment and multiple transits of materials would necessitate additional matting along the ROW, which could increase marsh compaction and hinder restoration. However, the FWS indicated that the wetlands past the leveed area are impounded marshes and are less susceptible to permanent marsh loss and should recover within a short period of time. We also note that the directional drill of the shoreline would require additional dredging in Sabine Lake. A temporary false right-of-way would need to be dredged to make up the pipeline for the drill. This right-of-way would be parallel to the shoreline to avoid interference with the Intracoastal Waterway. Although this dredging would increase the turbidity in the lake, we believe that in the long term preservation of the coast marsh would offset the temporary turbidity in the lake.

Another option to minimize impacts to the sensitive wetlands would be for Sempra to request relief from the DOT regulations on MLV placement. Sempra may request a variance to extend the distance of the MLV by sending a letter to DOT explaining the environmental and safety benefits of moving the MLV past MP 20 to a secure on land site that can be fenced and placed in a less sensitive area.

In total, we have identified three options that could minimize impacts to the Sabine Lake banks and the sensitive marsh area between MP 19.2 and 19.9:

1. HDD the north bank of Sabine Lake and move the MLV on land to the leveed area near MP 19.9.

2. HDD the north bank of Sabine Lake and request relief from the DOT regulations to move the MLV on land somewhere between MPs 20 and 21.

3. Reroute the pipeline path to reach land at Shell Island as discussed in the Pearl Crossing Route Variation in section 3.5.3.6.

Of these three options, we are recommending the Pearl Crossing Route Variation, as discussed in section 3.5.3.6. This route would avoid the impacts to the wetlands along the proposed route and would avoid placing the MLV in Sabine Lake. However, on January 31, 2006, Kinder Morgan asked the Commission to initiate the pre-filing process for a pipeline which would use the Pearl Crossing route to transport gas from the Sabine Pass LNG terminal. Since there is only room from one pipeline to use the Pearl Crossing route and the potential exists that the Kinder Morgan pipeline, if approved, may be constructed first **we recommend that**:

- **If Sempra is unable to construct the pipeline between MPs 18 and 28.1 using the Pearl Crossing Route Variation because another pipeline has been authorized in that location, Sempra should use its proposed route with the following modification. Sempra should cross the north bank of**

Sabine Lake using a horizontal directional drill. In addition Sempra should relocate the mainline valve proposed for MP 19.2 to a location onshore north of the levee, near MP 19.9.

General Construction. The amount of equipment used at one time at each waterbody crossing location, as well as the time period needed to perform the required work, would be kept to a minimum to minimize potential effects, as required by the Procedures. During pipeline construction activities at water crossings, disruption to flow would be limited and care taken to limit the increase in the suspended sediment concentrations of the watercourse. More particularly, adequate flow rates would be maintained in watercourses to limit the potential effects to aquatic life. In addition, banks that have been cut would be stabilized as soon as possible after construction activities have been completed. All watercourse trench backfilling and bank reclamation would be performed in accordance with engineering drawings, erosion and sedimentation control requirements, and permit requirements.

The trenching activity across Sabine and Keith Lakes would result in temporary siltation and sedimentation impacts similar to those that currently occur during maintenance dredging activities in the Port Arthur Ship Canal. These activities would temporarily stir up sediment and potentially degrade the water quality of Keith Lake and Sabine Lake. The suspended solids and turbidity levels would decline to ambient levels following completion of construction.

Turbidity resulting from trenching could reduce light penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton. Additionally, the resuspension of organic materials and sediments could cause an increase in biological and chemical oxygen demand along the construction right-of-way. Lower dissolved oxygen concentrations could cause a temporary displacement of motile organisms and may stress or kill sessile benthic organisms within the construction right-of-way.

According to Sempra's turbidity analysis (see **appendix F**), the proposed dredging activities in all but the lowest reaches of Sabine Lake would have the potential to generate turbidity levels above background concentrations. However, the ambient turbidity levels in the water (as generated by flows, waves, and ship traffic in the Intracoastal Waterway) create a high background level of turbidity, thereby reducing the potential relative impact of dredging-related turbidity. Correspondence from the TPWD suggests that Sabine Lake is chronically turbid and marine species mortality due to excess turbidity has not been documented.

Surface runoff and erosion from pipeline rights-of-way and construction areas would be minimized in accordance with our Plan. Potential increases in sediment from construction would be related to short-term suspended sediment concentrations in the water downstream from the construction activities. With adherence to our Plan, the effects from these are expected to be minimal. Construction of the proposed pipelines is not expected to result in storm water unsuitable for discharge to nearby waterbodies, since construction activities would be managed under an approved construction SWPPP. In the event of a release of petroleum products, chemicals or hydrocarbons from refueling of construction equipment, fuel storage, or equipment failure, Sempra would minimize the potential effects by immediately implementing measures in the appropriate construction or operation SPCC Plan.

As discussed above, sediment quality in the waterbodies crossed by the pipelines is not known to exceed sediment criteria standards. It is expected that construction activities in the vicinity of waterbodies would not detrimentally affect water quality or cause contaminant limits to be exceeded, except for localized and short-term increased turbidity events during construction.

4.3.3.2 Hydrostatic Testing

Prior to being placed into service, the LNG storage tanks and pipelines would be hydrostatically tested to ensure structural integrity.

LNG Terminal

Sempra proposes to use non-saline river water purchased from the Lower Neches River Authority to hydrostatically test the LNG storage tanks. The test water would be transported to the terminal in barges. This surface water use would require a Temporary Water Use Permit from the TCEQ, which, according to Sempra, would be obtained by the Lower Neches River Authority.

In advance of filling the tanks, Sempra would test the water source to ensure that the water met all applicable code requirements. To minimize water usage, the three tanks would undergo hydrostatic testing using the same water by transferring the water at the conclusion of the test of one tank to the next tank to be tested. Water would be introduced into the inner tank container through a manhole in the outer container concrete roof at a rate that would not exceed the limitations specified in applicable standards (API 620). The duration that the water remains in the tanks would be strictly controlled; therefore, Sempra does not expect that contamination or discoloration would be present in the discharge, and does not expect to have to chemically treat (e.g., addition of corrosion inhibitors, biocides, etc.) the hydrostatic test water. The water would be tested to confirm composition prior to transfer between tanks and before final discharge.

The quantity of water required for the hydrostatic testing of one tank is estimated to be approximately 29 million gallons. The three tanks installed during each of the two phases of construction would be tested in succession. The water would be transferred to the next tank once the testing of the previous tank is completed. Due to the inability to transfer the residual heel in each tank at the conclusion of the hydrostatic test, it is estimated that approximately 0.25 million gallons of additional water would be required for testing the second and third tanks in each of the three tank systems. Therefore, the total required volume of hydrostatic test water is estimated to be 29.5 million gallons for Phase I and an additional 29.5 million gallons for Phase II. The total duration of each hydrostatic test from start of filling to emptying is expected to be approximately 3 weeks.

Sempra plans to discharge the hydrostatic test water to the Port Arthur Ship Canal or, if requested by TPWD, to the J. D. Murphree WMA. TPWD has indicated that it would be receptive to a quantity of fresh water to help reduce the amount of salt water that is presently resulting in the degradation of the marsh in the WMA. Sempra is having on-going discussions related to TPWD's need for this water and the recommended discharge location. Water would be sampled and tested for suitability prior to discharge. If treatment is found to be required, treatment procedures would be developed prior to discharge, in accordance with permit conditions.

Discharge of hydrostatic test water to the Port Arthur Ship Canal would require a permit from TCEQ under the Texas Pollution Discharge Elimination System (TPDES) and would be performed in compliance with the requirements of such a permit. All hydrostatic test water discharges would be in accordance with our Procedures, which require that the discharge rate be regulated, and that appropriate energy dissipation device(s) and sediment barriers be used, as necessary, to prevent erosion, scour, suspension of sediments, or excessive streamflow. Hydrostatic test water withdrawal and discharge would be conducted in accordance with all federal and state rules, regulations, and permits.

Pipelines

Prior to being placed in service, the pipelines must be hydrostatically tested to DOT standards, as listed in 49 CFR Part 192. Sempra proposes to use non-saline water, withdrawn from either the Houston River Canal or the Sabine River, for hydrostatically testing the pipelines. The intake and discharge locations would be at the point where the pipeline route crosses each waterbody, specifically at MP 23.0 on the Sabine River and MP 52.9 on the Houston River Canal. In accordance with the Procedures, Sempra would screen intake hoses to prevent entrainment of fish.

Sempra currently plans to test the 70-Mile-Long Pipeline in four sections (MPs 0.0 to 23.0, MPs 23.0 to 37.2, MPs 37.2 to 53.0, and MPs 53.0 to 70.0). Approximately 4 million gallons of water from the Sabine River would be used to test the section between MPs 23.0 and 37.2. An additional 2.4 million gallons would be pumped from the Sabine River and, combined with the water used to test the section between MPs 23.0 and 37.2, would be used to test the section between MPs 0.0 and 23.0. Approximately 725,000 gallons of the 6.4 million gallons used to test that section would be used to test the 3-Mile-Long Pipeline. All of this hydrostatic test water would be discharged to the Port Arthur Ship Canal or, if requested by TPWD, to the J. D. Murphree WMA, as discussed above.

Approximately 4.4 million gallons of water from the Houston River Canal would be used to test the section between MPs 37.2 and 53.0. These 4.4 million gallons of water and an additional 335,000 gallons from the Houston River Canal would be used to test the section between MPs 53 and 70. All 4.7 million gallons would be returned to the Houston River Canal. In total, 6.4 million gallons would be withdrawn from the Sabine River and 4.7 million gallons would be withdrawn from the Houston River Canal.

After successfully testing each section, the pipeline would be dewatered and dried by pushing the test water with a foam pig using compressed air. Sempra does not propose to add chemicals (e.g., corrosion inhibitors, biocides, etc.) to the hydrostatic test water. The hydrostatic test water would be discharged after analytical testing results demonstrate that the hydrostatic test water meets discharge requirements. The discharge rate of the hydrostatic test water would be controlled by the speed of the pig to minimize scouring or erosion at the discharge point. In addition, energy dissipaters and sedimentation control devices would be used to minimize scouring and turbidity effects on the receiving waterbody, in accordance with the Procedures.

Water withdrawals from the Sabine River would be performed in compliance with the requirements of a Temporary Water Use Permit as issued by TCEQ. Water use permits are not required for surface water withdrawals in Louisiana. In accordance with the Procedures, the Project would maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

Discharge of hydrostatic test water to the Port Arthur Ship Canal would require a permit from TCEQ under the TPDES and would be performed in compliance with the requirements of the permit. Discharge of hydrostatic test water to the Houston River Canal would require a permit from LDEQ under the Louisiana Pollution Discharge Elimination System (LPDES) and would be performed in compliance with the requirements of the permit.

All hydrostatic test water discharges would be in accordance with the Procedures, which require that the discharge rate be regulated, and that appropriate energy dissipation device(s) and sediment barriers be used, as necessary, to prevent erosion, scour, suspension of sediments, or excessive streamflow. Hydrostatic test water withdrawal and discharge would be conducted in accordance with all federal and state rules, regulations, and permits.

4.3.3.3 Operational Impacts

LNG Terminal

Operational impacts associated with the LNG terminal would include resuspension of bottom sediments from periodic maintenance dredging and incidental propeller wash from LNG ships, and creation of additional impervious surfaces at the facility. Dredging and incidental propeller wash would result in temporary increases in turbidity in localized areas. Turbidity from propeller wash would be minor and short-term and would decrease as the berthings of LNG ships at the facility become routine. Turbidity caused by maintenance dredging would be short-term and localized.

LNG ship activity at the unloading facilities may result in minor resuspension of bottom sediments into the water column resulting in a temporary increase in turbidity within the slip. Resuspension of bottom sediments and resulting increases in turbidity are considered temporary short-term impacts. Use of shallow draft tugs to assist LNG ships throughout the mooring and departure operations may result in some resuspension of bottom sediments and increase turbidity over the short-term until they become stabilized.

Spills, leaks, or other releases of hazardous materials during operation of the LNG terminal facilities could adversely impact water quality. Hazardous materials entering nearby waterbodies as a result of spilled materials being flushed into waterbodies with storm water runoff or entering the Port Arthur Ship Canal directly from leaks or spills along the LNG unloading facility could have an adverse impact on water quality and aquatic organisms. To minimize the potential for accidental releases of hazardous materials and to establish proper protocol concerning minimization, containment, remediation, and reporting of any releases that occur, Sempra would finalize a site-specific SPCC Plan for both the construction and operational phases of the Project. Sempra's draft SPCC Plan is provided in **appendix D**.

Following construction of the terminal facilities, the amount of impervious surface area at the site would be increased, which would result in an increased volume of storm water runoff. A storm water management system would be designed and constructed to accommodate this increase in runoff volume, and a Storm Water Management Plan would be prepared to comply with TCEQ and EPA requirements. During normal operation of the LNG terminal, surface water discharges would be limited to storm water runoff. These discharges would be directed to NPDES-permitted discharge points.

Ballast Water

As with other large cargo ships, LNG carriers would take on some ballast water to maintain stability and trim as they off-load their cargo, but they would not be fully loaded when departing the Port Arthur Terminal. The amount of ballast water required by each LNG carrier would vary according to its size and the weather conditions. A typical 145,000 m^3 LNG carrier would require approximately 13.2 millions gallons of water, which would be obtained in Sabine/Neches Waterway and transported out of the waterway. The larger 200,000 m^3 ships would withdraw about 19.8 million gallons of water. This would constitute a minor but long-term impact to water resources of the Sabine/Neches Waterway.

Although ballast water intake by the LNG carrier would occur during off-loading of the LNG, it is unlikely that any ballast water would be discharged into the Sabine/Neches Waterway. Any limited discharge of ballast water that should occur would be conducted in accordance with the Coast Guard's mandatory ballast water management program (33 CFR 151).

Cooling Water Intake

In addition to ballast water, LNG carriers (as with other large ships) would intake and discharge some water during operations in the Sabine/Neches Waterway. The LNG carriers off-loading at the proposed terminal would be either steam- or diesel-powered vessels. Steam-powered vessels require more cooling water than comparably sized diesel-powered vessels. It is estimated that a steam-powered LNG carrier moored at the proposed terminal would intake and discharge approximately 2.6 million gallons per hour, or a total of 57 million gallons, to completely off-load (approximately 22 hours).

Pipelines

Operation of aboveground facilities associated with the proposed pipelines, such as MLVs and pig launchers and receivers, are not expected to affect water resources. Impacts to surface waters are not expected during operation of the proposed pipelines because no further in-stream activities would be expected. Since the pipelines would be installed at a sufficient depth below the beds of waterbodies, exposure of the pipe is not expected. In the event that a pipeline anomaly (i.e., corrosion, dent, rupture) is detected during routine inspections that could require pipeline excavation or replacement within a waterbody, impacts would be expected to be similar to those described for construction.

4.4 WETLANDS

The proposed Port Arthur LNG Project would be constructed in areas that support numerous and extensive wetlands. Wetlands are defined by the COE and the EPA as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support a prevalence of wetland vegetation typically adapted for life in saturated soil. Sempra delineated wetlands within the Project area in accordance with the 1987 COE Wetland Delineation Manual (COE 1987). The Cowardin system of wetland classification (Cowardin et al. 1979) was used to classify the wetlands into five primary wetland types - coastal emergent, submerged aquatic vegetation, palustrine emergent, palustrine scrub-shrub, and palustrine forested. In general, the Cowardin classification system is based on the hydrology and dominant vegetation present in the wetland, and further classifies wetland types according to their flooding regime, which ranges from temporarily or irregularly flooded to seasonally flooded or permanently flooded. Field delineations, where access was allowed, were used to identify wetlands present on the LNG terminal site and crossed by the proposed pipelines. FWS National Wetland Inventory (NWI) maps were used to supplement field delineations where survey access permission was not granted by the landowner. **Table 4.4-1** lists dominant wetland plant species found in the LNG terminal area and **table 4.4-2** lists dominant wetland plant species found along the proposed pipeline routes.

4.4.1 Affected Wetlands

Table 4.4.1-1 provides information on specific wetlands that would be affected by Project construction and operation, including the wetland type and the anticipated impacts during construction and operation of the Project. Because landowner permission to survey has not been granted between approximate MPs 23 and 35 of the 70-Mile-Long Pipeline route, those wetland types and acreages are based on interpretation of NWI maps rather than field delineation. Neither the wetland delineations for the LNG terminal site nor the pipeline routes have been verified by the COE; therefore, the wetlands acreage impacted could change upon COE verification.

TABLE 4.4-1 Dominant Wetland Species in the LNG Terminal Area	
Common Name	**Scientific Name**
Tallow tree	*Triadica sebifera*
cattail	*Typha latifolia*
groundselbush	*Baccharis halimifolia*
sea oxeye	*Borrichia frutescens*
smartweed	*Polygonum hydropiperoides*
black willow	*Salix nigra*
saltgrass	*Distichlis spicata*
marshhay cordgrass	*Spartina patens*
common reed	*Phragmites australis*
marsh elder	*Iva frutescens*
flatsedge	*Cyperus retrorsus*
saltmarsh bulrush	*Bulboshoenus robustus*
wax myrtle	*Morella cerifera*

TABLE 4.4-2 Dominant Wetland Species along the Pipeline Routes	
Common Name	**Scientific Name**
cattail	*Typha latifolia*
saltgrass	*Distichilis spicata*
common rush	*Juncus effuses*
common reed	*Phragmites australis*
retrorse flatsedge	*Cyperus retrorsus*
saline aster	*Symphyotrichum tenuifolium*
sea-ox-eye	*Borrichia frutescens*
bulrush	*Bulboshoenus* spp.
horned beakrush	*Rhynchospora corniculata*
sumpweed	*Iva annua*
soft-stem rush	*Juncus effusus*
cupgrass	*Eriochloa punctata*
goldenrod	*Solidago sempervirens*
jointed flatsedge	*Cyperus articulata*
seashore dropseed	*Sporobolus virginicus.*
dewberry	*Rubus trivialis*
smartweed	*Polygonum* spp.
spikerush	*Eleocharis cellulose*
maidencane	*Panicum hemitomon*
beakrush	*Rhynchospora comiculata*
needlegrass	*Juncus roemerianus*
saltmeadow cordgrass	*Spartina patens*
groundselbush	*Baccharis halimifolia*
marsh elder	*Iva frutescens*
black willow	*Salix nigra*
tallow tree	*Triadica sebifera*
wax myrtle	*Morella cerifera*
yaupon	*Ilex vomitoria*
loblolly pine	*Pinus taeda*
water oak	*Quercus nigra*
red maple	*Acer rubrum*
sweetgum	*Liquidambar styraciflua*
sedges	*Carex* spp.

The development of the Port Arthur LNG Project would affect about 90.0 acres of forested wetlands and 300.8 acres of estuarine, palustrine emergent, and palustrine scrub-shrub wetlands for a total of about 390.8 acres. Operational wetland impacts would include the permanent loss of 82.5 acres of wetlands for operation of the LNG facility. Operational wetland impacts along the pipeline rights-of-way include the

permanent loss of 0.04 acre of wetlands at MLV sites (MPs 19.2 and 29.9) and the permanent conversion of 13.1 acres of forested wetlands to emergent wetlands for a total of 13.1 acres of permanent impacts. Approximately 2.4 acres and 10.7 acres of forested wetlands would be permanently converted from forested to emergent wetlands along the 3-Mile-Long Pipeline and the 70-Mile-Long Pipeline, respectively. Approximately 0.04 acre of wetlands would be permanently replaced by the MLVs at MPs 19.2 and 29.9. Thus, a total of approximately 95.6 acres of wetlands would be permanently affected during operation of the proposed Project. All other areas would be restored to existing wetland types following construction.

LNG Terminal

Development of the LNG terminal facilities would require disturbance of approximately 263.2 acres of land during construction; about 198.2 acres of which would be permanently affected during operation. Approximately 82.5 acres of wetland habitats would be permanently filled by development of the terminal facilities (see **table 4.4.1-1**). Sempra would be required to mitigate for the loss of the 82.5 acres of wetlands, as determined by the COE in the issuance of a Section 404 permit.

To the extent practicable, Sempra would minimize impacts to the remaining wetlands on the LNG terminal site property by implementing the measures in our Procedures. Operation and maintenance of the LNG terminal facilities is not expected to further impact additional wetlands.

EFH wetlands are defined as those coastal marshes that are tidally influenced areas (or are associated with waterbodies with tidal influence). There are no EFH wetlands associated with the LNG terminal site property. EFH is discussed in greater detail in section 4.6.

Dredged Material Placement Areas (DMPAs)

Sempra proposes to use the approximately 600-acre, Sempra-owned tract of land immediately north of the proposed LNG terminal site for their DMPA (DMPA 1-2) (see section 3.4, **figure 3.4-1**). Approximately 583 acres of the tract comprise emergent wetlands classified as Palustrine, Emergent, Persistent, artificial, diked, spoil (PEM1Khs), which have become established in the area, which has been previously used as a DMPA. Although up to 583 acres of wetlands would be disturbed by use of this area as a DMPA, Sempra proposes to restore these wetlands in place, in kind. There are no EFH wetlands associated with the proposed DMPA.

TABLE 4.4.1-1

Wetlands Affected by Construction and Operation of the Port Arthur LNG Project

			Area Affected (acres)			
			Construction			
Milepost	Wetland Type[a]	Length Crossed (feet)	Forested	Non-forested	Operation[b]	Notes
LNG Terminal						
0.0	E2EM	N/A	0.0	25.0	25.0	
0.0	PFO/PFO	N/A	50.1	0.0	50.1	
0.0	PFO/PFO/PSS	N/A	7.4	0.0	7.4	
	Subtotal[e]		**57.5**	**25.0**	**82.5**	
3-Mile-Long Pipeline[c]						
0.0	PFO	1,300	3.7	0.0	1.5[g]	
0.2	PEM	2,825	0.0	8.2	0.0	
0.8	PSS	543	0.0	1.4	0.0	
0.9	PSS	90	0.0	0.04	0.0	
0.9	PSS	500	0.0	1.7	0.0	
1.0	PFO	599	3.6	0.0	0.7[g]	
1.1	PFO	283	0.5	0.0	0.2[g]	

TABLE 4.4.1-1

Wetlands Affected by Construction and Operation of the Port Arthur LNG Project

Milepost	Wetland Type[a]	Length Crossed (feet)	Area Affected (acres) Construction Forested	Construction Non-forested	Operation[b]	Notes
1.2	PEM	778	0.0	2.1	0.0	
1.4	PEM	397	0.0	1.0	0.0	
1.4	PSS	273	0.0	0.5	0.0	
1.5	E2EM	190	0.0	0.8	0.0	[f]
1.5	OW	290	0.0	1.0[e]	0.0	Keith Lake Cut[f]
1.6	E2EM	1,366	0.0	4.5	0.0	[f]
1.9	E2EM	123	0.0	0.12	0.0	[f]
1.9	E2EM	290	0.0	0.6	0.0	[f]
1.9	OW	3,460	0.0	11.9[e]	0.0	Keith Lake[f]
	Subtotal[e]	**13,307**	**7.8**	**20.9[e]**	**2.4** [g]	
70-Mile-Long Pipeline[c,d]						
1.0	PEM	701	0.0	2.79	0.0	
2.0	OW	93,880	0.0	224[e]	0.0	Sabine Lake[f]
18.8	E2EM	37	0.0	0.64	0.0	[f]
19.2	E2EM	3,354	0.0	11.67	0.02[g]	[f] MLV
19.8	E2EM	633	0.0	2.02	0.0	
19.9	E2EM	2,838	0.0	8.83	0.0	[f]
20.5	OW	352	0.0	0.5[e]	0.0	[f]
20.6	E2EM	103	0.0	0.3	0.0	
20.6	OW	90	0.0	0.1[e]	0.0	[f]
20.6	E2EM	2,925	0.0	7.92	0.0	[f]
21.1	OW	544	0.0	0.4[e]	0.0	[f]
21.15	E2EM	2,910	0.0	8.69	0.0	[f]
21.2	OW	154	0.0	0.06[e]	0.0	[f]
21.8	PSS	143	0.0	0.17	0.0	
21.9	E2EM	3,435	0.0	9.3	0.0	[f]
21.9	PSS	632	0.0	0.7	0.0	
22.6	E2EM	191	0.0	0.3	0.0	[f]
22.6	PSS	909	0.0	4.06	0.0	
22.7	E2EM	871	0.0	3.54	0.0	[f]
23.3	E2EM	488	0.0	0.72	0.0	
23.4	E2EM	2,021	0.0	5.6	0.0	[f]
23.7	E1UB	106	0.0	0.07[e]	0.0	[f]
23.9	E2EM	688	0.0	5.39	0.0	[f]
24.0	E1UB	387	0.0	0.1[e]	0.0	[f]
24.1	E1UB	358	0.0	0.4[e]	0.0	[f]
24.3	E1UB	98	0.0	0.1[e]	0.0	[f]
24.3	E2EM	3,680	0.0	10.98	0.0	[f]
25.0	E1UB	570	0.0	0.7[e]	0.0	[f]
25.1	E2EM	188	0.0	0.09	0.0	[f]
25.1	E2EM	8,782	0.0	42.4	0.0	[f]
25.9	E1UB	602	0.0	1.5[e]	0.0	[f]
25.9	E1UB	1,210	0.0	4.5[e]	0.0	[f]
26.9	PFO	1,156	2.0	0.0	1.0[g]	
27.1	PFO	236	0.31	0.0	0.1[g]	
27.2	PFO	1,507	3.96	0.0	1.6[g]	
27.8	PSS	4,429	0.0	15.62	0.0	
28.6	E1UB	87	0.0	0.1[e]	0.0	[f]
28.8	E1UB	57	0.0	0.1[e]	0.0	[f]
28.8	E2EM	780	0.0	2.65	0.0	[f]
28.8	E2EM	338	0.0	1.35	0.0	[f]
28.9	E1UB	623	0.0	1.0[e]	0.0	[f]
29.0	E2EM	2,703	0.0	7.03	0.0	[f]
29.2	E1UB	119	0.0	0.1[e]	0.0	[f]
29.5	E2EM	3,467	0.0	10.13	0.0	[f]
29.8	PSS	37	0.0	0.01	0.0	
29.9	PSS	132	0.0	0.09	0.02[g]	MLV
30.1	E2EM	465	0.0	1.17	0.0	[f]
30.2	E2EM	2,287	0.0	11.6	0.0	[f]
30.7	E2EM	1,723	0.0	5.07	0.0	[f]
30.9	E2EM	473	0.0	1.3	0.0	

TABLE 4.4.1-1

Wetlands Affected by Construction and Operation of the Port Arthur LNG Project

Milepost	Wetland Type[a]	Length Crossed (feet)	Area Affected (acres) Construction Forested	Area Affected (acres) Construction Non-forested	Area Affected (acres) Operation[b]	Notes
31.1	PEM	4,116	0.0	11.33	0.0	
31.2	PFO	325	0.17	0.0	0.0	
31.8	E2EM	637	0.0	1.29	0.0	[f]
31.8	PEM	434	0.0	0.5	0.0	
31.8	PFO	187	0.1	0.0	0.0	
31.9	PEM	244	0.0	0.5	0.0	
31.9	PAB	111	0.0	0.2[e]	0.0	
32.0	PEM	957	0.0	2.7	0.0	
32.2	E2EM	1,675	0.0	4.76	0.0	[f]
32.4	PSS	3,432	0.0	9.58	0.0	
33.1	PFO	204	0.06	0.0	0.0	
33.1	PEM	497	0.0	0.7	0.0	
33.1	PEM	1,579	0.0	4.3	0.0	
33.4	PEM	1,218	0.0	3.3	0.0	
33.5	PEM	295	0.0	0.4	0.0	
33.6	PEM	673	0.0	2.1	0.0	
33.7	PEM	415	0.0	1.0	0.0	
33.8	PEM	713	0.0	1.5	0.0	
33.9	PEM	1,023	0.0	2.2	0.0	
34.0	PEM	131	0.0	0.04	0.0	
34.1	PEM	345	0.0	0.7	0.0	
34.2	PEM	1,822	0.0	5.1	0.0	
34.5	PEM	759	0.0	0.9	0.0	
34.5	PSS	270	0.0	0.4	0.0	
34.6	PEM	72	0.0	0.1	0.0	
34.6	PEM	82	0.0	0.1	0.0	
34.5	PEM	2,177	0.0	6.6	0.0	
35.1	PSS	1,783	0.0	3.7	0.0	
37.2	PEM	458	0.0	0.18	0.0	
37.2	PSS	463	0.0	0.18	0.0	
37.4	PEM	136	0.0	0.07	0.0	
37.4	PFO	137	0.2	0.0	0.1[g]	
37.5	PFO	16	0.02	0.0	0.01[g]	
37.5	PEM	69	0.0	0.08	0.0	
37.9	PEM	120	0.0	0.13	0.0	
37.9	PFO	90	0.04	0.0	0.01[g]	
38.5	PFO	268	0.61	0.0	0.3[g]	
38.5	PEM	180	0.0	0.15	0.0	
39.7	PEM	92	0.0	0.05	0.0	
40.1	PEM	257	0.0	0.39	0.0	
40.3	PEM	145	0.0	0.19	0.0	
44.9	PFO	414	0.81	0.0	0.43[g]	
44.9	PEM	417	0.0	0.3	0.0	
45.2	PFO	50	0.03	0.0	0.02[g]	
45.5	PSS	27	0.0	0.05	0.0	
45.9	PEM	200	0.0	0.34	0.0	
46.0	PFO	159	0.14	0.0	0.02[g]	
46.1	PFO	1,885	3.12	0.0	2.04[g]	
46.4	PFO	9	<0.01	0.0	0.0	
47.4	PFO	29	0.03	0.0	0.02[g]	
47.4	PFO	35	<0.01	0.0	0.0	
47.5	PFO	75	0.17	0.0	0.08[g]	
47.6	PEM	1132	0.0	2.03	0.0	
47.7	PEM	6	0.0	<0.01	0.0	
48.1	OW	173	0.0	0.14[e]	0.0	
49.2	PFO	1,446	2.84	0.0	1.65[g]	
49.2	PEM	1,460	0.0	1.11	0.0	
49.8	PEM	66	0.0	0.02	0.0	
49.8	PFO	29	<0.01	0.0	<0.01[g]	
53.1	PP	43	3.48	0.0	0.5[g]	
53.2	PFO	131	0.13	0.0	0.1[g]	

TABLE 4.4.1-1

Wetlands Affected by Construction and Operation of the Port Arthur LNG Project

Milepost	Wetland Type[a]	Length Crossed (feet)	Area Affected (acres) Construction Forested	Construction Non-forested	Operation[b]	Notes
53.2	PFO	22	<0.01	0.0	0.0	
53.2	PEM	121	0.0	0.07	0.0	
53.3	PEM	231	0.0	0.14	0.0	
53.3	PP	10	<0.01	0.0	0.0	
53.3	PP	166	0.16	0.0	0.13[g]	
53.4	PEM	145	0.0	0.29	0.0	
54.9	PEM	348	0.0	0.54	0.0	
55.2	PFO	364	1.16	0.0	0.32[g]	
57.1	PFO	95	0.12	0.0	0.05[g]	
58.5	PSS	155	0.0	0.39	0.0	
61.2	PFO	394	0.9	0.0	0.36[g]	
61.9	PEM	6	0.0	<0.01	0.0	
61.9	PEM	77	0.0	0.04	0.0	
61.9	PEM	1	0.0	<0.01	0.0	
62.2	PFO	1,807	2.26	0.0	1.13[g]	
63.6	PFO	133	0.2	0.0	0.0	
68.2	PFO	606	1.66	0.0	0.7[g]	
68.8	PEM	325	0.0	0.24	0.0	
68.8	PEM	12	0.0	<0.01	0.0	
69.2	PSS	360	0.0	0.73	0.0	
69.4	PSS	504	0.0	0.51	0.0	
69.5	PEM	408	0.0	0.72	0.0	
	Subtotal[e]	**197,182**	**24.7**	**254.9[e]**	**10.7[g]**	
	Total[e]	**210,489**	**90.0**	**300.8[e]**	**95.6**	

(a) Key:
PEM - Palustrine Emergent
PSS - Palustrine Scrub Shrub
PFO - Palustrine Forested
E1EM - Estuarine Subtidal Emergent
E2EM - Estuarine Intertidal Emergent
OW - Open Water
E1UB - Estuarine Subtidal Unconsolidated Bottom
PAB - Palustrine Aquatic Bed
PP - Pine Plantation

(b) Includes permanent loss of wetlands and/or permanent conversion of forested wetlands to herbaceous wetlands.

(c) Includes additional temporary workspace, in addition to the temporary construction right-of-way.

(d) Wetlands or OW areas that would not be affected due to the proposed use of HDD construction techniques are not included.

(e) Totals do not include open water type wetlands OW, E1UBL, or PAB4V.

(f) Essential Fish Habitat (EFH) vegetated wetlands (non-vegetated [open water] EFH is addressed in section 4.6).

(g) Includes conversion of forested wetlands to emergent wetlands and permanent loss of wetlands. The MLVs at MPs 19.2 and 29.9 would result in the permanent loss of 0.04 acre of wetlands; 13.1 acres would be converted from forested to emergent wetlands.

Pipelines

A total of approximately 39.9 miles of wetlands would be crossed by the two pipelines. Construction would affect an estimated total of approximately 236.1 acres of marsh (palustrine and estuarine); approximately 39.7 acres of scrub-shrub wetlands; and approximately 32.5 acres of forested wetlands. This is based on field delineations for the entire 3-Mile-Long Pipeline and about 58 miles of the 70-Mile-Long Pipeline route, and NWI mapping for the remaining 12 miles. These estimates may change following COE verification of wetland delineations.

Most of the wetland impacts resulting from construction and operation of the proposed pipelines would be temporary, as the marsh and emergent vegetation would recover over time. Pre- and post-construction measures (see section 4.4.3) would be implemented to ensure successful revegetation of these areas. However, operation of the pipelines would result in the conversion of 13.1 acres (2.4 acres along the 3-Mile-Long Pipeline and 10.7 acres along the 70-Mile-Long Pipeline) of forested wetland (dominated by Chinese tallow trees, an invasive species) to emergent wetland, and the permanent loss of 0.04 acre of estuarine intertidal emergent and palustrine scrub-shrub wetlands for the operation of MLVs at MP 19.2 and MP 29.9, respectively, along the 70-Mile-Long Pipeline. Although Sempra has submitted its Section 404 permit application to the COE, they have not yet received verification of their wetland determinations/delineations. Once the COE has reviewed the application and verified the wetland impacts, they would issue a jurisdictional determination for wetland impacts for the Project.

Additional Temporary Workspaces

Sempra has identified numerous locations where additional temporary workspaces would be located partially or completely within wetlands. Wetland impacts associated with these temporary workspaces are presented in **table 4.4.1-2.** The wetland impacts provided in **table 4.4.1-2** are included in **table 4.4.1-1**, and are not additional impacts.

Our Procedures do not allow extra work space in wetlands without written approval for a variance. Sempra's reasons for each requested extra work space in a wetland is presented in section 4.3, **table 4.3.3.1-2.** We have reviewed these requests and believe that, because of the extensive wetlands along the pipeline routes, there is no other reasonable or practical location for them except in the wetlands and that that these work spaces are necessary for the installation of the pipeline.

Sempra has made efforts to locate additional temporary workspaces, to the extent practical, to minimize wetland impacts. Along the 3-Mile-Long Pipeline route, of the total 6.3 acres of extra workspace requested for construction of the pipeline, about 3.5 acres would be within delineated wetland boundaries; approximately 1.8 acres of which would be within forested wetlands. Of the total 176 acres of extra workspace required for construction of the 70-Mile-Long Pipeline, about 80.1 acres would be within delineated wetland boundaries. Of these 80.1 acres, about 4.1 acres of this workspace would be located within forested wetlands. Although forested wetlands would take longer to revegetate, all 83.6 acres (5.9 acres, forested; 77.7 acres, non-forested) of temporary workspace located in wetlands along the pipeline routes would be allowed to return to pre-existing conditions following restoration.

Location of Aboveground Facilities in Wetlands

The MLVs at MPs 19.2 and 29.9 would be within estuarine intertidal emergent and palustrine scrub-shrub wetlands, respectively, and would permanently impact 0.04 acre of these wetlands. Our review of the sites indicates that minor realignment or configuration of these MLVs would not result in wetland avoidance. Further, the location of the MLVs along the pipeline is limited to certain areas due to DOT requirements, and permanent access to the MLVs is necessary for operation and maintenance purposes. As proposed, Sempra indicated that locating the MLV at MP 19.2 would eliminate the need to construct a new access road across the marsh, avoiding creation of a new permanent access road and potentially greater wetland impacts. Access to the MLV at MP 19.2 could be achieved by boat. However, as discussed in section 3.5.3.6, we are recommending that the MLV be relocated as discussed in the Pearl Crossing Route Variation in order to minimize impacts on the north bank of Sabine Lake and the surrounding undisturbed wetlands.

TABLE 4.4.1-2

Additional Temporary Workspace Located in Wetlands

Facility	Wetland Type	Forested Wetland (acres)	Non-Forested Wetland (acres)
Workspace (Milepost)			
3-Mile-Long Pipeline			
(1.0) Push Area	PFO / PSS	1.8	0.4
(1.6) North Side Keith Lake Cut	PSS / E2EM / PEM	0.0	0.5
(1.6) South Side Keith Lake Cut	E2EM	0.0	0.8
Sub Total Workspace in Wetlands		**1.8**	**1.7**
70-Mile-Long Pipeline			
(1.2) Bore Entry Ship Canal	PEM	0.0	0.8
(2.0) Bore Exit Ship Canal	E1UBL	0.0	4.2
(2.1) Bore Pull Back Ship Canal	E1UBL	0.0	5.2
(5.6) Line Lowering ANR Pipeline	E1UBL	0.0	6.4
(18.0) Bore Entry West Pass Sabine River	E1UBL	0.0	0.6
(18.6) Bore Exit West Pass Sabine River	E1UBL	0.0	0.7
(19.2) MLV Site	E1UBL / E2EM	0.0	0.3
(21.7) Bore Exit West Side Cow Bayou Canal	E2EM	0.0	2.0
(21.9) Bore Entry East Side Cow Bayou Canal	PSS / E2EM	0.0	2.8
(22.4) Bore Exit West Side Cow Bayou	E2EM	0.0	2.1
(22.6) Bore Entry East Side Cow Bayou	E2EM / PSS	0.0	2.1
(22.8) Bore Entry West Side Sabine R.	E2EM / PSS	0.0	4.1
(23.3) Bore Exit East Side Sabine R.	E2EM	0.0	1.2
(24.3) West Side Burton Shell Slip	E2EM / E1UBL	0.0	0.83
(24.3) East Side Burton Shell Slip	E2EM	0.0	0.9
(25.9) Push Site	E2EM / E1UBL	0.0	23.2
(28.5) Push Site Bore Entry GIWW	PSS / E1UBL	0.0	6.3
(28.9) Bore Exit West Side GIWW	E2EM / E1UBL	0.0	2.5
(30.0) MLV Site	E2EM	0.0	0.3
(30.6) Push Site	E2EM	0.0	5.2
(33.6) Push Site	PEM	0.0	0.8
(35.3) Creek Crossing	PSS	0.0	0.9
(38.5) Bore Exit North Side US 90	PFO /PEM	0.2	0.1
(44.9) Drain Ditch Crossing	PFO / PEM	0.2	0.2
(45.6) Drain Ditch Crossing	PFO	<0.01	0.0
(45.8) Drain Ditch	PSS	0.0	0.02
(46.0) Bore Exit West Side Parish Rd	PFO / PEM	0.1	0.2
(47.6) Creek Crossing	PFO / PEM	0.04	0.4
(48.0) Pond Crossing	OW	0.0	0.05
(49.2) Drain Ditch Crossing	PFO / PEM	0.2	0.3
(49.4) Foreign Pipeline Crossing	PFO / PEM	0.4	0.5
(53.0) Bore Exit South Side of Houston River Canal	PP	0.6	0.0
(53.1) Pull Back Area for Bore	PP	0.1	0.0
(55.2) Bore Entry Houston River Crossing	PFO	0.5	0.0
(57.0) Drain Ditch Crossing	PFO	0.05	0.0
(58.6) Foreign Pipeline Crossing	PSS	0.0	0.2
(61.3) Drain Ditch Crossing	PFO	0.4	0.0
(62.4) Bore Entry West Side of Beckwith Creek	PFO	0.5	0.0
(63.7) Bore Entry Calcasieu River	PFO	0.2	0.0
(68.3) Drain Ditch Crossing	PFO	0.6	0.0
(69.1) Drain Ditch Crossing	PSS	0.0	0.2
(69.6) Foreign Pipeline Crossing	PEM / PSS	0.0	0.4
Sub Total Workspaces in Wetlands		**4.1**	**76.0**
TOTAL Workspaces in Wetlands		**5.9**	**77.7**

[a] Key:
PEM – Palustrine Emergent
PSS – Palustrine Scrub Shrub
PFO – Palustrine Forested
E1EM – Estuarine Subtidal Emergent
E2EM – Estuarine Intertidal Emergent
OW – Open Water
E1UB – Estuarine Subtidal Unconsolidated Bottom
PP – Pine Plantation

Access to the MLV at MP 29.9 would be achieved by means of an improved existing access road. The Project would not require construction of any new access roads across wetland areas. Although we generally discourage the location of aboveground facilities in wetlands, we believe that the minor wetland impacts at MP 29.9 are unavoidable and concur with this proposed location.

Nonjurisdictional Facilities

To the degree to which we have the information, a discussion of effects on wetlands related to the construction and operation of the nonjurisidictional facilities (relocation project and electrical service transmission lines) is provided in **appendix A**. Estimated wetlands impacts related to the nonjurisdictional facilities also are included in our cumulative impacts analysis in section 4.12.2.

EFH Wetlands

No EFH wetlands would be affected by the construction or operation of the LNG terminal portion of the project. However, EFH wetlands affected by the pipelines are shown in **table 4.4.1-1**, designated with an "(f)" in the "Notes" column. EFH wetlands along the proposed 3-Mile-Long Pipeline route are those tidally influenced marshlands located adjacent to Keith Lake and the Keith Lake Cut from MPs 1.5 to 1.9. These EFH wetlands are dominated by saltgrass, retrorse flatsedge, saline aster, cattail, and common reed. EFH wetlands are found along the proposed 70-Mile-Long Pipeline route from approximate MP 19.0 to MP 33. Sempra used field surveys to identify EFH wetlands and confirm tidal influence. In areas where survey access was not granted, NWI maps were used to identify wetland types and aerial photography was used to confirm tidal influence. These EFH wetlands are characterized by gulf cordgrass, marshhay cordgrass, and saltgrass.

Vegetated wetlands classified as EFH comprise approximately 6.0 acres of the 28.7 acres (21 percent) of non-forested wetlands that would be affected by construction of the 3-Mile-Long Pipeline. EFH wetlands comprise approximately 160.4 acres (73 percent) of the 218.8 acres of non-forested (estuarine emergent and non-tidal emergent) wetlands that would be affected during construction of the 70-Mile-Long Pipeline. Open water EFH habitats are not included in these numbers and are discussed further in section 4.6.

The effects of pipeline construction on vegetated EFH wetlands would be temporary and the EFH wetlands would be allowed to return to their pre-construction condition following backfilling of the pipeline. The duration of the temporary impacts to EFH wetlands would be restricted to the duration of pipeline construction plus the length of time for the vegetation to reestablish, likely to be on the order of one to two growing seasons. In order to facilitate reestablishment of the vegetation, Sempra has committed to minimizing the duration of construction in EFH wetlands to only that which is necessary, and returning the final grade of the pipeline trench to as close as possible to the pre-construction grade during the backfilling of the trench. Additionally, Sempra has committed to conduct a monitoring program (as requested by FWS) and would compensate for all remaining impacts (i.e., open water that was marsh or vegetated wetland prior to construction) within the pipeline construction right-of-way at the end of the 12-month period by revegetating until successful. See Sempra's Revised Draft Wetland Mitigation Plan (**appendix G**) for further details.

4.4.2 Wetland Construction Procedures

To minimize impacts on adjacent wetlands at the LNG terminal site, Sempra would implement the requirements of our Procedures. For the pipeline portion of the Project, Sempra would implement our Procedures, with approved variances.

The impact from the construction and operation of the Project on wetlands would vary depending on the timing of construction, construction techniques used, the sensitivity of aquatic resources to disturbance, and the length of time required for wetlands temporarily affected by construction to be restored. Impacts associated with the construction of the Project would include the disturbance and removal of wetland vegetation. Following construction, temporarily disturbed wetlands would be restored and allowed to revegetate in accordance with our Procedures, which require Sempra to develop a project-specific wetland restoration plan and to monitor the success of the revegetation efforts. Wetland areas that are located directly within the footprint of permanent aboveground facilities required for the operation of the Project would be filled.

Temporary impacts during construction activities would occur within the pipeline construction corridors and extra workspace areas where vegetation would be cleared for equipment movement and installation of the pipelines. Additional temporary impacts associated with construction of the proposed pipelines could include temporary changes to wetland soils and hydrology. During construction, in herbaceous wetlands, the impact on vegetation would be short-term, since the herbaceous vegetation would regenerate quickly. Failure to properly segregate soil could result in mixing of the soil layers, resulting in altered biological components of the wetland. These changes could affect the reestablishment and natural recruitment of native wetland vegetation. In addition, inadvertent compaction and furrowing of soils during construction could result from the temporary stockpiling of soil and the movement of heavy machinery. This could alter the natural hydrologic patterns of the wetlands, inhibit seed germination, or increase seedling mortality. Altered surface drainage patterns and hydrology could increase the potential for siltation, and increased turbidity may result from construction and trenching activities. Construction clearing activities and disturbance of wetland vegetation could temporarily affect the wetland's capacity to buffer flood flows or control erosion. Construction activities also have the potential to diminish the recreational and aesthetic value of wetlands.

To minimize potential impacts on wetlands, Sempra would adhere to the mitigation measures outlined in our Procedures during construction and operation of the pipelines. Among other measures, the Procedures include the following protective measures:

- wetland crossings would be installed using standard cross-country construction methods, push-pull methods, or HDD;
- when possible, extra workspace would be located at least 50 feet outside of wetlands;
- existing roadways through wetlands may be used as access roads only if they can be used with no modification and no impact on the wetland;
- the top 12 inches of topsoil over the trenchline would be segregated, except where standing water or saturated soils are present;
- dewatering would be conducted such that no heavily silt-laden water is discharged into wetland areas;
- the right-of-way would be returned, as closely as possible, to preconstruction contours following construction; and

- when possible, push-pull methods of pipe laying would be used in which an open trench is dug and the pipe is pushed down the trench segment by segment as it is fabricated and welded in an adjacent upland area or a central location within a large wetland complex.

Our Procedures require that an applicant identify those provisions of the Procedures that it considers unnecessary or technically infeasible, or unsuitable, due to local conditions. The applicant must provide site-specific justification why those provisions are not applicable and/or provide alternative measures that would ensure an equal or greater level of protection. Sempra has identified provisions where it proposes alternative measures as discussed below.

4.4.2.1 3-Mile-Long Pipeline

The 3-Mile-Long Pipeline would cross approximately 1.8 miles of wetlands, not including open water. Sempra has requested a variance from our Procedures to use a 125-foot-wide temporary construction right-of-way in the wetlands that occur from MP 0.0 to MP 2.0. Our Procedures generally limit the construction right-of-way in wetlands to 75 feet to minimize wetland impacts and require a 50-foot setback from wetland boundaries for extra workspaces. Given that two 36-inch-diameter pipelines would be installed between MPs 0.0 and 1.0, the saturated soil conditions, and the fluid material of the soil types, Sempra expects excessively wide ditches and difficult to contain fluid spoil piles during construction and is requesting the use of a 125-foot-wide right-of-way and additional workspace to safely construct the pipelines. Sempra is proposing to use the same 125-foot-wide temporary construction right-of-way from MP 0.0 to approximate MP 1.0 for both the 3-Mile-Long Pipeline and the 70-Mile-Long Pipeline, which would be in the same right-of-way in this segment. In addition to providing for sufficient construction right-of-way width for both pipelines, Sempra asserts that the 125-foot-wide temporary construction right-of-way would allow for sufficient trench width to meet safety guidelines and for sufficient width in the right-of-way to temporarily stockpile material removed from the trench. Sempra has cited the following reasons for its request:

- both the natural gas send out pipelines (3-Mile-Long and 70-Mile-Long Pipelines) would be in the same temporary construction right-of-way from MP 0.0 to approximate MP 1.0;

- the weight of a 36-inch-diameter pipe combined with approximately 6 inches of concrete coating would require specific equipment and sufficient area to handle the pipe in a safe manner;

- a trench width of 25 feet wide and a minimum approximate trench depth of 7 feet;

- the composition and consistency of the soils and the amount to be removed as required by the trench width and depth specifications for the concrete coated 36-inch-diameter pipe would require additional area for stockpiling and containing the material removed from the trench;

- a minimum of 2 feet between the edge of the trench and the stockpiled material would be required to prevent the material from falling back into the trench;

- trench would have to be excavated an additional 12 to 18 inches due to the material that sloughs off into the trench; and

- an area within the temporary construction right-of-way and offset from the edge of the construction right-of-way would be required for the stockpiled material to ensure that effects associated with the placement of the material remain within the construction right-of-way.

Specially equipped marsh draglines and hoes would be used to excavate the trench and backfill the trench once the pipeline is installed. A variance for each of the temporary workspaces listed in **table 4.4.1-2** for this portion of the pipeline route also was requested to support the crossing of these wetlands. Sempra based the areal extent of the requested temporary workspaces on the minimum area required to support the specific construction approach. The specific areas along the 3-Mile-Long Pipeline for which a variance was requested are presented in **table 4.3.3.1-2**, relative to the applicable section of our Procedures. The temporary workspace in wetlands variance request is based on the following site-specific conditions:

- the combination of a push site and an HDD entry site within the same workspace to minimize effects on wetlands; and

- the area required for stockpiling material removed from the trench and to maintain the required setback from waterbodies.

Given the soil conditions along the route and the size of the pipelines, we believe that it would not be feasible to maintain construction disturbance within a 75-foot-wide right-of-way where the two pipes of this size would be in the same right-of-way. Therefore, in wetland areas where conventional construction methods would be used and where the two pipelines would be within the same right-of-way, we have no objection to a 110-foot-wide construction right-of-way, contingent upon implementation of a wetland restoration plan (see section 4.4.3 below). However, we do not approve of a 125-foot-wide construction right-of-way without additional site-specific justification for the wider construction right-of-way. Therefore, **we recommend that:**

- **Sempra revise its alignment sheets for the 3-Mile-Long and 70-Mile-Long Pipelines where they would be in the same temporary construction right-of-way (MPs 0.0 to 1.0) to show a maximum width of 110 feet with respect to the construction right-of-way in wetlands. The revised construction plans and alignment sheets should be filed with the Secretary for review and written approval by the Director of OEP prior to construction of the pipelines.**

As mentioned previously, our Procedures do not allow extra work space in wetlands without written approval for a variance. Since the soils crossed by the pipelines do not have the characteristics of poor revegetation potential (see section 4.2.1.2), appropriate restoration and revegetation techniques would minimize any long-term impacts associated with the additional construction disturbance described in the previous sections. We believe that, because of the extensive wetlands along the pipeline routes, there is no other reasonable or practical location for the extra workspaces except in the wetlands and that that these work spaces are necessary for the installation of the 36-inch-diameter pipeline facilities. Therefore, the variance for these extra workspaces is approved.

Depending upon water depth at the time of construction, Sempra would use push construction methods in the wetland areas between MPs 1.0 and 1.4, where the two pipelines would no longer be within the same right-of-way. In the push construction technique, lengths of concrete coated pipeline are welded together, the joints x-rayed, coated and floatation added. As each length of pipeline is added, the pipeline is pushed (and floated) into the open, water-filled trench, and at the appropriate time, the floatation is removed and the pipeline settles into the trench which is then backfilled and the right-of-way restored. Use of the push construction method allows a narrower right-of-way through the wetland than would be required by conventional construction methods. It also limits the necessity for other equipment and vehicles to cross the wetland, thus minimizing compaction in the wetland.

4.4.2.2 70-Mile-Long Pipeline

The 70-Mile-Long Pipeline would cross approximately 37.3 miles of jurisdictional wetlands and waters. The wetland areas avoided by HDD have been accounted for in the list presented in **table 4.4.1-1**. Sempra currently plans to use several push and HDD sites for pipeline installation in the marsh area between approximate MPs 19.2 and 35.4. Sempra also has requested a variance from our Procedures to use a 125-foot-wide temporary construction right-of-way to cross the wetland areas that occur between MPs 0.0 and 1.2 and the marsh areas that occur between MPs 19.2 and 35.4. As discussed above, Sempra is proposing to use the same 125-foot-wide temporary construction right-of-way from MP 0.0 to approximate MP 1.0 for both the 3-Mile-Long and 70-Mile-Long Pipeline. As stated above, where the two pipelines would be within the same right-of-way, we believe that the construction right-of-way should be limited to 110 feet contingent upon implementation of a wetland restoration plan (see section 4.4.3 below). However, between approximate MP 1.0 and MP 1.2 and MP 19.2 and MP 35.4, the two pipelines would not be within the same right-of-way. Therefore, for these areas, **we recommend that**:

- **Sempra limit its construction right-of-way to 100 feet in wetland areas where the two proposed pipelines would not be within the same right-of-way (between MPs 1.0 and 1.2 and MPs 19.2 and 35.4) and where the push method can be used. If additional right-of-way is required, Sempra should file with the Secretary for review and written approval by the Director of OEP a site-specific construction plan and written justification before use of any additional right-of-way width.**

<u>The Marsh (MPs 19.2 to 35.4)</u>

The marsh, particularly the portion in Louisiana between the Sabine River and the GIWW (MPs 23.3 to 25.8) has been identified by the LADNR and various federal agencies as an area of concern. The marsh is breaking up because of past utility construction. These agencies are concerned that construction of this pipeline would increase the break up of the marsh by forming linear open water features along the construction right-of-way.

Sempra is proposing to use a number of HDDs between MPs 19.2 and 35.4 to cross waterbodies and other portions of the marsh. A variance for the each of the temporary workspaces listed in **table 4.4.1-2** for these portions of the pipeline route also was requested to support the crossing of the wetlands and the marsh (and associated waterbodies). The specific workspace areas along the 70-Mile-Long Pipeline for which Sempra has requested a variance are presented in **table 4.3.3.1-2**, relative to the applicable section of our Procedures. Sempra's temporary workspace in wetlands variance request is based on the following site-specific conditions:

- the combination of a push site and an HDD site (exit or entry) within the same workspace to minimize effects on wetlands;

- providing equipment access from adjacent waterbody, rather than having to construct an equipment access road through the wetland;

- the construction of a ring levee around the workspace to temporarily limit the flow of storm water into the workspace;

- the construction of a water control system within the workspace to maintain the water level such that matting can be used if necessary for placement and movement of equipment within the workspace; and

- the development of sufficient workspace area for the types of equipment and activities to be conducted on or in association with the workspace with regard to worker safety and the requirements of the particular technology.

Sempra proposes to construct the push sites by building ring levees using material within the push site work space area. The borrow areas used to construct the ring levees would be used to collect water that accumulates within the ring levees. This water would be pumped through sediment control structures constructed of hay bales or filter bags to be discharged outside the ring levees. Wooden mats would be installed inside the ring levees for the equipment needed to assemble the pipeline and push the sections into the open trench. The use of mats would help to mitigate the effects on the marsh. Sempra has designed each of these push sites to minimize the area disturbed and most would serve a dual purpose as a push site and HDD exit site. The dimensions of these push/HDD exit sites would be approximately 150 feet wide by 1,000 feet long, with two 25-foot-long by 200-foot-wide extensions. The HDD entry sites also would serve a dual purpose as a push and HDD site. Sempra states that they have designed these sites to minimize the area disturbed and would comprise two adjoining extra workspaces of 300 feet by 300 feet and 150 feet wide by 600 feet long.

One push site would be set up at the HDD exit site on the west side of Cow Bayou Canal (MP 21.8) with the pipeline being pushed to the southwest where it would be tied into the segment of the pipeline exiting Sabine Lake at MP 19.2. Another push site would be set up on the west side of Cow Bayou at the HDD exit site (MP 22.4) and the pipeline pushed to the west where it would connect with the pipeline from the HDD crossing of the Cow Bayou Canal (MP 21.8). Another push site would be set up on the east side of Cow Bayou at the HDD entry site (MP 22.6), with the pipe being pushed to the east to the HDD entry site crossing of the Sabine River at MP 22.8. Another push site would be set up near MP 26 on the south side of the Sabine River near the Calcasieu and Cameron Parish lines. The pipe would be pushed two directions from this push site, one to the west to the HDD exit site for the Sabine River crossing (MP 23.0) and one to the east connecting with the HDD entry site of the GIWW crossing. The Burton Shell Slip (MP 24.3) would be crossed by open cut. Another push site would be set up at approximate MP 30.5 with the pipe being pushed south to the HDD exit (MP 28.9) of the GIWW crossing and to the northeast connecting to the pipeline being pushed from a push site at MP 33.6. The pipeline would be pushed from the push site at MP 33.6 to the south and north. The pipeline being pushed to the north would connect with the pipeline being installed with conventional construction techniques at MP 35.4. The overall duration of the construction across this marsh area, including the crossing of Cow Bayou, Cow Bayou Canal, Sabine River, the Burton Shell Slip, and the marsh to the north of the GIWW (ending at MP 35.4) is estimated to be approximately 9 months.

In the marsh area, Sempra states that a 125-foot-wide construction right-of-way is necessary to allow for sufficient trench width to meet safety guidelines and for sufficient width in the right-of-way to temporarily stockpile material removed from the trench. With a wider spoil side area, approximately 48 feet wide, Sempra states that material removed from the trench would not have to be placed in tall piles, which would have the tendency to allow the material to dry, and while drying, shrink in volume to the extent that there would be less material to backfill the trench. Keeping the material in its naturally saturated state would serve to maintain the volume available for backfill. Additionally, Sempra contends that spreading the material over a larger surface area of the marsh would cause less compaction on the underlying marsh. Specially equipped marsh draglines and hoes would be used to excavate the trench and backfill the trench once the pipeline is installed. We do not believe that such a variance should be granted and have recommended use of no more than a 100-foot-wide right-of-way between MPs 1.0 and 1.2 and

MPs 19.2 and 35.4 (see above). Widening the right-of-way expands the area of potential impact. In addition, spreading out the material from the trench increases the potential for loss of this material.

In an effort to further minimize the effects of pipeline construction on the marsh areas, Sempra would incorporate the monitoring recommendations developed by the FWS - Clear Lake Ecological Services (Houston), NOAA Fisheries - Habitat Conservation Division (Galveston), and TPWD - Resource Protection Branch, which would significantly reduce impacts to coastal habitats caused by construction of pipelines.

Sempra has agreed to conduct a monitoring program of the temporary construction right-of-way (and the 100 meters paralleling each side of the construction corridor) through the marsh from approximate MP 19.2 to MP 25.8 using pre- and post-construction aerial photography and a geographic information system (GIS) analysis per FWS-provided specifications. Sempra would submit the monitoring reports detailing the results from the pre- and post- construction GIS analysis within 90 days after the completion of the 12-month interval between the pre- and post-construction analysis.

As part of their Revised Draft Wetland Mitigation Plan (**appendix G**), Sempra provided a site-specific restoration plan, which provides for the immediate restoration of the emergent marsh area between MPs 23.3 and 25.8 (see appendix B within **appendix G**). Since the authorizing agencies expressed concern about the northern part of the pipeline route, specifically that part across the Louisiana coastal marsh, Sempra has agreed to replant the areas that remain as open water and devoid of marsh cover following the first year within the temporary construction right-of-way from approximate MPs 23.3 to 25.8. We agree with these measures, but are uncertain of their ultimate success. The Procedures, which Sempra has agreed to implement, require that the wetlands be revegetated; converting vegetated wetlands to open water would require a variance from the Procedures. Sempra has not requested and has given no justification for such a variance.

As previously mentioned, the LADNR and various federal agencies have expressed concern over the conversion of marsh habitat to open water along the construction right-of-way, which also could further facilitate saltwater intrusion into freshwater marsh habitats, further reducing these already shrinking habitat types in the region. Some of these agencies stated that in marsh areas, there is a tendency for backfilled areas to lack adequate backfill material to bring the trenched area back to the original grade; thus, often creating an open waterway through the marsh where the emergent vegetation has difficulty reestablishing its pre-construction condition. These agencies have suggested that Sempra be required to bring in additional fill at the time of backfill to compensate for the loss/compaction of backfill material.

Sempra evaluated several options for bringing additional fill material into the marsh to supplement backfilling of the pipeline trench to bring it back to original grade. Sempra states that the only viable options would be to barge in suitable material or hydraulically transport it as a slurry using a hydraulic dredge and discharge pipe. After evaluating these potential methods of introducing supplemental material, Sempra stated that they would be prohibitively expensive, would have additional deleterious impacts to the marsh, and that their proposed approach: 1) using the requested construction right-of-way width, 2) replanting the vegetation lost over the pipeline trench as soon as possible following backfilling of the trench, 3) monitoring over a 1-year period with the replanting of areas that remain open water and devoid of marsh cover following the first year of the growing season, and 4) compensating for all permanent impacts (amount of vegetated marsh remaining as open water after 12 months) at a compensation ratio required in their Section 404 permit.

We note that our Procedures require that disturbed wetlands be revegetated; therefore, the conversion of wetlands to open water would be unacceptable. Our Procedures require the applicant to develop a wetland mitigation/restoration plan, which could be part of the Aquatic Resources Mitigation Plan, in

consultation with the appropriate agencies. Our Procedures in this instance are performance standards describing the desired result without dictating the methods. The final wetland mitigation/restoration plan would set out the methods through consultation with the appropriate federal and state agencies. Through the process of developing the wetland mitigation/restoration plan, the importation of fill has been discussed. However, since the importation of fill into a wetland would be under the jurisdiction of the COE, we can not require Sempra to import fill into the wetland without the concurrence of the COE. In addition, NOAA Fisheries indicated that the marsh area consists of a portion of a wetland restoration project under its jurisdiction and recommended that Sempra develop in coordination with NOAA Fisheries a site-specific restoration plan for the marsh. If the COE, NOAA Fisheries, and other pertinent agencies are in agreement with the importation of fill and are willing to permit it, we are not opposed.

4.4.3 Aquatic Resources Mitigation Plan

In addition to the mitigation measures required by our Procedures and those recommended above, Sempra would be required to comply with the permit conditions attached to the COE's Section 404 permit, the Texas Railroad Commission's and LADEQ's Section 401 permits, the TGLO's Coastal Zone Management Consistency Determination, and LADNR's Coastal Use Permit. For the COE to determine whether practicable alternatives have been assessed and incorporated as appropriate, Sempra is required to avoid wetland impacts to the maximum extent possible. Sempra also must 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 dredged or fill material where a less environmentally damaging alternative exists. To help ensure that it meets these requirements, Sempra has further refined its Revised Draft Wetland Mitigation Plan (**appendix G**), which is one part of what we envisioned as its Aquatic Resources Mitigation Plan. Sempra's Revised Draft Wetland Mitigation Plan includes:

- an outline of wetland impacts and provides proposed compensatory mitigation;
- an adaption of the monitoring recommendations developed by the COE, FWS - Clear Lake Ecological Services (Houston), NOAA Fisheries - Habitat Conservation Division (Galveston), and TPWD - Resource Protection Branch;
- a description of the methods to be employed to ensure final grades in wetlands are restored to preconstruction conditions;
- a site-specific, marsh restoration plan for the marsh area between MPs 23.3 and 25.8, which describes how the marsh would be restored to pre-construction conditions, including an 80 percent revegetation success rate; and
- a plan for controlling invasive species.

However, EFH impacts and mitigation are still not fully disclosed in Sempra's Revised Draft Wetland Mitigation Plan. Additionally, we are not convinced of complete agency-concurrence with all of Sempra's proposed mitigation measures.

The COE requires compensatory mitigation for any permanent loss of wetlands resulting from the Project. Sempra has stated in its Revised Draft Wetland Mitigation Plan how it would mitigate for the effects of construction and operation on wetlands, but Sempra is continuing to work with the COE and other federal and state agencies to finalize the details through the Section 10/404 permitting process.

NOAA Fisheries has commented that impacts on wetlands that provide EFH should be minimized and that allowing up to a 20 percent loss of vegetated wetlands and potential EFH would be inconsistent with the President's "no net loss of wetlands" policy and should be considered unacceptable. NOAA Fisheries recommends the following:

- development of a restoration and mitigation plan, in coordination with the various natural resource management agencies, that provides appropriate success criteria for evaluating right-of-way revegetation and defines actions to be taken if restoration efforts along the pipeline are less than fully successful;
- use of best management construction and restoration practices, including repairing of banks;
- restricting the number and limits of airboat and tracked equipment passage over marshes;
- backfilling the pipeline ditch to marsh elevation;
- replanting marsh vegetation on all impacted areas if the wetland is not revegetated within 1 year;
- documenting the need for compensatory wetland mitigation through ground and aerial (low altitude infrared photography) monitoring prior to and immediately after construction; and
- completing additional surveys within one complete growing season after construction, if needed.

Sempra's Revised Draft Wetland Mitigation Plan includes an appendix entitled "Natural Restoration Monitoring and Remedial Action Revegetation Plan" which commits to restoring wetlands to pre-project contours and elevations; includes the monitoring and reporting guidelines suggested by the agencies; and discusses remedial vegetation plantings that would occur if successful natural revegetation is not being achieved. For all emergent marsh areas outside of MPs 23.3 and 25.8, Sempra has requested that a one-year growing season be allowed to pass before mitigation requirements are established. If the COE, NOAA Fisheries, and other pertinent agencies are in agreement with this approach and are willing to permit it, we are not opposed to allowing a one-year growing season before final mitigation requirements are set forth. We anticipate futher review and comments from the agencies prior to the finalization of the Wetland Mitigation Plan.

Since Sempra's Revised Draft Wetland Mitigation Plan is not entirely responsive to the agencies' concerns and is only part of what we envisioned as an acceptable Aquatic Resources Mitigation Plan, **we recommend that:**

- **Prior to construction, Sempra should file with the Secretary the <u>finalized</u> Aquatic Resources Mitigation Plan (including a <u>finalized</u> Wetland Mitigation Plan) developed in consultation with the COE, NOAA Fisheries, FWS, TCEQ, LADNR, EPA, and LADWF. In addition to the information currently provided in Sempra's Revised Draft Wetland Mitigation Plan, as ultimately approved by the agencies, the <u>finalized</u> Aquatic Resources Mitigation Plan (including a <u>finalized</u> Wetland Mitigation Plan) also should include EFH impacts and agency-approved mitigation for those impacts.**

4.4.4 Third-Party Mitigation Monitoring

In a further effort to ensure that the marsh and other resources are protected and restored to the greatest extent possible, **we recommend that:**

- **Sempra hires and funds a third-party contractor to work under the direction of the Commission staff for the sole purpose of monitoring compliance with the environmental conditions provided in the EIS, and all mitigation measures proposed by Sempra. Sempra should develop a draft monitoring program and obtain proposals from potential contractors to provide monitoring services, and file the program and proposals with the Secretary for review and approval by the Director of OEP at least 60 days before the anticipated start of pipeline construction. The monitoring program should include:**

  a. the employment by the contractor of one to two full-time on-site monitors per construction spread;

b. the employment by the contractor of a full-time compliance manager to direct and coordinate with the monitors, manage the reporting system, and provide technical support to the FERC staff;

c. a systematic strategy for the review and approval by the contract compliance manager and monitors of variances to certain construction activities as may be required by Sempra based on site-specific conditions;

d. the development of an internet website for posting daily or weekly inspection reports submitted by both the third-party monitors and Sempra's environmental inspectors; and

e. a discussion of how the monitoring program can incorporate and/or be coordinated with the monitoring or reporting that may be required by other federal and state agencies.

4.5 VEGETATION

4.5.1 Habitat/Community Types

The Port Arthur LNG Project area vegetation analyses indicate the presence of six general vegetation habitat/community types:

- marsh/wetlands
- upland prairie
- coastal woodlands/upland forests
- open lands
- open water
- revegetated disturbed land

Of these, open water is generally characterized by a lack of vegetation and is not discussed. **Table 4.5.1-1** lists the general types of vegetation found in the above habitat/community types.

4.5.1.1 LNG Terminal

The LNG terminal would be located on a previously disturbed parcel that is atypical of the coastal marsh area due to alteration of hydrology by leveeing and placement of fill. The location of the LNG terminal site was selected on the basis of avoiding, to the extent practical, unique vegetation communities, while still providing sufficient area and the required orientation for the slip relative to the Port Arthur Ship Canal, for meeting the spacing requirements between facilities within the LNG terminal site, and for the relocation of SH 87 in compliance with TxDOT requirements. Selection of temporary construction areas for the LNG terminal within the property would be purposely restricted to upland areas to minimize the requirements for filling wetlands. Exotic invasive plant species have established dominance over large portions of the proposed terminal parcel altering the vegetation complex such that native plant species are completely absent in many locations on the property.

Construction of the LNG terminal would permanently convert approximately 112.2 acres of upland, 3.5 acres of disturbed land, and 82.5 acres of wetlands to 116.2 acres of industrial use and 82 acres of open water. A Revised Draft Wetland Mitigation Plan has been drafted to address the type and location of mitigation (see **appendix G**). Additionally, nearly 65 acres of uplands and less than 0.5 acre of wetlands would be temporarily disturbed during construction. Following construction these areas would be stabilized with grass or returned to their pre-construction state. Operation and maintenance of the proposed facilities is not expected to have any additional impacts on the Project area vegetation.

TABLE 4.5.1-1 General Vegetative Habitats and Species Present in the Project Area
Common Name/Scientific Name
Pine-Hardwood Forest
Upland Forest
live oak (*Quercus virginiana*)
post oak (*Quercus stellata*)
slash pine (*Pinus elliottii*)
loblolly pine (*Pinus taeda*)
sweetgum (*Liquidambar styraciflua*)
southern magnolia (*Magnolia grandiflora*)
greenbriar (*Smilax* sp.)
Pine Plantations
slash pine (*Pinus elliottii*)
loblolly pine (*Pinus taeda*)
Pine Savannahs
slash pine (*Pinus elliottii*)
Wetland Forest
bald cypress (*Taxodium distichum*)
green ash (*Fraxinus pennsylvanica*)
American elm (*Ulmus americana*)
swamp chestnut oak (*Quercus michauxii*)
Sweetgum (*Liquidambar styraciflua*)
cherrybark oak (*Quercus pagoda*)
American hophornbeam (*Carpinus caroliniana*)
silverbell (*Halesia diptera*)
loblolly pine (*Pinus taeda*)
water oak (*Quercus nigra*)
hophornbeam (*Ostrya virginiana*)
Upland Prairie
Open lands
grasses
forbs
shrubs
Emergent Marsh Wetlands
dwarf spikerush (*Eleocharis parvula*)
needlegrass rush (*Juncus roemerianus*)
seaside tansy (*Borrichia frutescens*)
inland saltgrass (*Distichlis spicata*)
cordgrass (*Spartina patens*)
herbaceous vegetation community
swamp smartweed (*Polygonium hydropiperoides*)
dwarf spikerush (*Eleocharis parvula*)
sedge (Carex sp.)
flatsedge (*Cyperus* sp.)
dwarf palmetto (*Sabal minor*)
St. Augustine grass (*Stenotaphrum secundatum*)
dog fennel (*Eupatorium capillifolium*)
herbaceous/shrub vegetation community type
buttonbush (*Cephalanthus occidentalis*)

TABLE 4.5.1-1 General Vegetative Habitats and Species Present in the Project Area
Common Name/Scientific Name
eastern baccharis (*Baccharis halimifolia*)
Wax myrtle (*Myrica cerifera)*
Chinese Tallow (*Sapium sebiferum)*
hibiscus (*Hibiscus* sp.)
sugarcane plume grass (*Saccaharum giganteum*)
common rush (*Juncus effusus*)
tapered rosette grass (*Dichanthelium acuminatum*)
bushy bluestem (*Andropogon glomeratus*)
laxleaf yelloweyed grass (*Xyris laxifolia*)
sedge (*Carex* sp.)
flatsedge (*Cyperus* sp.)
Seagrass beds
Widgeongrass (*Ruppia maritima*)
Crown Point Distinctive Site
Several ecologically diverse plant communities up to 600-700 plant species. Habitats include:
Cypress-water tupelo forest
Mature pine-hardwood forest
Longleaf pine savannah
Mesic longleaf pine woodland
Saline glade

4.5.1.2 Pipelines

3-Mile-Long Pipeline

The 3-Mile-Long Pipeline route would be located within the same characteristic vegetation types as the LNG terminal site. Construction of the 3-Mile-Long Pipeline, including extra workspace, would involve the temporary clearing and disturbance of approximately 47.9 acres, including 7.8 acres of forested wetlands, 20.9 acres of non-forested wetlands, 7.3 acres of open land, and 11.9 acres of open water (Keith Lake Cut and Keith Lake). The route was selected on the basis of avoiding sensitive vegetation types, such as wetlands, by routing through uplands to the extent feasible. The proposed route would minimize the disturbed area by co-locating the two natural gas send-out pipelines within the same corridor for the first mile and would use an HDD to cross Keith Lake Cut. Upon completion of the 3-Mile-Long Pipeline approximately 2.4 acres of forested wetlands would be maintained permanently in an herbaceous state. Effects on wetlands and other vegetation communities would be minimized by crossing through Keith Lake, as opposed to the wetlands bordering the eastern side of Keith Lake.

70-Mile-Long Pipeline

Construction of the proposed 70-Mile-Long Pipeline, including extra work space and staging areas, would involve the temporary clearing and disturbance of approximately 1185.9 acres. Vegetation types affected would include 164.4 acres of upland forest, 24.7 acres of forested wetland, 164.8 acres of freshwater and intermediate marsh wetland, 54 acres of other emergent wetland, and 36.1 acres of non-forested, scrub-shrub wetland. The remainder comprises open water, open land, industrial land, agricultural land, and residential areas. Upon completion of the proposed facilities, 74.1 acres of upland forest and

10.7 acres of forested wetlands would be maintained permanently in an herbaceous state (see section 4.4.3 for proposed wetland mitigation).

Following construction of the pipelines, all construction workspace would be allowed to re-vegetate to pre-construction conditions. Pre- and post-construction measures would be implemented to ensure successful revegetation of these areas. Furthermore, permanent impacts to wetland habitats under the jurisdiction of the COE would be mitigated as determined through consultation/permit conditions with the COE and other Texas and Louisiana resource agencies. Wetland areas disturbed by the Project are discussed in greater detail in section 4.4.

Where required, standard erosion control/cover species would be planted after construction is completed. The upland permanent right-of-way would be maintained in an herbaceous state following construction. Existing herbaceous cover type would be restored in-kind after construction has been completed and no long-term impacts are anticipated.

Routine vegetation maintenance clearing could occur within the existing permanent right-of-way no more than once every 3 years. However, to facilitate leak and corrosion surveys, a corridor no more than 10 feet wide centered on the pipeline could be maintained by mowing or a similar means on an annual basis, in accordance with the Plan and Procedures.

4.5.2 Vegetative Communities of Special Concern

The Crown Point Distinctive Site is an approximate 360-acre site defined and designated by Temple-Inland, Inc. (Temple-Inland), a forest products corporation (see **figure 3.5.3-6**). It would be crossed by the 70-Mile-Long Pipeline route between MPs 62.6 and 63.6 (specifically, between MPs 62.6 and 62.8 and MPs 63.0 and 63.6). The designation applies to sites of unique ecological, geologic, or historical significance that Temple-Inland has agreed to manage and protect as part of its commitment to the American Forest and Paper Association Sustainable Forestry Initiative Standard and in accordance with a memorandum of agreement with the Louisiana Nature Conservancy. Little to no published information about the site is readily available, except for information presented by Temple-Inland representatives; however, as stated in the Hackberry LNG Project Final EIS, the Louisiana Natural Heritage Program (LNHP) reported that "pending verification of the species and communities, the area would qualify for inclusion on their database identifying sensitive resources of Louisiana." We received a letter from the FWS, dated February 25, 2005, in support of conserving and protecting the Crown Point Distinctive Site. The FWS states that, "Because it may potentially support species of special management concern, and because surveys and investigations are continuing in an effort to more fully document its environmental values, the Service supports every effort to avoid adversely impacting Temple-Inland's 'distinctive site.'" In the same letter, the FWS strongly recommended that the "…HDD method be used to install the pipeline in a manner that would avoid and/or minimize impacts to that 'distinctive site.'"

According to a recent botanical study performed by Temple-Inland, the site contains several ecologically diverse plant communities, including a pristine cypress-water tupelo forest, a mature pine-hardwood forest, a longleaf pine savannah, a mesic longleaf pine woodland, and a saline glade. Temple-Inland reports that the highly diverse plant communities contain an estimated 600 to 700 plant species and has provided a species list for the saline phase longleaf pine savannah component of the Crown Point Site in Calcasieu Parish. This list, compiled by the LNHP and Temple-Inland from field visits conducted on June 12, 2003, and August 21, 2003, contains 48 species, of which 2 species, coastal plain lobelia (*Lobelia flaccidifolia*) and largeleaf white rosepink (*Sabatia macrophylla*) are noted as being rare and are ranked by the LNHP. The LNHP, within the LDWF, is part of the Natural Heritage Network, partnering with The Nature Conservancy. Species ranked by this program are assigned both a global rank as well as a state rank for each state within which the species occurs. Global ranking is done under the guidance of

the Science Department of NatureServe, Arlington, Virginia. State ranks are assigned by each state's Natural Heritage Program, thus a rank for a particular species may vary considerably from state to state. The other plant species are typical of these vegetation community types within this part of Louisiana.

The proposed route would parallel the planned Hackberry (now Cameron) Pipeline through the Site. Avoidance of this Site was examined in the Hackberry LNG Project Final EIS (see section 3.5.3.5 of this EIS). In the Hackberry LNG Project Final EIS, it was determined that the proposed route variations did not provide a clear environmental advantage over the proposed route of the Hackberry Pipeline. The Commission approved the route of the Hackberry Pipeline through the Site, but required a site specific plan for the crossing of the Site. For that project, the staff concluded that the upland vegetation communities between MPs 28.2 and 29.2 on the Cameron Project (which correspond to MPs 62.6 to 63.6 on the Port Arthur LNG Project 70-Mile-Long Pipeline route) would not be significantly affected by pipeline construction, particularly with the implementation of appropriate mitigation measures. The mitigation measures the Commission required for Cameron included:

- moving the HDD entry point and associated workspace for the Beckwith Creek crossing approximately 200 feet northeast off Temple-Inland's parcel;
- constructing the HDD entry point and associated extra workspace for the Hickory Branch crossing entirely on the parcel north of Temple-Inland's parcel;
- limiting the construction right-of-way between the above HDD extra workspaces to 75 feet in width; and
- actively revegetating the disturbed areas with native species, including replanting of native trees in the temporary workspaces.

Sempra has committed to implement most of these same measures for the Port Arthur LNG Project; however, now Sempra is proposing to cross this Site with three parallel, large diameter pipelines (Cameron Pipeline, 70-mile-long Port Arthur Pipeline, and the Liberty Storage Project Pipeline). While the mitigation required by the Hackberry Order is sufficient for a single pipeline, we believe that this mitigation may not be sufficient for the additional pipelines. Potentially tripling the workspaces and rights-of-way may cause significant impacts on the plant communities within the Site. Further, since that time, as mentioned above, the FWS has voiced support for the designation of the Crown Point Site as a Distinctive Site.

Currently, Sempra proposes to install the pipeline between MPs 62.4 and 62.9 using the HDD technique to avoid the bottomland hardwoods bordering Beckwith Creek. Both the HDD entry and exit points and their associated workspaces would be outside the Temple-Inland property (see **figure 3.5.3-6**). However, Sempra currently proposes to install the proposed pipeline, Sempra's Cameron pipeline, and Sempra's Liberty pipeline in the upland portion of the property between MPs 63.0 and 63.6 using the open cut construction technique, a 150-foot-wide construction right-of-way, and the workspaces listed in **appendix I**, **table I-1**. In late June 2005, Sempra and Temple-Inland reached an agreement whereby Temple-Inland has agreed to allow Sempra to construct all three pipelines on its property in accordance with the terms of a Grant of Easement and Right-of-Way for Pipeline, Surface, and Road Use.

4.5.2.1 Noxious Weeds and Other Invasive Plants

The Project area is heavily dominated by a species listed as a noxious weed, the Chinese tallow tree (*Triadica sebifera* formerly *Sapium sebiferum*). Tallow trees were introduced into the U.S. in the

late 1700s. It was originally cultivated as an ornamental shrub and possibly touted as a food source for chickens (hence the colloquial name of chicken tree). Tallow tree is capable of invading areas and rapidly replacing the natural communities with nearly monospecific stands. Characteristic of woody invaders, it grows rapidly, begins reproduction when young (only 3 years old), produces abundant viable seed, and can reproduce from cuttings. Seeds are spread by birds and also may float for great distances. Tallow tree degrades the surrounding ecosystem by producing tannins and increasing the rate of eutrophication (the aging process and conversion of water habitats to marsh and dry land). Its white sap may be a skin irritant or diuretic. It is extremely popular among landscapers in the U.S., Australia, and elsewhere, although it is becoming illegal to sell in some areas. This species can persist in all situations with the exception of permanently saturated areas. Because of its prevalence in the Project area and in the absence of any known management program for this species, it is likely that the Chinese tallow tree would be reestablished in the construction areas within 1 to 2 years.

Two other species of noxious or invasive plant species could occur within the project area: giant salvinia (*Salvinia molesta*) and deep-rooted sedge (*Cyperus entrerianus*). Giant salvinia is a floating, rootless aquatic fern consisting of horizontal stems that float just below the water surface and produce a pair of floating or emergent leaves at each node. One of the world's most noxious aquatic weeds, salvinia is notorious for dominating slow moving or quiet freshwaters. Its rapid growth, vegetative reproduction, and tolerance to environmental stress make it an aggressive, competitive species known to impact aquatic environments, water use, and local economies. Mechanical controls can temporarily prevent the spread of salvinia, but herbicide treatment is currently the most efficient method of control. If equipment is exposed to infestation, proper sanitation measures are vital in preventing the spread of salvinia to other waterbodies.

Deep-rooted sedge is a wetland sedge that invades disturbed areas thoughout the southeastern United States. It is a tall (up to 40 inches), robust, grass-like plant with deeply set, thick rhizomes and dark purple to black leaf bases. Deep-rooted sedge is native to South America and was accidentally introduced into the United States around 1990. It invades wet, disturbed areas such as highway ditches and field margins, and displaces native vegetation. Construction, agricultural activities, and road-side mowing are spreading the seeds and dispersing this plant to new areas. Repeated mowing and disking at 2 to 4 week intervals can suppress deep-rooted sedge seed production. Research has shown that herbicides most effectively control deep-rooted sedge in combination with mechanical methods and proper equipment sanitation measures.

To control the spread of these species within maintained areas, Sempra would use a management approach based on recommendations from the Texas Cooperative Extension. Sempra has provided a draft Invasive Species Management Plan to address the control of these species during construction and maintenance activities (see **appendix G**).

4.6 WILDLIFE AND AQUATIC RESOURCES

This section provides a description of the wildlife and aquatic resources in the Project area. Potential impacts to those resources from construction and operation of the Project are discussed, and proposed or additional mitigation measures needed to eliminate or minimize adverse impacts to these resources are identified. Threatened, endangered, and special status species are discussed in section 4.7.

4.6.1 Wildlife Resources

Based on vegetative characteristics, the Project area can be divided into five basic wildlife habitat/community types that include:

- open water
- emergent marsh
- coastal prairies/grasslands
- coastal woodlands/upland forest
- developed or previously disturbed land

Since each habitat/community type supports a distinct collection of wildlife species, analysis of habitat types, rather than individual species, is provided to meaningfully describe Project-related impacts to wildlife resources. An overview of each habitat type that would be impacted by the Project is provided below. Representative non-fish vertebrates found within the Project area habitats are listed in **table 4.6.1-1**.

TABLE 4.6.1-1

Typical Non-Fish Vertebrate Species Found within the Project Area

Common Name, *Scientific Name*	Common Name, *Scientific Name*
Open Water Habitat	**Coastal Grassland/Prairie Habitats, continued**
coastal cricket frog, *Acris crepitans*	eastern hognose snake, *Heterodon platyrhinos*
Bullfrog, *Rana catesbeiana*	rough green snake, *Opheodrys aestivus*
Cottonmouth water moccasin, *Agkistrodon piscivorus*	upland sandpiper, *Bartramia longicauda*
diamondback water snake, *Nerodia rhombifer*	cattle egret, *Bubulcus ibis*
red-eared slider, *Chrysemys scripta*	Killdeer, *Charadrius vociferous*
spotted sandpiper, *Actitis macularia*	common nighthawk, *Chordeiles minor*
great egret, *Casmerodius albus*	American kestrel, *Falco sparverius*
blue winged teal, *Anas discors*	song sparrow, *Melospiza melodia*
laughing gull, *Larus atricilla*	painted bunting, *Passerina ciris*
common muskrat, *Ondatra zibethicus*	eastern kingbird, *Tyrannus tyrannus*
Nutria, *Myocastor coypus*	least shrew, *Cryptotis parva*
	Virginia opossum, *Didelphis virginiana*
Emergent Marsh Wetland Habitats	striped skunk, *Mephitis mephitis*
Woodhouse's toad, *Bufo woodhousii*	eastern cottontail, *Sylvilagus floridanus*
eastern narrow-mouth toad, *Gastrophryne carolinensis*	fulvous harvest mouse, *Reithrodontomys fulvescens*
southern leopard frog, *Rana utricularia*	white-tailed deer, *Odocoileu virginianus*
speckled king snake, *Lampropeltis getulus*	
diamondback water snake, *Nerodia rhombifer*	**Coastal Woodland/Upland Forest Habitat**
red-winged blackbird, *Agelaius phoeniceus*	coastal cricket frog, *Acris crepitans*
American widgeon, *Anas Americana*	spring peeper, *Pseudacris crucifer*
American bittern, *Botaurus lentiginosus*	green anole, *Anolis carolinensis*
common snipe, *Capella gallinago*	six-line racerunner, *Cnemidophorus sexlineatus*
great egret, *Casmerodius albus*	eastern hognose snake, *Heterodon platyrhinos*
northern harrier, *Circus cyaneus*	Cooper's hawk, *Accipiter cooperi*
North American mink, *Mustela vison*	cedar waxwing, *Bombycilla cedorum*
common muskrat, *Ondatra zibethicus*	red-tailed hawk, *Buteo jamaicensis*
marsh rice rat, *Oryzomys palustris*	whip-poor-would, *Caprimulgus vociferous*
swamp rabbit, *Sylvilagus aquaticus*	hermit thrush, *Catharus guttata*
	Red-bellied woodpecker, *Melanerpes carolinus*
Coastal Grassland/Prairie Habitats	barred owl, *Strix varia*
coastal cricket frog, *Acris crepitans*	white-eyed vireo, *Vireo griseus*
gulf coast toad, *Bufo valliceps*	Seminole bat, *Lasiurus seminolus*
spring peeper, *Pseudacris crucifer*	Bobcat, *Felis rufus*
green anole, *Anolis carolinensis*	nine-banded armadillo, *Dasypus novemcinctus*

4.6.1.1 Wildlife Habitats

Open water habitat generally is considered to be any aquatic habitat that lacks emergent, hydrophytic vegetation and is at least 2 meters deep. These habitats are maintained by rainfall, river and runoff inflow, and Gulf of Mexico tidal influences. Based on the presence of similar regional habitat and the wide range of salinity (fresh to saline), there is a high species diversity comprising at least 8 species of amphibians, 25 species of reptiles, 89 species of birds, and 8 species of mammals (Gosselink et al. 1979).

Emergent marsh wetland habitats within the Project area consist of fresh, intermediate, and brackish marsh. Salt concentrations governed by freshwater input from rainfall, river discharge, and tidal flows determine the occurrence of emergent marsh. These habitats support a multitude of wildlife species that includes at least 5 species of amphibians, 16 species of reptiles, 86 species of birds, and 10 species of mammals based on the presence of habitat and historical occurrence (Gosselink et al. 1979).

Coastal prairie/grassland habitats in the Project area, consisting of native grasslands, historically drained marshlands, and pastures, provide foraging area and/or cover for a variety of species. These species include approximately 10 species of amphibians, 19 species of reptiles, 94 species of birds, and 18 species of mammals based on presence of habitat and regional occurrence (Gosselink et al. 1979).

Coastal woodland/upland forest habitat types provide refuge to a variety of wildlife. This includes approximately 11 species of amphibians, 24 species of reptiles, 111 species of birds, and 19 species of mammals based on presence of habitat and regional occurrence (Gosselink et al. 1979).

The previously disturbed/developed areas are identified as open lands along the Project route, for example, on the edge of the Port Arthur Ship Canal, and those areas covered by SH 87 and road shoulders. No natural habitats of wildlife value occur, although the unpaved portions of the lands are vegetated by a variety of native and nonnative herbaceous and semi-woody plant species. Roadside ditches are utilized for forage grounds by wading birds and support a variety of invertebrate and amphibian species, but are not considered valuable wildlife habitat.

The impact of construction and operation of the proposed Project on wildlife would be the temporary alteration and permanent loss of habitat. Impacts of construction and operation of the Port Arthur LNG Project are expected to be minimal.

Initial clearing and construction activities would result in the disruption of approximately 1,497 acres of wildlife habitat comprising open water; emergent marsh; coastal grasslands/prairie; coastal woodland/upland forest; forested, shrub/scrub, and emergent wetlands; and developed or previously disturbed land. During clearing and grading, smaller, less mobile wildlife could experience direct mortality. Other wildlife would likely leave the Project area when construction begins. Displaced animals may relocate into similar nearby habitats. Stresses related to increased levels of competition could cause disruption of breeding cycles of some wildlife species, lower reproductive success, and reduced survival.

During operation, habitat within maintained areas would be altered, although restoration of disturbed locations would result in the restoration of wildlife habitat function for some species. In particular, grassland/upland pasture bird species, small mammals, amphibians, and reptiles would be able to utilize restored areas.

Long-term impacts would result from the permanent alteration of 198.2 acres of previously disturbed wildlife habitat at the LNG terminal site, including the permanent loss of approximately 82.5 acres of wetlands. Maintained areas during operation of the pipelines would result in the permanent loss of 3.22 acres for the MLVs and pig launchers and receivers and conversion of approximately 87.2 acres (74.1 acres of upland forest to open land and 13.1 acres of forested wetland habitat to emergent wetlands).

LNG Terminal

Habitat directly within the aboveground footprint of the LNG terminal components would be permanently lost. This habitat loss would result in the loss of existing, less mobile species occupying those areas as well as the loss of recruitment of new individuals that potentially would use these areas. Although

individuals of less mobile species would be lost, these losses would be minimal, and are not likely to affect the overall population of any given species in the area. Other than a permanent loss of habitat, we do not expect wildlife to be impacted by the operation of the LNG terminal. Operation of the marine basin would involve frequent berthing of large ships and an increase in large-vessel traffic in Sabine Pass and in the Port Arthur Ship Canal. Because such activities are already common in the vicinity of the LNG terminal, a significant impact due solely to the LNG terminal is not expected.

Disruption of wildlife movement patterns would result from construction of permanent aboveground facilities. Noise and light associated with facility operations would be expected to affect wildlife behavior, as would the general increase in human activity resulting from operation and maintenance activities.

The acreage of wildlife habitat lost due to the LNG terminal is not expected to cause significant impact on the faunal resources of the area. The proposed LNG site is surrounded by areas that provide similar and ample habitats for wildlife displaced during and after construction, including the J. D. Murphree WMA. Further, Sempra owns a total of 2,900 acres of land in the vicinity, of which 263.2 acres of wildlife habitat would be used for construction of the LNG terminal facilities. Once construction was completed, wildlife could re-occupy or continue to occupy the remaining 2,636.8 acres of available habitat on the Sempra-owned parcels. Because there are abundant unoccupied lands adjacent to the LNG terminal site, it is unlikely that there would be any cumulative impact on the region's wildlife, as most species can evacuate the construction area to adjacent, undisturbed areas.

Brackish marsh habitats and wetlands temporarily affected during construction of the proposed facilities would be restored to pre-construction conditions. Permanent impacts to brackish marsh habitats and wetlands under the jurisdiction of the COE would be mitigated through the creation of marshes and wetlands at a ratio prescribed by the COE and other regulatory agencies. Additionally, dredged material could be used for beneficial uses, potentially creating additional wildlife habitat. See sections 4.3 and 4.4 for further discussion of water and wetland impacts and mitigation.

Pipelines

Pipeline construction would temporarily affect a total of 1,233.8 acres of wildlife habitat, including open water, emergent wetlands and marsh, coastal grassland/prairie, upland and wetland forest, and some previously disturbed/developed land. Following construction of the proposed pipelines, all workspace would be restored to pre-construction contours and be allowed to return to its preconstruction vegetative state with the exception of 74.1 acres of upland forest and 13.1 acres of forested wetlands, which would be maintained in an herbaceous state as the maintained part of the 50-foot-wide permanent easement. In wetlands, a 10-foot-wide corridor, centered on the pipe, can be maintained in an herbaceous state and trees within 15 feet of the pipeline that are greater than 15 feet in height can be selectively cut and removed from the permanent right-of-way, in accordance with the Procedures. Long-term impacts would include the 87.2 acres of forest (74.1 acres of upland forest and 13.1 acres of forested wetlands) permanently cleared for for the new rights-of-way and 0.04 acre of wetland permanently converted to industrial use for the MLV sites at MPs 19.2 and 29.9. Other wetland areas and other potentially significant habitats located within the project area (see section 4.6.1.3) would be temporarily impacted during construction. Construction timeframes that would avoid or minimize impacts to wildlife species would be determined along with specialized construction and operation mitigation plans.

Although temporary and permanent impacts on food, cover, and water sources may occur, the species identified within the Project area are not dependent on the Project area for the overall fitness or reproductive viability of the populations as a whole. Many of the mammal, bird, reptile, and amphibian species are adaptive to changing habitat conditions and have the capability of temporarily expanding or

shifting their home ranges to find alternative sources of food, water, and shelter until the right-of-way habitats become re-established. The permanent pipeline rights-of-way would be restricted to 50 feet wide or less and would be maintained in an herbaceous state. In wetlands, the right-of-way would be allowed to revegetate naturally to preconstruction conditions. In addition, we are requiring Sempra to coordinate with NOAA Fisheries to develop restoration of marsh areas (see section 4.4.2.2).

4.6.1.2 Migratory Flyways

Migratory birds follow broad routes called "flyways" between breeding grounds in Canada and the U.S. and wintering grounds in Central and South America. The Sempra site is at the western edge of the Mississippi flyway and the eastern edge of the Central flyway. The Mississippi flyway extends from Alaska and central Canada to Patagonia, South America. The eastern boundary of the flyway follows the Mississippi River, while the western boundary extends through portions of Nebraska, Louisiana, and Arkansas. The Central flyway extends from Alaska and Canada into Mexico, bounded on the west by the Rocky Mountains, and to the east merges with the Mississippi flyway (Birdnature.com 2002).

The northern Gulf Coast is an important stopover for the Mississippi flyway, where the Trans-Gulf migrants cross the Gulf of Mexico. This requires a long flight over water and birds often reach land exhausted and require shelter, food, and water, some or all of which are found in stopover habitat. Preferred stopover habitat for Trans-Gulf migrants in the Gulf Coast are woodlands with a developed understory and riparian bottomland (Moore et al. 1990), although other habitat types are used, depending on the species. The key habitat value would be for "stopover" habitat for northbound birds of the Mississippi flyway during the spring migration, although some species use the habitat as a refueling area prior to the fall migration across the Gulf of Mexico.

In its comments on the DEIS, the FWS Albuquerque, New Mexico Office expressed concerns regarding migratory birds and rookeries in the vicinity of the proposed facilities. The FWS has recommended that bird rookeries and nesting islands be left undisturbed, and that all development operations be prohibited within 1,000 feet of rookery areas during the peak-nesting season from February 15 to September 1.

We reviewed the available data at the FWS Texas Coastal Program website (http://texascoastalprogram.fws.gov/TCWC.htm) and determined that, potentially, there are, or have been in the recent past, two rookeries very close to, or within 1,000 feet of, proposed construction areas. The Round Lake rookery is potentially within 1,000 feet of the proposed LNG terminal. During 2005, biologists performed observations of the Round Lake area to document the use or lack thereof, of this historic rookery. No use of the rookery was recorded in 2005 during this survey and FWS and TPWD staff members have acknowledged that no use occurred during the observation period. Trends in the monitoring databases reflect a dramatic drop in use of rookeries in proximity to the proposed facilities since 1995. Regardless, Sempra has agreed to conduct an overview of the Round Lake area rookery 30 days prior to commencement of construction, and has committed to avoid construction activities within 1,000 feet of the Round Lake area rookery, if it is active, between February 15 and September 1.

Construction of the LNG terminal could cause potential injury or mortality of migrating birds that may strike the LNG terminal facilities. Communication towers that can exceed 300 feet in height are known to be the source of large numbers of bird strikes and an estimated 4 to 5 million birds collide with them each year (Manville 1999). By comparison, building window collisions are estimated to take from 97 to 970 million birds per year, or from 1 to 10 birds per building annually in North America (Klem 1989, 1990; O'Connell 1998). In addition to radio towers and large structures, electric utility power lines also have been documented as a cause of avian mortality due to wire strikes.

The FWS also has expressed concerns with regard to project lighting, structures, and transmission lines and their potential hazards to migratory and nesting birds. Sempra plans to use sodium vapor lights shielded to direct the light toward specific areas, rather than broadcast over general areas. Sempra also plans to train personnel on the issue of bird strike mortality and, through periodic environmental training and posted flyers, remind staff to be observant for dead birds at or adjacent to buildings and structures. Personnel finding dead birds wouldwill be instructed to collect and freeze the specimens and record the date, time, and location of the birds. If more than five occurrences are documented at a single location within a one-month-period, Sempra has agreed to consult with a qualified biologist to review the potential factors involved with the mortality and to make recommendations to alleviate the problem. Mortality data would be made available for agency review upon request.

Studies on building strikes by birds generally focus not so much on the structures themselves, but the veneer of reflective or clear glass construction materials, the use of guy wires to support tall structures, or substantial lighting from either inside or outside sources (Klem 1990). Lighting is a particular concern, since it appears that migrating birds, which often fly at night, are drawn to artificial lights. Absent from the extensive literature available on bird strikes is any mention of storage tanks or other solid non-reflective/transparent man-made structures or natural solid objects (trees, hills, etc.).

The historical lack of favorable habitat would likely cause migratory species to be unattracted to the LNG terminal site, further reducing the likelihood of interaction with the LNG storage tanks (the tallest structures at the terminal). The LNG storage tanks would not be illuminated with high intensity lighting. The intensity and number of lights would be limited to what is required for security and operations. Due to the limited amount of suitable habitat historically present on the LNG terminal site, the lack of scientific literature reporting on bird striking storage tanks, and the low intensity lighting to be used, the likelihood of adverse effects on migratory birds from collisions with the LNG storage tanks is minimal.

The proposed facility would obtain electrical power from an outside power source and would need long distance power lines. The LNG tanks would be left in their light concrete non-reflective state. This design further reduces the likelihood of bird strikes since no reflective materials would be used and there would be no extensive lighting of the tanks, thus avoiding the two major sources of bird strikes on man-made structures.

The wildlife habitats crossed by the 3-Mile-Long Pipeline are similar to those found to occur on the LNG terminal site, but also would include the open water habitats and marshes of the Keith Lake Cut and Keith Lake. Most of the upland and wetland habitat along this route is anthropogenically disturbed and provides limited habitat value for migrating birds.

The 70-Mile-Long Pipeline route would affect about 189.1 acres of forested uplands and forested wetlands. Of this, approximately 84.8 acres of upland forest and forested wetland would be impacted (maintained in an herbaceous state) during operation. These areas are likely stopover habitats, but are not unique to the area. It is unlikely that the construction, placement, and/or operation of the 70-Mile-Long Pipeline would have long-term impacts on migratory birds.

The wildlife habitats crossed by the route of the relocation project are the same as found to occur on the LNG terminal site. No tidally influenced mud flats were observed along the route of the relocation project. Since the wildlife habitat types are relatively consistent throughout the property where both the LNG terminal and the relocation project would occur, impacts to migratory birds are not expected due to the relocation project.

4.6.1.3 Managed and Sensitive Wildlife Areas

The Project location is adjacent to the J. D. Murphree WMA and Sea Rim State Park, both of which are lands under the management of the TPWD. The J. D. Murphree WMA is a 24,250-acre tract of fresh, intermediate and brackish water within the prairie-marsh zone along the upper coast of Texas. The primary goal of the area is management and preservation of wetland habitats with an emphasis on waterfowl habitat management. Sea Rim State Park is located to the south and west of the proposed LNG terminal location. This is a multiple use state park comprising 4,141 acres of marshland with 5.2 miles of Gulf of Mexico beach shoreline.

The Taylor Bayou Heron Rookery occurs at the J. D. Murphree WMA located west of the LNG terminal site. The Project would not impact this area, as it is located more than 1 mile west of the LNG terminal site.

No federal wildlife refuges, state game or WMAs would be crossed by the proposed pipelines. The 70-Mile-Long Pipeline route would cross two private hunting areas, or hunt clubs. Land under the ownership and management for hunting by the Hawk Club is crossed by the proposed 70-Mile-Long Pipeline route between MPs 19.8 and 22.5. Land under the ownership and management for hunting by the Grey's Estate is crossed by the 70-Mile-Long Pipeline route between MPs 23.2 and 37.2 (see section 4.8.3). Sempra has stated that construction of the 70-Mile-Long Pipeline would occur outside the hunting season to avoid impacts to these hunting clubs.

4.6.2 Aquatic Resources

The main body of water in the Sabine River Basin is Sabine Lake, which is approximately 20 miles long and 8 miles wide. Sabine Lake receives water from the Sabine River, which drains 9,325 square miles in southern Louisiana and Texas, and the Neches River, which drains 7,948 square miles in southwest Texas. Sabine Pass connects Sabine Lake to the Gulf of Mexico and is naturally shallow, with an average depth of approximately 6 feet. However, the COE maintains a deep draft ship channel (the Sabine Pass Channel) at a depth of 40 feet below mean low tide (MLT) in Sabine Pass that connects the Jetty Channel in the Gulf of Mexico with the Port Arthur Ship Canal southeast of the LNG terminal site.

The proposed LNG terminal site is located on the western shore of the Port Arthur Ship Canal segment of the SNWW, approximately 10.5 miles north of the Gulf of Mexico. The Port Arthur Ship Canal is an artificially constructed waterway, which has undergone several modifications and maintenance-dredging operations since modification of the Sabine Pass area began between 1895 and 1899 (LADNR 2002). The COE constructed the portion of the SNWW bordering the site by dredging a channel along the western shore of Sabine Lake and placing the dredged material along the eastern slope of the newly formed channel, forming most of what is now Pleasure Island. Pleasure Island separates the Port Arthur Ship Canal from Sabine Lake (LADNR 2002).

The proposed pipeline routes would cross 84 waterbodies (16 crossings of 100 feet wide or greater), including 37 perennial streams, 2 lakes, 3 ponds, and 42 intermittent streams, in the Sabine Lake, Lower Neches, Lower Sabine, and the West Fork Calcasieu watersheds. Waterbodies crossed by the proposed pipeline routes support warmwater marine, estuarine, and freshwater fish communities. The 70-Mile-Long Pipeline route crosses four major rivers, including the West Pass of the Sabine River, the Houston River Canal, the Houston River, the Little River, and the West Fork (Hickory Branch) of the Calcasieu River, and spans several other streams, canals, and wetlands. The TPWD and LADFW classify fisheries in the Project area as marine fisheries and warm water fisheries. The following sections provide an overview of the fishery resources found within the Project area and potential impacts on these resources.

4.6.2.1 Fish and Invertebrates

The fisheries in the vicinity of the proposed terminal and 3-Mile-Long Pipeline are classified as either estuarine or marine. Further inland, where freshwater inflow from the Neches River, Sabine River, and other smaller tributaries occur, there is reduced mixing with marine waters and the fisheries become more estuarine and brackish, ultimately becoming freshwater fisheries. Aquatic organisms in the Project area reflect the great diversity of fish and invertebrate resources found in the surrounding coastal waters and the Gulf of Mexico. The ecological stability of aquatic resources, notably the abundance and diversity of fish and invertebrate species, is dependent in large part on salinity, substrate, and vegetation.

Life histories of many Gulf fish species also can be characterized as estuarine-dependent. These species typically spawn in the Gulf, allowing their larvae to be carried inshore by currents. Juvenile fish generally remain in these estuarine nurseries for about 1 year, taking advantage of the greater availability of food and protection that estuarine habitats afford. Upon reaching maturity, estuarine fishes either remain in the estuary, migrate to sea to spawn (returning to the estuary between spawnings), or migrate from the shallow estuaries to spend the rest of their lives in deeper offshore waters (Marx and Herrnkind 1986). Estuary-dependent species potentially occurring within the Project area include Gulf menhaden (*Brevoortia patronus*), shrimps, crabs, and drums/croakers. True-estuarine fishes, which inhabit estuaries throughout their entire life, that are likely to occur within the Project area include killifishes (*Fundulus* spp.), sheepshead minnow (*Cyprinodon variegatus*), mosquito fish (*Gambusia affinis*), silversides (*Menidia beryllina*), striped mullet (*Mugil cephalus*), Atlantic croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus*), hardhead catfish (*Arius felis*), silver perch (*Bairdiella chrysura*), hogchoker (*Trinectes maculatus*), puffer (*Sphoeroides parvus*), and ladyfish (*Elops saurus*).

Non-estuarine dependent fishes, including coastal pelagic marine fishes and freshwater fishes, also are likely to occur in the vicinity of the Project area. The major coastal pelagic families occurring in the region are Carcarhinidae (requiem sharks), Elopidae (ladyfish), Engraulidae (anchovies), Clupeidae (herrings), Scombridae (mackerels and tunas), Carangidae (jacks and scads), Mugilidae (mullets), Pomatomidae (bluefish), and Rachycentridae (cobia). Coastal pelagic species traverse shelf waters of the region throughout the year. Some species form large schools (e.g., Spanish mackerel), while others travel singly or in smaller groups (e.g., cobia). The major freshwater families occurring in the region are Lepisosteidae (gars), Amiidae (bowfins), Ictaluridae (catfishes), Anguillidae (freshwater eels), Cyprinidae (minnows and carp), and Centrarchidae (sunfishes, basses, and crappies) (Gosselink et al. 1979).

Benthic invertebrates are an important food source for fish and larger invertebrates. In addition, invertebrates are valuable indicators of water/sediment pollution and construction-related sediment disturbance. In general, populations of invertebrates increase from fall to spring in coastal Texas and Louisiana waters. Estuaries, such as the Sabine Lake estuary, often determine the shellfish resources of the Gulf of Mexico. Shellfish species range from those located only in brackish wetlands to those found mainly in saline marsh and inshore coastal waters. Sempra contractors conducted oyster assessments along the proposed pipeline routes in both Keith Lake and Sabine Lake (**appendix J**). No potential shellfish reef habitat was found in Keith Lake, while 0.8 percent of the substrate along the proposed right-of-way in Sabine Lake was characterized as reef habitat. One reef area was found between MPs 2 and 3 during pole soundings in Sabine Lake. Further investigation and delineation of the reef area revealed only shell fragments and that the reef does not currently support oysters or other bivalves.

The major waterbodies in the Project area provide habitat for a wide variety of aquatic invertebrates, which play an important role in the transfer of food energy to higher trophic levels within coastal waters. Dominant motile benthic species likely to occur in the shallow fringes of these major waterbodies include gastropods, such as oyster drill (*Thais haemostoma*) and moon snail (*Polinices lewisii*); and crustaceans, such as hermit crabs (*Clibanarius vittatus*) and mud crabs (*Rhithropanopeus harrisii*, *Neopanope texana*,

and *Panopeus herbstii*). Sessile macroepifauna, such as sea pansy (*Renilla mulleri*) and acorn barnacles (*Balanus* sp.) are found throughout the nearshore Gulf and are likely to occur within the Project area on hard surfaces such as pilings, rock jetties, and other structures (Hoese and Moore 1977).

Up to 15 species of penaeid shrimp can be expected to occur in the Project area, of which the brown (*Farfantepenaeus aztecus*) and white (*Litopenaeus setiferus*) are the most numerous. At least eight species of portunid (swimming) crabs are common residents of the coastal and estuarine waters of the northern Gulf of Mexico. Blue crabs (*Callinectes sapidus*) are the only species, however, located throughout the Gulf of Mexico that comprise a substantial fishery (Turner and Brody 1983).

Waterbodies and wetlands in the Project area include designated EFH and also provide nursery and foraging habitats that support a variety of economically important marine fishery species, such as striped mullet, Atlantic croaker (*Micropogonias undulates*), Gulf menhaden (*Brevoortia patronus*), spotted seatrout (*Cynoscion nebulosus*), and blue crab (*Callinectes sapidus*). NOAA Fisheries commented that some of these species also serve as prey for other fish species managed under the Gulf of Mexico Fisheries Management Council (GMFMC) (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NOAA Fisheries (e.g., billfishes and sharks). The wetlands also produce nutrients and detritus, important components of the aquatic food web. Our EFH assessment is provided in section 4.6.3, below and in more detail in **appendix K**.

4.6.2.2 Commercial and Recreational Fisheries

The fishery resources found within the Project area can be classified as warmwater marine, warmwater estuarine, and warmwater fresh (freshwater areas are limited to the pipeline route). **Table 4.6.2.2-1** is a list of representative commercial and game aquatic species known to occur in the Project area.

TABLE 4.6.2.2-1

Game and Commercial Aquatic Species Known to Occur in the Project Area

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 ocellatus*	Warmwater estuarine
Spanish mackerel	*Scomberomorus maculates*	Warmwater marine
Atlantic croaker	*Micropogonias undulatus*	Warmwater marine/estuarine
Gulf menhaden	*Brevoortia patronus*	Warmwater marine/estuarine
black drum	*Pogonias cromis*	Warmwater marine/estuarine
gafftopsail catfish	*Bagre marinus*	Warmwater marine/estuarine
sand seatrout	*Cynoscion arenarius*	Warmwater estuarine
sheepshead	*Archosargus probatocephalus*	Warmwater marine/estuarine
southern flounder	*Paralichthys lethostigma*	Warmwater marine/estuarine
spotted seatrout	*Cynoscion nebulosus*	Warmwater estuarine
striped mullet	*Mugil cephalus*	Warmwater marine
spotted gar	*Lepisosteus oculatus*	Warmwater fresh/estuarine
bowfin	*Amia calva*	Warmwater fresh/estuarine
blue catfish	*Ictalurus furcatus*	Warmwater fresh
channel catfish	*Ictalurus punctatus*	Warmwater fresh
gizzard shad	*Dorosoma cepedianum*	Warmwater fresh/estuarine
threadfin shad	*Dorosoma pentense*	Warmwater fresh/estuarine
largemouth bass	*Micropterus salmoides*	Warmwater fresh
black crappie	*Pomoxis nigromaculatus*	Warmwater fresh
red swamp crayfish	*Procambatus clarkii*	Warmwater fresh
White River crayfish	*Procambatus zonangulus*	Warmwater fresh

Source: Gosselink et al. 1979.

Of the total fishing effort in Texas bays and passes between 1988 and 1998, the Sabine Pass system received a yearly average of 8.8 percent of the private-boats and 0.6 percent of the party-boats. The Sabine Pass system accounts for approximately 12.5 percent of the private-boat landings and less than 1 percent of the party-boat landings. The principle finfish species harvested by sport-boat anglers in the Project area are: Atlantic croaker (*Micropogonias undulates*), black drum (*Pogonias cromis*), gafftopsail catfish (*Bagre marinus*), red drum (*Sciaenops ocellatus*), sand seatrout (*Cynoscion arenarius*), sheepshead (*Archosargus probatocephalus*), southern flounder (*Paralichthys lethostigma*), and spotted seatrout (*Cynoscion nebulosus*) (Green et al. 2002). Other economically important marine fishery species include the striped mullet, Gulf menhaden, and blue crab (*Callinectes sapidus*).

In 2000, approximately 27 million pounds of seafood worth more than $42.5 million were harvested in the Texas bay systems, of which the Sabine Lake system accounted for approximately 1.6 million pounds valued at more than $1.2 million. Blue crab dominates the commercial fisheries harvest in the Project area. In 2000, more than 1.5 million pounds of blue crab worth more than $1.1 million was harvested from the Sabine Lake system. This accounted for approximately 96 percent of the commercial landings and 91 percent of the ex-vessel value of fishes harvested from the Sabine Lake system in 2000. Other commercially important species include white shrimp, Atlantic croaker, striped mullet, southern flounder, and unclassified baitfish (Auil-Marshalleck et al. 2002). The Project area likely provides habitat for seven of these species, including the Atlantic croaker, black drum, gafftopsail catfish, sheepshead, southern flounder, blue crab, and striped mullet.

In addition to blue crab, shrimp, and fish species, the red swamp crayfish (*Procambatus clarkii*) and the White River crayfish (*Procambatus zonangulus*) represent a major recreational and commercial freshwater fishery within Cameron Parish. Louisiana produces over 90 percent of the domestic crayfish crop within the U.S. Between 75 million and 105 million pounds of crayfish are harvested annually from man-made ponds (often times rotated with rice) and natural wetlands. The total economic revenue to Louisiana from crayfish exceeds $120 million annually (Reed 2003).

4.6.2.3 Construction Impacts to Aquatic Resources

Potential impacts to aquatic resources from Project construction and operation include those associated with dredging of the berth area and pipeline construction across waterbodies and through wetlands.

4.6.2.4 LNG Terminal

The dredging of the slip and turning basin would affect approximately 38.3 acres. This includes the slip area, the area from the western edge of the Port Arthur Ship Canal to the existing shoreline, and the area on the east side of the Port Arthur Ship Canal for the turning basin. These areas would be dredged to minus 40 feet MLLW. The dredging of the slip would create approximately 82 acres of deep water habitat. Materials dredged from these areas would be placed in a DMPA and ultimately could be used in a beneficial manner.

Effects on fisheries would be limited to those species found along the edge of the Port Arthur Ship Canal where the new slip would be formed. Fish would relocate from the area of the dredging activity, with the duration dependent on the length of time for recolonization of food sources and habitat. The pilings used for the various marine facilities would provide substrate for food sources which, in time, would attract fish to the slip.

Suspended sediments from dredging and dewatering can impact benthic species by adversely affecting water quality. The primary mechanisms of impact on biota from dredging and dewatering of dredge spoil

is interference with respiration, feeding, and alteration of habitat suitability. Suspended particles can physically clog breathing and feeding organs or can result in lowered oxygen levels through increases in chemical oxygen demand. As suspended sediments settle out of the water column, they can smother immobile benthic invertebrates, such as barnacles, sponges, and hydroids. However, given the existing water quality conditions with relatively high suspended sediment concentrations, dredging would not be expected to noticeably increase turbidity in the already turbid waters of the Ship Canal.

Resuspension of sediments by cutterhead dredges has been studied by the COE. McLellan et al. (1989) describes resuspension characteristics of the most commonly used dredges. As discussed in the report, the cutterhead suction dredge, which would be used for this Project, resuspends the lowest amounts of sediment at the dredging location, primarily because of the net suction of the cutterhead. The turbidity around the suction head returns to background levels within several tens of feet from the cutterhead. By contrast, hopper dredges and mechanical dredges can create much larger sediment plumes. Because of the enclosed nature of the berth dredging and the large volumes of water required to accomplish the dredging, there should be a net movement of water towards the dredge, limiting the migration of sediments outside of the dredging vicinity.

Overall impacts to the fishery resources in the LNG terminal area generally would be minimal and short-term. There would be a net gain of new deeper open water habitat that would be created through the conversion of coastal land into open water for the marine terminal basin and berths, and the conversion of shallow muddy-bottomed open water habitats to similar but deeper open water habitats in the Port Arthur Ship Canal between the berthing area and the navigation channel. Species that currently occupy the shallow-water habitats also inhabit the deeper water habitats that currently exist in the adjacent Port Arthur Ship Canal, and there would be no loss of habitat due to dredging. This activity would be comparable to periodic maintenance dredging of the Ship Canal. The marine terminal also would create some additional hard substrate areas on the submerged pilings and other structures that would allow for the growth of attached organisms and the creation of three-dimensional structures that are used by some species for refuge. Fish and benthic organisms in the area would be impacted slightly during the construction phase of the marine terminal basin, but recruitment and re-colonization would replenish the species with a minor potential for a subtle shift in species using the slip area.

The portion of the shoreline from which the berthing area would be excavated has little natural habitat resource value due to anthropogenic impacts. Sempra has not yet finalized its Aquatic Resources Mitigation Plan. Sempra has provided a Revised Draft Wetland Mitigation Plan (**appendix G**) that will be reviewed by the COE, NOAA Fisheries, and other federal and state agencies and would address the possibility of providing a more contiguous habitat of higher quality for fish, crabs, and shrimp (see section 4.4.3). Given the steep shoreline and limited tidal wetlands in the berthing area, little nutrient export is likely occurring, and the buffering of wave energy is minimal. The steep shoreline and largely unvegetated shallow water areas along the LNG terminal site border within Sabine Pass provide minimal foraging area for mobile predators since prey species are more likely concentrated within larger tidal wetlands further inland from the Sabine Lake estuary. The area within the new marine basin would provide for increased protection from wave energy compared to the currently exposed shoreline.

In addition to the alteration/creation of aquatic habitats, the primary impacts to fishes associated with dredging include entrainment of organisms by dredging machinery and increased turbidity due to the re-suspension of bottom sediments (Nightingale and Simenstad 2001). Incidental take of fish due to entrainment during the dredging of the marine terminal basin would be expected, but would not be extensive enough to have a significant impact on the fishery resources of the area.

NOAA Fisheries defines the low salinity season for the Sabine Lake area as March through May and the high salinity season as August through October. The remaining months are transitional months. Project

dredging, depending upon the size of dredge used, is expected to take up to 12 months, which means that the dredging would extend through a full cycle of seasons. Given the location of the dredging, the proposed location of the DMPA, and the comparatively small volumes of water moved, the dredging is not expected to have a significant effect on salinity either at the berth or the DMPA. Dredging-related salinity changes should, therefore, have essentially no effect on any of the species in the area.

Other potential effects of construction include temporary interruption of fish and invertebrate movement in and out of the estuary either during development changes or during foraging. Construction may cause temporary emigration of fish populations from the immediate area in order to avoid areas of elevated suspended sediments. However, it is unlikely that relocation or disrupted migration would significantly affect fish populations because construction activities would be short-term and localized.

Direct spills of petroleum or other toxic products into waterbodies during construction and facility operation could be harmful to aquatic organisms, depending on the type, quantity, and concentration of the spill. To reduce the potential for direct surface water contamination, Sempra would implement the procedures in its SPCC Plan, including restrictions on refueling equipment and storing fuel and other potentially toxic materials at least 100 feet from waterbodies during construction (see **appendix D**).

4.6.2.5 Pipelines

Construction of the proposed pipelines would result in the temporary alteration of open water and temporary disturbance of estuarine and palustrine wetland habitats. Impacts on fisheries resources resulting from pipeline construction activities at waterbody crossings can include sedimentation and turbidity, alteration or removal of instream and stream bank fish cover, introduction of water pollutants, or entrainment of small organisms during hydrostatic testing. Studies generally have indicated that pipeline construction through waterbodies results in temporary impacts on streams and rivers, and that there are no long-term effects on water temperature, pH, dissolved oxygen, benthic invertebrate populations, or fish populations (Vinkour and Shubert 1987; Blais and Simpson 1997).

Increased sedimentation and turbidity resulting from construction of the pipeline would have the greatest potential to adversely affect fishery resources. Sedimentation can bury fish eggs, while turbidity affects juvenile and adult fish by reducing oxygen uptake by the gills. Because most of the fish species spawn offshore, increased sedimentation from pipeline construction should not affect nesting sites where eggs and young fry concentrate. Studies have indicated that in-stream turbidity levels increase during construction, but decrease rapidly after construction activities are completed (Vinkour and Shubert 1987; Blais and Simpson 1997). Turbidity also reduces photosynthesis of aquatic vegetation, which results in reduced dissolved oxygen levels in the water column, particularly near the bottom in areas of still or barely moving water.

The proposed pipelines would cross 84 perennial and intermittent waterbodies (see **table 4.3.3-1**). Pipeline construction and restoration activities within and adjacent to these waterbodies would be conducted mostly in accordance with our Procedures to minimize impacts to fisheries, fish habitat, and other aquatic organisms. Sempra proposes to conduct the majority of the pipeline construction between February 1 and November 31, 2008. The Procedures state that instream work for warmwater fisheries would be completed between June 1 and November 30 unless expressly permitted or further restricted by the appropriate state agency in writing on a site-specific basis. For the Sabine Pass LNG and Pipeline Project, the LADWF stated that, while there are no designated timing windows for instream construction work, requests are reviewed on a case-by-case basis during project permitting. Sempra would be required to comply with permit conditions and applicable crossing windows.

4.6.2.6 Sabine and Keith Lake Construction

Pipeline construction in Sabine and Keith Lakes would involve trenching and temporary stockpiling of excavated sediments adjacent to the pipeline trench. Approximately 301.8 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Sabine Lake due to construction of the 70-mile-long natural gas send out pipeline right-of-way. Additional areas would be disturbed by use of extra workspaces as listed in **appendix I**, **table I-1**. Approximately 12.9 acres of bottom sediments in Sabine Lake would be avoided through directional drills. Approximately 11.9 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Keith Lake due to construction of the 3-mile-long natural gas send out pipeline to the NGPL pipeline. An additional 1.8 acres of bottom sediments would be disturbed by the one workspace in Keith Lake.

Alteration of benthic community patterns could render the area of the pipeline rights-of-way temporarily unavailable as feeding areas or habitat for fishes or other bottom feeding species. The duration of this impact would be for the length of construction activities plus benthic recolonization time. For all EFH, any adverse environmental consequences would be minor due to the temporary increase in turbidity and suspended sediments. Effects on recreational and commercial fisheries would be minimal considering the temporary nature of the disturbance from pipeline construction activity. There would be no impacts from the operation of the pipelines.

4.6.2.7 Stream Crossings

The instream open-cut construction method would result in short-term increases in turbidity and siltation downstream of the pipeline crossing sites. The increased siltation may cause decreased flow of oxygenated water to benthic organisms and fish eggs, resulting in degradation of benthic and spawning habitat. Direct loss of spawning habitat, benthic invertebrates, and protective cover may occur at the pipeline crossing location due to trenching and backfilling. However, any sedimentation and turbidity resulting from construction would be short-term. Sempra proposes to follow our Procedures (**appendix D**), section V.B.1, which allows for construction activities to occur between June 1 and November 30 in warm water fisheries, unless expressly permitted or further restricted by the appropriate state agency. This construction time window allows activities to be performed during summer months, which are typically low-precipitation months. This minimizes the potential for negative effects of release and transport of sediment downstream during critical egg laying and egg incubation periods.

Open-cut construction would require clearing of streamside vegetation, resulting in reduced shading and increased water temperatures in some of the warmwater streams. However, since the stream bank clearing would be limited and mostly would occur adjacent to previously cleared rights-of-way, the effect is expected to be minimal. Downstream water temperatures would not be significantly increased. The adoption of the Procedures, which limit vegetation maintenance adjacent to waterbodies and allow a riparian strip at least 25 feet wide to permanently revegetate with native plants across the right-of-way, would reduce the long-term effects of construction. In addition, adherence to the stream bank restoration and revegetation guidelines in the Procedures would minimize the potential for streambank erosion.

4.6.2.8 Hydrostatic Testing

Hydrostatic testing of the integrity of the completed pipelines would occur following construction, which would require that water is withdrawn from the Houston River Canal, the Sabine River, and/or other permitted sources, along the pipeline routes. Water withdrawal could entrain fish eggs and juvenile fish. To minimize the potential for entrainment, Sempra would cover the intake hose with an adequately sized mesh screen. Additionally, Sempra does not intend to chemically treat the hydrostatic test water; thus, impacts to fisheries related to hydrostatic testing are expected to be minimal.

4.6.2.9 Spills

A fuel spill in or near waterbody crossings could release contaminants, which could affect fish directly or indirectly through changes in food sources or contamination of the water. Adherence to the SPCC Plan would reduce the potential of a spill and the response time for control and cleanup of a spill, should one occur. Therefore, the probability of a spill of hazardous materials would be reduced and temporary or permanent impacts to fisheries are expected to be negligible.

Overall, the impact of pipeline construction on fish and other aquatic organisms would be expected to be localized and short-term. In addition, other federal, state, or local agencies may require Sempra to implement additional protective measures as part of the environmental permitting process.

4.6.2.10 Operational Impacts to Aquatic Resources

LNG Terminal

Post-construction and operational impacts on aquatic resources would be minimal and primarily associated with periodic maintenance dredging in the berthing area. Maintenance dredging activities would most likely be performed using a conventional barge-mounted hydraulic cutter suction dredge and dredged materials would be deposited as agreed in consultation with the COE, Texas, and Louisiana state agencies. Long-term maintenance dredging would be conducted in accordance with applicable federal or state regulations. Any permitting or agency coordination efforts would be conducted at the time of the maintenance activities to accommodate the current environmental or regulatory conditions and requirements at that time. Sempra anticipates that maintenance dredging would occur approximately on a 2-year cycle and would necessitate the removal of approximately 1,000,000 cubic yards of material during each episode. Sempra has analyzed several options for placement and beneficial reuse of the dredged material and, because it concluded that the preferred option for maintenance dredging would be to coordinate the terminal maintenance dredging with the COE maintenance dredging of the Port Arthur Ship Canal, it would effectively necessitate using the same disposal areas as the COE. Regardless, ongoing maintenance dredging would require ongoing coordination with and input from the COE.

The increased ship traffic (about 360 LNG ships per year) represents a small incremental increase in the total annual vessel traffic in the Project area and would not result in a measurable increase in aquatic impacts. Over 1,400 freighters and tankers with drafts in excess of 18 feet, and another 2,300 with drafts less than 18 feet, used the SNWW in 2001. Sempra would have to prepare a SPCC Plan as part of its NPDES permit for stormwater management during facility operation that would address measures to minimize the potential for spills and leaks to enter the aquatic environment and spread to more distant locations. In addition, Sempra would be required to comply with the conditions of other federal and state permits for stormwater control.

Sempra would utilize a LNG vaporization system consisting of 12 shell-and-tube LNG vaporizers (two as spares) each sized for 305 million standard cubic feet per day (MMscf/d). The heat source to the vaporizers would be heated water. Heat for the LNG vaporization would be supplied from the burning of natural gas to heat water that would be circulated through the shell side of the vaporizers. In this process, water is not condensed from the atmosphere and no disposal or treatment methods would be required.

Ballast Water

The LNG ships associated with the proposed project could import or export exotic species into or out of the Sabine/Neches Waterway. LNG ships would arrive at the LNG terminal fully loaded with LNG from

locations throughout the world. To maintain a constant draft during the unloading operation, the LNG ship would bring on ballast water (about 8 to 18 million gallons, depending on the size of the ship) during transfer of its LNG cargo and retain this ballast water until after the LNG ship departs the waterway. The absence of ballast water discharges within the waterway would decrease the potential for importing an exotic species. The intake of ballast water may also result the impingement, entrainment, or loss of aquatic resources, especially larvae and eggs. In addition to water withdrawn for ballast, LNG ships may also withdraw water for cooling the ship boilers. The specific volumes needed for this operation are not available; however, based on the limited annual LNG ship traffic, it will not result in appreciative impingement and entrainment impacts beyond what is described for ballast water.

Pipelines

Post-construction or operational impacts of the pipelines are expected to be minimal. Restoration of the vegetation along the rights-of-way and extra work spaces would minimize erosion potential relative to waterbodies. Minimal impact on fisheries is expected from maintenance mowing or manual removal of woody vegetation in the vicinity of the pipeline rights-of-way, as maintenance would be in accordance with our Plan and Procedures. Adherence to the Plan and Procedures would allow for the continued reestablishment of vegetation along the edges of the waterbodies minimizing long-term effects to the fisheries. Conservation measures outlined in the Procedures, consistent with federal and state requirements, would be implemented to avoid maintenance work within streams where adverse conditions would be created during spawning period(s). The greatest impacts would be from the turbidity created by the placement of the 70-mile pipeline across Sabine Lake, but this impact would be localized and short-term. Suction dredging would reduce the risk of impact to benthic infauna, benthic fish eggs, and larvae. The use of HDD to cross under the Ship Channel would further reduce aquatic impacts.

4.6.3 Essential Fish Habitat

In 1996, new habitat conservation provisions were added to the Magnuson-Stevens Fishery Conservation Management Act (MSFCMA) that mandated the identification of EFH for managed species. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1802(10)). The MSFCMA granted the NOAA Fisheries legislative authority for fisheries regulation in the U.S. within a jurisdictional area located between 3 and 200 miles offshore, depending on geographical location. NOAA Fisheries also was granted legislative authority to establish eight regional fishery management councils, each responsible for the proper management and harvest of finfish and shellfish resources within their respective geographic regions. Fishery management councils developed Fisheries Management Plans (FMP), which outline measures to ensure the proper management and harvest of the finfish and shellfish within these waters. The Sabine Pass estuary lies within the management jurisdiction of the Gulf of Mexico Fisheries Management Council (GMFMC). **Table 4.6.3-1** lists invertebrate and fish species that are managed by the GMFMC for which EFH has been identified.

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

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

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

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

4. **Agency Response** – The action agency must respond to NOAA Fisheries within 30 days of receiving NOAA Fisheries' recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH.

TABLE 4.6.3-1

Invertebrate and Fish Species Managed by the Gulf of Mexico Fishery Management Council

for which Essential Fish Habitat has been Identified

Common Name	Scientific Name
Invertebrate Species	
White shrimp	*Litopenaeus setiferus*
Brown shrimp	*Farfantepenaeus aztecus*
Pink shrimp	*Farfantepenaeus duorarum*
Royal red shrimp	*Pleoticus robustus*
Stone crab	*Menippe* spp.
Spiny lobster	*Panulirus argus*
Coral complex	
Red Drum	
Red drum	*Sciaenops ocellatus*
Coastal Pelagic Fishes	
Cobia	*Rachycentron canadum*
Dolphin	*Coryphaena hippurus*
King mackerel	*Scomberomorus cavalla*
Spanish mackerel	*Scomberomorus maculatus*
Bluefish	*Pomatomus saltatrix*
Little tunny	*Euthynnus alletteratus*
Cobia	*Rachycentron canadum*
Bonnethead shark	*Sphyrna tiburo*
Reef Fishes	
Red grouper	*Epinephelus morio*
Gag grouper	*Mycteroperca microlepis*
Scamp grouper	*Mycteroperca phenax*
Black grouper	*Mycteroperca bonaci*
Gray snapper	*Lutjanus griseus*
Red snapper	*Lutjanus campechanus*
Vermillion snapper	*Rhomboplites aurorubens*
Lane snapper	*Lutjanus synagris*
Yellowtail snapper	*Ocyurus chrysurus*
Tilefish	*Lopholatilus chamaeleonticeps*
Greater amberjack	*Seriola dumerili*
Lesser amberjack	*Seriola fasciata*
Gray triggerfish	*Balistes capriscus*

We incorporate EFH consultations for the Port Arthur LNG Project with the interagency coordination procedures required under NEPA. **For purposes of reviewing this Project under NEPA, the FERC is the lead federal agency. As such, the FERC requests that NOAA Fisheries consider this document as notification of initiation of EFH consultation. An assessment of potential effects of the entire**

Project (including the LNG terminal and pipelines) is included below. A more detailed assessment is contained in appendix K.

4.6.3.1 Federally Managed Species

Aquatic and tidally influenced wetland habitats in the Project area have been designated as EFH for postlarval, juvenile, and subadult red drum (*Sciaenops ocellatus*); adult and subadult Spanish mackerel (*Scomberomorus maculatus*); juvenile and subadult white (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*); and late juvenile, subadult, and adult bonnethead shark (*Sphyrna tiburo*) (NOAA Fisheries 2004). Categories of EFH include tidally influenced marsh (estuarine emergent wetlands), tidally influenced water bottoms (estuarine mud substrates), and tidally influenced waters (estuarine water column). **Table 4.6.3-2** summarizes the seasonal abundance data of each of the EFH designated species within the Project area and the seasonal relative abundance for each of these species. NOAA Fisheries issued a letter to Sempra on August 17, 2004, indicating that the proposed Project facilities would be adjacent to and include areas identified as EFH for postlarval, juvenile, and sub-adult red drum; adult and sub-adult Spanish mackerel; and juvenile and sub-adult white and brown shrimp. In their comments on the draft EIS, NOAA Fisheries indicated that EFH has been designated for late juvenile, subadult, and adult bonnethead shark in the portion of the proposed pipeline right-of-way within Sabine Lake.

TABLE 4.6.3-2

Relative Abundance of EFH Designated Species within the Project Area

		Relative Abundance[a]			
Species	**Life Stage[b]**	**Low Salinity (March-May)**	**Increasing Salinity (June-July)**	**High Salinity (Aug.-Oct.)**	**Decreasing Salinity (Nov.-Feb.)**
brown shrimp (*Farfantepenaeus aztecus*)	Adult	C	C	C	R
	Juvenile	A	A	A	C
white shrimp (*Litopenaeus setiferus*)	Adult	C	C	HA	HA
	Juvenile	HA	HA	HA	HA
red drum (*Sciaenops ocellatus*)	Adult	R	R	C	R
	Juvenile	C	C	C	C
Spanish mackerel (*Scomberomorus maculatus*)	Adult	R	R	R	R
	Juvenile	R	R	R	NP
bonnethead shark (*Sphyrna tiburo*)	Adult	N/A	N/A	N/A	N/A
	Juvenile	N/A	N/A	N/A	N/A

[a] Relative abundance provided for salinity seasons as provided by GMFMC (EFH maps) and was determined as the highest monthly relative abundance value in the Estuarine Living Marine Resources database for that salinity season.
[b] Life stages for which EFH is mapped include only adults and juveniles.
R=Rare, C=Common, A=Abundant, HA=Highly Abundant, NP = Not Present, N/A=Similar Data Not Available.

Table 4.6.3-2 includes general seasonal distribution information for Sabine Lake EFH derived from NOAA Estuarine Living Marine Resources (ELMR) Abundance and Distribution Maps. The expanded EFH Assessment contains additional detailed ELMR life history information for each EFH species within varied salinity zones. The following subsections provide species/life stages information for EFH identified for Sabine Lake.

EFH Species Accounts

Brown Shrimp (*Farfantepenaeus aztecus*). Brown shrimp inhabit coastal waters from low tide to a depth of approximately 110 meters throughout the Gulf of Mexico, but are most abundant off the coasts of Texas, Louisiana, and Mississippi. Non-spawning adults prefer turbid waters to soft sediments (i.e., mud and sand). In the spring and fall, adult brown shrimp move to slightly deeper waters (46 to 91 meters) to spawn. Brown shrimp eggs are demersal (benthic) and usually hatch within one day at temperatures greater than 24°C. Larval brown shrimp are most abundant offshore, but do occur in waters that range from 0 to 82 meters deep. Post-larval brown shrimp migrate to shallow vegetated habitats in estuaries in the spring, typically reaching their destination between February and April (with another minor peak in the fall). Late post-larval and juvenile brown shrimp are most abundant in shallow (less than 1 meter) estuarine habitats in the spring and early summer, but typically are present through the fall.

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

Although adult brown shrimp typically inhabit offshore waters, there is a high likelihood that they occur in the area adjacent to the Project area. Adult brown shrimp are known to prefer habitat such as turbid waters and soft sediments that would be commonly found in Sabine Lake, Sabine Pass and possibly the Ship Channel. Furthermore, the GMFMC (2003) considers adult brown shrimp common in the Sabine Lake estuary outside the low salinity season, which lasts from March through July. Because juvenile brown shrimp also prefer marsh edge habitats, there also is a high probability that they occur in intertidal brackish marshes of Sabine Lake during high tides.

White Shrimp (*Litopenaeus setiferus*). Non-spawning adult white shrimp inhabit offshore waters in the winter and move inshore in the spring. Spawning generally occurs offshore (limited in bays and estuaries), typically in water less than 27 meters deep, from spring to late fall (spawning peaks in the summer between June and July). Eggs are demersal and share the same distribution as spawning adults. Larval white shrimp hatch within 12 hours of spawning and begin to migrate through passes toward estuaries as they develop into post-larvae. Estuarine migration peaks between June and September.

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

According to the GMFMC (2003), adult white shrimp are highly abundant in the Sabine Lake estuary from August through February and common throughout the rest of the year. With the exception of salinity, white shrimp have habitat preferences similar to those of brown shrimp, and therefore there is a high probability that they occur in the open water portion of the Project area. The GMFMC (2003) considers juveniles highly abundant year-round. Juvenile white shrimp prefer turbid estuaries and marsh edges. Therefore, there is a high probability that juvenile white shrimp occur in both the open water and intertidal brackish marsh habitat types adjacent to the Project area.

Red Drum (*Sciaenops ocellatus*). In the Gulf of Mexico, red drum occur in a variety of habitats, ranging from depths of about 40 m offshore to very shallow estuarine waters. They commonly occur in virtually all of the Gulf's estuaries (GMFMC 1998), where they are found over a variety of substrates including sand, mud and oyster reefs. Red drum can tolerate salinities ranging from freshwater to highly saline, but optimum salinities for the various life stages have not been determined. Types of habitat occupied depend upon the life stage of the fish. Spawning occurs in deeper water near the mouths of bays and inlets, and on the Gulf side of the barrier islands (Perret et al. 1980) from September through November. Eggs typically hatch in late summer and early fall mainly in the Gulf, and larvae are transported into estuaries where the fish mature before moving back to the Gulf (Pattillo et al. 1997). Larval red drum are most abundant in estuaries from mid-August through late November. Estuarine wetlands are especially important to larval, juvenile and subadult red drum. Yokel (1966) concluded that abundance of red drum varied directly with the estuarine area (habitat). An abundance of juvenile red drum has been reported around the perimeter of marshes in estuaries (Perret et al. 1980). Young fish are found in quiet, shallow, protected waters with grassy or slightly muddy bottoms (Simmons and Brewer 1962). Within these estuarine nurseries, larvae, post-larvae, and juveniles prefer habitats protected from currents with submerged and emergent vegetation and muddy substrates, but also tolerate non-vegetated hard and soft-bottomed areas. Larval and post-larval red drum feed primarily on copepods, whereas juveniles feed on a wide variety of small invertebrates. Juvenile red drum become most abundant in early winter. Much like adult red drum, late juveniles utilize a wide variety of habitats. However, they still prefer protected waters and do not become abundant in open waters until mid-September to early October. Estuarine wetlands are very important to larval and juvenile red drum. While adult red drum use estuaries, they tend to spend more time offshore as they age. Schools of large red drum are common in deep Gulf waters. Shallow bay bottoms or oyster reef substrates are especially preferred by subadult and adult red drum (Miles 1950). Adult red drums are roving predators that opportunistically feed on a variety of invertebrate and vertebrate prey including crab, shrimp, and other fishes. ELMR data for Sabine Lake indicate that adult red drum are reported as rare in Sabine Lake throughout the year, except for periods of higher salinities, from about April through the end of the year, when they are common. Juvenile red drum are reported as common at all salinities throughout the year. ELMR reports that eggs, larvae and spawning adults are not present in the Sabine Lake estuary.

There is a low probability of adult red drum occurring in the Project area because they are rare in the Sabine Lake estuary most of the year, are generally found in deeper waters, and tend to spend more time offshore as they age. There is a moderate probability of juvenile red drum occurring in the shallow open water and intertidal brackish marsh habitats because the GMFMC (2003) considers juvenile red drum to be common in the Sabine Lake estuary and juveniles prefer protected waters and estuarine wetlands.

Spanish Mackerel (*Scomberomorus maculates*). Spanish mackerel are pelagic, occurring to 75-meter depths throughout the coastal zone of the Gulf. Adults usually are found in neritic waters and along coastal areas. Spanish mackerel will inhabit estuarine areas, especially the higher salinity areas, during seasonal migrations, but are considered rare and infrequent in many Gulf estuaries. Spawning grounds are offshore, where spawning occurs from May to October. Nursery areas are in estuaries and coastal waters year-round. Larvae are most frequent offshore over the inner continental shelf in marine waters, most frequently in water depths from 9 to about 84 meters but are most common in less than 50 meters. Juveniles are found offshore and in beach surf, and sometimes in estuarine habitat. Although they occur in waters of varying salinity, juveniles appear to prefer marine salinity and generally are not considered estuarine dependent. Clean sand appears to be the substrate preference of juveniles; while preferences of other life stages are unknown (GMFMC 1998). ELMR data indicate that adults are rare in the Sabine Lake system except from April through September. Juveniles are reported as rare at moderate to higher salinities from May through August. Eggs, larvae, and spawning adults are not present in the estuary.

Bonnethead Shark (Sphyrna tiburo). The bonnethead is a small shark species commonly found in shallow coastal waters and estuaries of the Gulf of Mexico and the southwest Atlantic Ocean. These locations provide EFH that include warmer water temperatures, bottom types that include sand, mud, and seagrass, and millions of acres of estuarine habitat.

Adults (≥85 cm total length [TL]) range from the Florida Keys to Mobile Bay, AL and west to South Padre Island, TX (NOAA Fisheries 2004c). Adult bonnethead habitat association data includes water depths of 3.9 meters (m) (1.5-6.5 m), water clarity of 130.9 centimeters (cm) (50.0-400.0 cm), temperatures of 27.9°C (22.2-30.5°C), salinities of 30.3 parts per thousand (ppt) (26.1-24.8 ppt), and dissolved oxygen concentrations of 5.1 milligrams per liter (mg/L) (3.2-6.6 mg/L) (Carlson 2003).

Late juveniles and subadults (51 to 84 cm TL) range from the Mississippi River westward to the Rio Grande River (Texas/Mexico border). Inshore and estuarine areas made up of sand, mud, and seagrass bottoms bordered by wetlands are important as pupping and nursery grounds for juvenile stages (NOAA Fisheries 1999). Juvenile habitat association data includes water depths of 3.6 m (1.5-5.0 m), water clarity199.0m (50.0-370.0 m), temperatures of 27.9°C (20.2-31.3°C), salinities of 30.7 ppt (25.8-34.3 ppt), and dissolved oxygen levels of 5.8 mg/L (3.2-6.6 mg/L) (Carlson 2003).

Neonate and early juveniles (≤50 cm TL) range from Jekyll Island, GA to north of Cape Canaveral, Florida, and the Gulf side of the Florida Keys as far north as Cape Sable. Additionally, they have been located from Apalachee Bay to St. Andrews Bay, Florida. (NOAA Fisheries 1999). Carlson (2003) summarized the preferred habitat associations for bonnethead young-of-the-year at 3.6m deep (1.5-6.5 m), water clarity of 168.4 m (70.0-220.0 m), average temperatures of 29.4°C (25.5-31.6°C), salinities of 29.2 ppt (26.1-34.8 ppt), and dissolved oxygen levels of 5.2 mg/L (3.2-6.6 mg/L). Hueter (1991) also found young-of-the-year, which includes neonate life stages, and juveniles in the west coast of Florida, at temperatures of 16.1° to 31.5° C, salinities of 16.5 to 36.1 ppt, and DO of 2.9 to 9.4 mg/L.

Listed Species Prey Dependence on EFH. Even though most managed species, other than the species discussed above, do not have identified EFH in the Sabine Lake Estuary, prey for these species do depend to some extent on estuarine systems. Many species of snapper and grouper occupy inshore areas of the Gulf during juvenile stages (mutton, dog, lane, gray and yellowtail snapper; and jewfish, red, gag, and yellowfin groupers) where they feed on estuarine-dependent prey, including shrimp, small fish, and crab. As they mature and move offshore, the diets in many cases change more to fish, but estuarine-dependent species (shrimp, crab) can still constitute an important dietary component.

Estuaries are important habitats for most of the major prey species of coastal pelagics (GMFMC and SAFMC 1985, 1990). For this reason estuarine habitats and factors which affect them are considered as a part of the coastal pelagic management unit. All the coastal pelagic species, except dolphin, move about and forage on any locally abundant prey. Coastal pelagics feed throughout the water column on a variety of fish, especially herrings. Squid, shrimp, and other crustaceans also are eaten. Many of the prey species of the coastal pelagics are estuarine-dependent in that they spend all or a portion of their lives in estuaries.

Habitat for prey items of species for which EFH has been identified in Sabine Lake is essentially the same as that required by those managed species (i.e., estuarine and marine habitats). Shrimp larvae feed on phytoplankton and zooplankton. Postlarvae feed on epiphytes, phytoplankton, and detritus. Juveniles and adults prey on polychaetes, amphipods, and chironomid larvae but also on detritus and algae (Pattillo et al. 1997).

Estuaries are important habitat for the prey species of red drum. This is especially true for larvae, juvenile and early adults of red drum as they spend virtually all of their time in estuarine habitat. Larval

red drum feed almost exclusively on mysids, amphipods, and shrimp, whereas larger juveniles feed more on crabs and fish (Peters and McMichael 1987). Overall, crustaceans (crab and shrimp) and fish are most important in the diet of red drum; primary food items are blue crab, striped mullet, spot, pinfish and pigfish. As they grow larger, red drum eat proportionately more crab, with fish diminishing in importance as food for the largest red drum (Mercer 1984).

Potential for EFH at the LNG Terminal Site. No EFH is present on the proposed LNG terminal site, but the open water portion of the LNG terminal site would be located on the western edge of the Port Arthur Ship Canal, which is the narrow portion of the estuary system that also includes Sabine Lake and the lower portions of its tributaries (Neches River, Cow Bayou, and Sabine River). The Port Arthur Ship Canal, part of the SNWW, is a man-made channel that is regularly dredged to allow the passage of large ships. Bottom sediments are fine, consisting primarily of mud and silt (GMFMC 1998). The water column can be turbid, due to the high sediment load of inflowing waters and disturbance of bottom sediments by vessel traffic. Salinity is probably the most important factor in determining the distribution and relative abundance of marine and estuarine organisms. NOAA Fisheries (1985) classifies the Sabine Lake estuary as a Mixing Zone (salinity of 0.5 to 25 ppt), where saline Gulf waters mix with freshwater inflows from Sabine Lake and its tributaries, producing an annual average salinity of 6 ppt (GMFMC 1998). Salinity varies temporally, fluctuating in response to seasonal precipitation patterns. The Sabine Lake estuary receives an average of 17.2 cubic feet per second (cfs) of freshwater daily. Dredging for the ship berth would have the greatest potential impact to EFH with resuspension of sediment in the Port Arthur Ship Canal. However, this would be a temporary, short-term impact. Dredging is expected to last 14 months and would remove a significant amount of material. Dredging for creation of the berth area would provide additional deep water habitat for pelagic fish.

Potential for EFH within the Approved DMPA. The proposed DMPA (DMPA 1-2) is part of a former COE DMPA that was used in conjunction with the Port Arthur Ship Canal dredging and the construction of the Taylor Bayou Bypass. It has been inactive for many years. No EFH is present within the proposed DMPA. Sempra is considering several restoration, enhancement, and protection projects in which they could put some of the dredged material to beneficial use in the J.D. Murphree WMA. Should one of the alternate DMPAs be used, potential impacts to EFH would be addressed prior to approval for use. Of the EFH species of concern, the juvenile stages of brown shrimp and white shrimp are restricted to shallow water less than 1 to 2 meters deep. These species prefer intertidal estuarine areas, and cannot tolerate the salinity of the open Gulf. Early juvenile red drums utilize shallow water less than 3 meters deep. The juvenile red drums prefer protected waters, such as bays and estuaries, and also are unlikely to be found in the open Gulf. Spanish mackerel juveniles are found offshore and in beach surf, and sometimes in estuarine habitat. Although they occur in waters of varying salinity, juveniles appear to prefer marine salinity and generally are not considered estuarine dependent. Clean sand appears to be the substrate preference of juveniles. Once a DMPA site has been authorized, these habitat preferences would be analyzed against the conditions at the selected site to determine potential impacts on EFH. If the proposed DMPA is used, no EFH would be affected.

Potential for EFH Along the Pipelines

Sempra considered habitats to be EFH if they possessed open waters with salinities representative of tidal influence, or if they were vegetated areas connected to a waterbody with tidal influence and had water depths that could sustain fisheries under normal conditions, exclusive of periods of extreme conditions such as major storm events. Mean salinity and salinity range at any given location within the Project area is determined by the relative volume, timing, and duration of upstream (fresh) and downstream (saline) flows. These parameters in turn control the type of habitat that can develop at a particular site and directly influence the productivity of those habitats (Gosselink et al. 1979).

3-Mile-Long Pipeline Potential for EFH. EFH wetlands along the proposed 3-Mile-Long Pipeline route are those tidally influenced marshlands located adjacent to Keith Lake and the Keith Lake Cut between MPs 1.5 and 1.9. Keith Lake is interconnected with the Port Arthur Ship Canal via the Keith Lake Cut. The TPWD classifies fisheries in the area of the pipeline route as marine fisheries. Keith Lake has been identified to have EFH for the same species found in Sabine Lake.

70-Mile-Long Pipeline, Potential for EFH. Sempra indicated that EFH wetlands are found along the proposed 70-Mile-Long Pipeline route between approximate MPs 19.0 and 33. Based on aerial infrared photography and field investigations conducted in August 2004, NOAA Fisheries believes that EFH exists along the entire portion of the route of the 70-Mile-Long Pipeline in Sabine Lake. Waterbodies crossed by the 70-Mile-Long Pipeline route support estuarine and warm water freshwater fish communities. The route of the 70-Mile-Long Pipeline would cross 83 waterbodies (14 are 100 feet wide or greater) in the Sabine Lake, Lower Neches, Lower Sabine and the West Fork Calcasieu (Hickory Branch) watersheds. The 70-Mile-Long Pipeline crosses four major rivers, including the West Pass of the Sabine River, the Houston River Canal, the Houston River, the Little River, and the West Fork (Hickory Branch) of the Calcasieu River, and spans several other streams, canals, and wetlands. Sabine Lake and its connecting waterways provide adult foraging, juvenile nursery, migratory and spawning habitat to numerous fishes and invertebrates. In addition Sabine Lake supports commercial fisheries for oyster, blue crab, brown shrimp, and white shrimp.

Potential Construction Effects on EFH

LNG Terminal and Marine Basin. Sempra has identified one habitat type associated with the LNG terminal site that is tidally influenced and could function as EFH, the open water of the Port Arthur Ship Canal adjacent to the portion of the LNG terminal site that would be used for the marine slip and turning basin. There are no EFH wetlands affected by the LNG terminal site and no EFH would be affected if Sempra is permitted to use the proposed DMPA. As a result, EFH mitigation associated with the LNG terminal or proposed DMPA is not anticipated to be necessary.

Approximately 38.3 acres of open water EFH, the area from the western edge of the Port Arthur Ship Canal to the existing shoreline, and the area on the east side of the Port Arthur Ship Canal, would be affected by the dredging and deepening of the turning basin. Excavation and dredging of the slip area would convert approximately 82 acres of land into 82 acres of deep water habitat. These areas would be dredged to minus 40 feet MLLW. Materials dredged from these areas would be placed in an authorized DMPA and, ultimately, could potentially be used in a beneficial manner to restore marsh in the J. D. Murphree WMA and/or other agency-recommended areas.

Adverse effects to fish and fish habitats typically associated with dredging activities include: destruction of benthic habitats, the impairment of water quality and the direct (injury or mortality) and indirect (i.e., habitat alteration) effects on the fish and their prey species. The extent of the effect depends on hydrologic processes, sediment texture and composition, chemical content of the sediment, and the behavior or life stage of the species of concern.

Disturbance of bottom sediments during dredging can significantly increase turbidity and downcurrent deposition of re-suspended sediments. Increased turbidity can result in the physical impairment of estuarine species (e.g., turbidity-induced clogged gills resulting in suffocation, or abrasion of sensitive epithelial tissue). Resuspension of sediments by cutterhead dredges has been studied by the COE. McLellan et al. (1989) describes resuspension characteristics of the most commonly used dredges. As discussed in the report, the cutterhead suction dredge (as would be used for dredging of the proposed marine terminal basin) resuspends the lowest amounts of sediment at the dredging location, primarily because of the net suction of the cutterhead. The turbidity around the suction head returns to background

levels within several tens of feet from the cutterhead. By contrast, hopper dredges and mechanical dredges can create much larger sediment plumes. Because of the enclosed nature of the berth dredging and the large volumes of water required to accomplish the dredging, there should be a net movement of water towards the dredge, limiting the migration of sediments outside of the dredging vicinity.

Impacts to EFH associated with these activities are expected to be minimal and temporary, and turbidity control methods are not expected to be required based on the following factors:

- the materials to be dredged are primarily stiff clays with some silty deposits that typically do not create high turbidity levels during dredging;

- the dredging would be performed with a hydraulic cutterhead dredge, which generally creates less turbidity at the dredge site than other types of dredges (i.e., mechanical bucket or hopper dredges); and

- with a cutterhead dredge, the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity.

Dredging also can result in the chemical impairment of the water column due to the suspension of contaminated sediments. The sediments that would be dredged in Sabine Pass, however, are not contaminated based on a study conducted by NOAA Fisheries (Long 1999). The study assessed sediment toxicity and chemical contamination in Sabine Pass and Sabine Lake and the analyses found that toxicity of the sediments in the Project area was not significant, and that the potential for toxicity was greatest in the Sabine-Neches Channel north of Port Arthur. The report concluded that sediment quality in the Sabine Lake area was not severely degraded (Long 1999). However, there is a potential for contamination from offsite sources through air or waterborne deposition.

Dredging and the direct removal of suitable benthic substrates can impact EFH by removing suitable cover or settlement structure. Dredging typically homogenizes bottom substrates, reducing the structural complexity of habitats. Field surveys of the LNG terminal site revealed that the open water habitats already consist of a homogenous bed of fine substrates. Dredging of these areas would not alter the existing bottom type, and therefore removal of bottom sediments is not expected to have a significant impact on EFH. Furthermore, information gathered from a Corpus Christi Bay National Estuary Program publication from May 1998 (Montagna et al. 1998) identified anthropogenic and natural disturbances and their affects on benthic communities. The report states that "Although benthic communities are removed by dredging and smothered by dredge spoil, soft-bottom benthic communities recover within a year." Therefore, it is expected that recovery and colonization would occur relatively quickly within the newly dredged slip. This section would be updated if a DMPA other than the proposed DMPA were authorized.

Entrainment of aquatic organisms by dredging machinery can have significant impacts on EFH species directly or indirectly through the removal of prey species (e.g., benthic invertebrates) or food species (e.g., macroalgae), disrupting energy flow and biotic interactions. Although entrainment of benthic and demersal organisms during the dredging of the marine basin is expected, it would not be extensive enough to have a significant impact on the existing EFH resources given the small area involved compared to the availability of similar habitat in the surrounding Sabine Lake estuary.

Long-term impacts to EFH resources associated with dredging in open waters would be expected to be minimal and temporary because dredging would not result in a permanent alteration of habitat structure. Although dredging would occur in open waters that provide habitat for a variety of finfish species, these activities would not have a measurable permanent impact on these species. Some of these species would recolonize the deeper water created by the slip or adjust to the greater water depths while others would

find similar suitable habitat in adjacent areas of the Port Arthur Ship Canal. Species that currently occupy this habitat also inhabit the deeper water habitats that currently exist in the adjacent Port Arthur Ship Canal. Therefore, these species would not experience a loss of habitat, but rather an increase in deepwater habitat, due to dredging of the slip and turning basin.

Pipelines. **Table 4.6.3-3** lists the potential EFH affected by construction and operation of the proposed pipelines. Pipeline construction in Sabine and Keith Lakes would involve trenching and temporary stockpiling of excavated sediments adjacent to the pipeline trench. Approximately 301.8 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Sabine Lake due to construction of the 70-mile pipeline. Additional areas would be disturbed by workspaces. Approximately 12.9 acres of bottom sediments in Sabine Lake would be avoided through directional drills. Approximately 11.9 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Keith Lake due to construction of the 3-mile natural gas send out pipeline to the NGPL pipeline. An additional 1.8 acres of bottom sediments would be disturbed by the proposed workspace in Keith Lake.

TABLE 4.6.3-3

Potential EFH Affected by Construction and Operation of the Project

Wetland Identifier[a]	Begin MP	Approximate Crossing Length (feet)	Wetland Type	Construction Impacts (acres)[b,c]	Operation Impacts (acres)
3-Mile Pipeline					
E2EM1P	1.5	190	Estuarine Intertidal Emergent	0.8	--
OW	1.5	290	Open Water	1.0	--
E2EM1P	1.6	1,366	Estuarine Subtidal Emergent	4.5	--
E2EM1P	1.9	123	Estuarine Intertidal Emergent	0.12	--
E2EM1P	1.9	290	Estuarine Intertidal Emergent	0.6	--
OW	1.9	3,460	Open Water	11.9	--
			Subtotal	**18.9**	**0.0**
70-Mile Pipeline					
E1UBL	2.0	93,880	Estuarine Subtidal Unconsolidated Bottom/Open Water	224	--
E2EM1P	18.8	37	Estuarine Intertidal Emergent	0.64	--
E2EM	19.2	3,354	Estuarine Intertidal Emergent	11.67	--
E2EM	19.8	633	Estuarine Intertidal Emergent	2.02	--
E2EM	19.9	2,838	Estuarine Intertidal Emergent	8.83	--
OW	20.5	352	Open Water	0.5	--
E2EM	20.6	103	Estuarine Intertidal Emergent	0.3	--
OW	20.6	90	Open Water	0.1	--
E2EM	20.6	2,925	Estuarine Intertidal Emergent	7.92	--
OW	21.1	544	Open Water	0.4	--
E2EM	21.15	2,910	Estuarine Intertidal Emergent	8.69	--
OW	21.2	154	Open Water	0.06	--
E2EM	21.9	3,435	Estuarine Intertidal Emergent	9.3	--
E2EM	22.6	191	Estuarine Intertidal Emergent	0.3	--
E2EM	22.7	871	Estuarine Intertidal Emergent	3.54	--

TABLE 4.6.3-3

Potential EFH Affected by Construction and Operation of the Project

Wetland Identifier[a]	Begin MP	Approximate Crossing Length (feet)	Wetland Type	Construction Impacts (acres)[b,c]	Operation Impacts (acres)
E2EM1P	23.3	488	Estuarine Intertidal Emergent	0.72	--
E2EM1P	23.4	2,021	Estuarine Intertidal Emergent	5.6	--
E1UBL	23.7	106	Estuarine Subtidal Unconsolidated Bottom	0.07	--
E2EM1P	23.9	688	Estuarine Intertidal Emergent	5.39	--
E1UBL	24.0	387	Estuarine Subtidal Unconsolidated Bottom	0.1	--
E1UBL	24.1	358	Estuarine Subtidal Unconsolidated Bottom	0.4	--
E1UBLx	24.3	98	Estuarine Subtidal Unconsolidated Bottom	0.1	--
E2EM1P	24.3	3,680	Estuarine Intertidal Emergent	10.98	--
E1UBL	25.0	570	Estuarine Subtidal Unconsolidated Bottom	0.7	--
E2EM1P	25.1	188	Estuarine Intertidal Emergent	0.09	--
E2EM1P	25.1	8,782	Estuarine Intertidal Emergent	42.4	--
E1UBL	25.9	602	Estuarine Subtidal Unconsolidated Bottom	1.5	--
E1UBL	25.9	1,210	Estuarine Subtidal Unconsolidated Bottom	4.5	--
E1UBLx	28.6	87	Estuarine Subtidal Unconsolidated Bottom	0.1	--
E1UBLx	28.8	57	Estuarine Subtidal Unconsolidated Bottom	0.1	--
E2EM1P	28.8	780	Estuarine Intertidal Emergent	2.65	--
E2EM1N	28.8	338	Estuarine Intertidal Emergent	1.35	--
E1UBL	28.9	623	Estuarine Subtidal Unconsolidated Bottom	1.0	--
E2EM1N	29.0	2,703	Estuarine Intertidal Emergent	7.03	--
E1UBL	29.2	119	Estuarine Subtidal Unconsolidated Bottom	0.1	--
E2EM1P	29.5	3,467	Estuarine Intertidal Emergent	10.13	--
E2EM1N	30.1	465	Estuarine Intertidal Emergent	1.17	--
E2EM1P	30.2	2,287	Estuarine Intertidal Emergent	11.6	--
E2EM1N	30.7	1,723	Estuarine Intertidal Emergent	5.07	--
E2EM1P	30.9	473	Estuarine Intertidal Emergent	1.3	--
E2EM1P	31.8	637	Estuarine Intertidal Emergent	1.29	--
E2EM1P	32.2	1,675	Estuarine Intertidal Emergent	4.76	--
			Subtotal	**398.5**	**0.0**

TABLE 4.6.3-3

Potential EFH Affected by Construction and Operation of the Project

Wetland Identifier[a]	Begin MP	Approximate Crossing Length (feet)	Wetland Type	Construction Impacts (acres)[b,c]	Operation Impacts (acres)
LNG Facility (turning basin only) [d]					
OW	0.0	N/A	Open Water	38.3	--
			Subtotal	**38.3**	**0.0**
			Project Total EFH	**455.7**	**0.0**

_____

(a) Key:
PEM - Palustrine Emergent
PSS - Palustrine Scrub Shrub
PFO - Palustrine Forested
E1EM - Estuarine Subtidal Emergent
E2EM - Estuarine Intertidal Emergent
OW - Open Water
E1UB - Estuarine Subtidal Unconsolidated Bottom
PAB - Palustrine Aquatic Bed
PP - Pine Plantation

(b) Wetlands or OW areas not affected due to the use of HDD construction techniques are not included.

(c) Includes additional temporary workspace in addition to the temporary construction right-of-way.

(d) Represents open water EFH that would be affected by deepening the area required for the turning basin. Construction of the LNG terminal proper would not affect EFH.

N/A-Not applicable.

EFH wetlands comprise approximately 4.2 acres of the 13.3 acres of wetlands that would be affected by the proposed 125-foot-wide temporary construction right-of-way and temporary workspaces (**table 4.4.1-1**) associated with the 3-Mile-Long Pipeline. The construction-related effects on these wetlands would be temporary. All of these wetland areas would reestablish to their pre-construction condition, or would be actively revegetated by Sempra (see section 4.4.3), with the duration of the temporary impacts related to the length of construction and the length of time for the vegetation to reestablish; likely to be on the order of one to two growing seasons. In order to facilitate reestablishment of the vegetation, Sempra would return the final grade of the pipeline trench to as close as possible to the pre-construction grade during the backfilling of the trench.

EFH wetlands comprise approximately 112.4 acres of the 172.2 acres of non-forested wetlands affected by the temporary construction right-of-way and temporary workspaces associated with the 70-mile pipeline. The construction-related effects on these wetlands would be temporary. All of these wetland areas would reestablish to their pre-construction condition, or would be actively revegetated by Sempra (see section 4.4.3), with the duration of the temporary impacts related to the length of construction and the length of time for the vegetation to reestablish; likely to be on the order of one to two growing seasons. In order to facilitate reestablishment of the vegetation, Sempra would return the final grade of the pipeline trench to as close as possible to the pre-construction grade during the backfilling of the trench.

Open water (EFH habitat) pipeline construction activities in Keith Lake associated with the 3-Mile-Long Pipeline and in Sabine Lake associated with the 70-Mile-Long Pipeline would affect the benthic community through disruption of existing sediments. Direct impacts could include the permanent loss of organisms that occupy the area of the construction activity and the temporary or permanent alteration of soft bottom aquatic habitat in the channel area. Construction can physically damage benthic organisms, resulting in stress, burial, sublethal injury, or death. The composition of the macrobenthic community

depends upon bottom sediment conditions, and is vulnerable to physical or chemical alterations of the substratum.

Impacts on EFH resources resulting from wetland and waterbody construction activities can include temporary sedimentation and turbidity, alteration or removal of fish cover, introduction of water pollutants, or entrainment of fish. Potential turbidity impacts created by pipeline construction are expected to be minimal based on the turbidity plume modeling results (see **appendix F**) and the fact that Sabine Lake is naturally turbid. These affects would be localized, temporary, and affect a very small area of the Sabine Lake estuary and therefore would not be significant. Removal of trees from the edges of the waterbodies crossed by the pipeline could reduce shading of the waterbody, eliminate escape cover, and potentially result in locally elevated water temperatures. Elevated water temperatures can lead to reductions in levels of dissolved oxygen and influence fish survival and fitness. However, wetlands that comprise the EFH along the pipeline route consist primarily of marsh vegetation that would become reestablished within a few years following construction. The loss of woody shrub species in EFH wetlands is not anticipated, so no longer term impacts associated with the re-growth period for woody species would occur.

NOAA Fisheries has commented that impacts on wetlands that provide EFH should be minimized and recommends the following:

- use of best management construction and restoration practices, including repairing of banks;
- restricting the number and limits of airboat and tracked equipment passage over marshes;
- backfilling the pipeline ditch to marsh elevation;
- replanting marsh vegetation on all impacted areas if the wetland is not revegetated within 1 year;
- documenting the need for compensatory wetland mitigation through ground and aerial (low altitude infrared photography) surveys prior to and immediately after construction; and
- completing additional surveys within one complete growing season after construction, if needed.

These recommendations should be incorporated into Sempra's finalized Aquatic Resources Mitigation Plan (see section 4.4.3).

Richardson et al. (1977) and Bingham (1978) found that the effects of dredged material placement on benthos probably were related to direct burial of benthos and changes in sediment characteristics, rather than increased turbidity from placement operations or introduction of pollutants or organic matter. The immediate impact of stockpiling dredged sediments would be to smother portions of the benthic invertebrate populations that inhabit surficial sediments along the stockpiled areas adjacent to the pipeline trench. Similarly, trenching would injure or kill portions of the local populations that inhabit the trench path. Sedimentary habitat of Sabine Lake is predominantly fine clays, muds, and silts. These types of estuarine sediments tend to support populations of rapidly colonizing opportunists. Early stage succession would begin within days of sediment disturbance, through settlement of larval recruits. Populations of deposit-feeding, opportunistic taxa that live in Sabine Lake would dominate initial larval recruits. Many species in these taxonomic groups are well adapted to environmental stress, have continually reproducing life history strategies, and exploit suitable habitat when it becomes available. The great densities and fecundity of local invertebrate populations, along with the relatively small areas of impact proposed, would preclude significant long-term negative effects on benthic populations. Impacts would be localized and short-term. The area does not represent any unique or ecologically critical habitat for macrobenthos.

Species that contribute the bulk of benthic faunal assemblages in estuarine habitats (including the annelids, arthropods, and mollusks) exhibit high reproductive potential. This enables benthos to

efficiently replace lost individuals through larval recruitment. Recolonization of sediments is expected to begin immediately after construction is complete. Organism-sediment interactions result in a predictable sequence of benthic invertebrates belonging to specific functional types following a major benthic disturbance (Rhoads and Germano 1982, 1986). Studies indicate that benthic repopulation is rapid, with no long term impact on species composition or seasonal abundance. Rates of recolonization have been measured in studies of disturbed soft bottom habitats (Oliver et al. 1977; Van Dolah et al. 1984) and in studies using defaunated sediment (McCall 1977; Simon and Dauer 1977; Rhoads et al. 1978; Bowen and Marsh 1988). All of these studies showed that recolonization of sediments generally occurs very rapidly, and that community characteristics of recolonized sediments, such as faunal abundance, diversity, and evenness, were comparable to that of nearby non-impacted areas within a relatively short period of time. Long-term stability of estuarine benthic assemblages is primarily a result of the adaptive life histories and behaviors of their constituent populations that allow these communities to withstand and rebound from episodic environmental perturbation (Holland 1985). Opportunistic benthic species probably are continually present in most estuarine environments, which are very resilient (Diaz and Boesch 1977).

Alteration of benthic community patterns could render the area of the pipeline rights-of-way temporarily unavailable as feeding areas or habitat for fishes or other bottom feeding species. The duration of this impact would be for the length of construction activities plus benthic recolonization time. For all EFH, any adverse environmental consequences would be minor due to the temporary increase in turbidity and suspended sediments. Effects on recreational and commercial fisheries would be minimal considering the temporary nature of the disturbance from pipeline construction activity.

Potential Operational Impacts on EFH

LNG Terminal and Marine Basin. Operation of the LNG terminal facilities would involve frequent berthing of the large LNG ships and an increase in large-vessel traffic in Sabine Pass, but such activities are already common in the vicinity of the proposed LNG terminal and therefore a significant impact due solely to the Project is not expected. During LNG ship entry and departure maneuvering, there would be short periods of turbidity associated with incidental propeller wash from the handling tugs. This would represent a small increase in the number of episodic turbidity events above those currently occurring due to shipping traffic within the Sabine Pass Ship Canal. Since the Sabine Lake estuary has naturally high levels of turbidity, biota has adjusted to the suspended sediments and would not experience any substantial degradation of habitat conditions due to the LNG terminal shipping operations.

Operation of the LNG facility would require periodic maintenance dredging of the turning basin and berth areas in order to maintain adequate clearance beneath the LNG tankers and barges. Although we are not aware of Sempra's proposed maintenance dredging frequency (see section 4.2.6.10), we expect that it would be required no more than every 6 to 7 years. Maintenance dredge materials for the slip and turning basin are expected to be composed of 94 percent silts and clays, and 6 percent sand, based on samples taken by the University of Texas, Austin at a station located near the proposed LNG terminal site. Dredge materials would be deposited in accordance with permits issued by the COE and the state, and may be deposited for beneficial use at the J. D. Murphree WMA, or as part of the COE maintenance dredging program. The amount of dredging would be much less than that which is periodically performed to maintain the Port Arthur Ship Canal. Therefore, impacts on EFH resulting from Project maintenance dredging would represent a minor increase over those occurring during COE dredging of the federal navigation channels in the Project vicinity.

Operation of the LNG facility would utilize a closed loop vaporization system (which reuses heating water in a closed system) rather than an open rack vaporization system (which withdraws outside water for heating the LNG). Because of this, there would be no impacts to EFH species from the regasification process.

Direct spills of petroleum or other potentially toxic products into the berthing area or Port Arthur Ship Canal during facility operation could be harmful to aquatic organisms, depending on the type, quantity, and concentration of the spill. To reduce the potential for direct surface water contamination from an accidental or unintentional release of any pollutant, Sempra would implement the procedures in its SPCC Plan, including restrictions on refueling equipment and storing fuel and other potentially toxic materials at least 100 feet from waterbodies during facility operations.

Pipelines. Operation of the pipelines would have minimal impacts on EFH since the pipelines would be buried and the existing coastal emergent wetlands would become reestablished in the construction corridor. Sempra would maintain the permanent right-of-way in compliance with our Plan and Procedures. This would allow the permanent pipeline rights-of-way to continue to function as EFH habitat and support EFH species.

Conservation Measures and Mitigation Plans

LNG Terminal. To reduce turbidity during dredging, Sempra would use a hydraulic cutterhead dredge, which generally creates less turbidity than other types of dredges (i.e., mechanical bucket or hopper dredges). Therefore, no additional mitigation would be necessary to protect EFH from turbidity. Excavation of berth areas would create an additional 82 acres of deep open water habitat, potentially increasing the acreage of EFH in the vicinity of the proposed LNG terminal. Therefore no mitigation is necessary to compensate for impacts to open water habitats.

During design of the LNG facilities, Sempra sited major LNG facility components in upland areas to the maximum extent possible, thus minimizing cumulative impacts to valuable wetland habitats. Sempra's finalized Aquatic Resources Mitigation Plan will provide further information regarding mitigation and conservation measures (see section 4.4.3). The finalized Aquatic Resources Mitigation Plan will incorporate agency recommendations received to date, including those of NOAA Fisheries.

Pipelines. Pipeline construction in Sabine and Keith Lakes would involve trenching and temporary stockpiling of excavated sediments adjacent to the pipeline trench. Approximately 301.8 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Sabine Lake due to construction of the 70-Mile-Long Pipeline. Additional areas would be disturbed by work spaces. Approximately 12.9 acres of bottom sediments in Sabine Lake would be avoided through directional drills. Approximately 11.9 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Keith Lake due to construction of the 3-Mile-Long Pipeline. An additional 1.8 acres of bottom sediments would be disturbed by the work space in Keith Lake. Sempra has not proposed mitigation for the turbidity created by the construction of the pipelines due to the fact that the waters of Keith and Sabine Lake are naturally turbid and that the turbidity would be a localized and short-term effect.

Approximately 178 acres of emergent marsh EFH would be affected by construction of the two pipelines. NOAA Fisheries commented on the Cheniere Sabine Pass Final EIS, stating that monitoring of wetlands should be conducted every year for 3 years to ensure that wetlands are revegetated over the long term and that any wetlands that do not revegetate successfully after 3 years be mitigated for at a 1.5:1 ratio. Sempra should propose to monitor in accordance with these NOAA Fisheries comments. In addition, the FWS commented that the post-construction elevation survey should be conducted 6 months after material deposition to document the final created mitigation areas. Sempra should consider these comments in the development of its finalized Aquatic Resources Mitigation Plan.

NOAA Fisheries Conservation Recommendations

NOAA Fisheries filed EFH Conservation Recommendations on October 19, 2005, as listed below:

1. To the maximum extent practicable, the pipeline right-of-way should be located to avoid and minimize impacts to shell reefs in Sabine Lake. Where unavoidable impacts to reefs occur, water bottoms should be returned to pre-project conditions, including restoring the original bottom elevations and replacing shell substrate.

2. The final mitigation plan to compensate for impacts associated with project implementation should be coordinated with NOAA Fisheries and completed prior to the issuance of a record of decision (ROD) for the project. That mitigation plan should require the placement of additional fill as necessary to restore wetlands in the Black Bayou project area to pre-construction elevations, as well as the planting of wetland vegetation to restore previously existing vegetative communities.

3. A monitoring plan to assess restoration and mitigation needs should be developed in coordination with NOAA Fisheries and made a condition of any license issued for this project. The plan should include the following stipulations:

    a. Ground photographs of those portions of the pipeline right-of-way (i.e., temporary construction and permanent) that cross marsh shall be taken prior to construction and immediately after construction. The photographs shall be taken at 500-foot intervals from the center of the right-of-way with two photographs being taken at each location, one in each direction. Global Positioning System coordinates shall be used during photography such that pre- and post-construction photographs wouldwill be taken at the same locations. Copies of all photographs shall be provided to the Galveston District and NOAA Fisheries within one month of the completion of pipeline installation activities. The photographs should be individually identified and cross-referenced on low level aerial photographs showing the pipeline right-of-way.

    b. The pipeline right-of-way shall be monitored until 80 percent re-vegetation has occurred, and for a period of no less than 3 years. If 80 percent re vegetation has not occurred after the first year, adjustments to wetland soil elevations and/or vegetation shall be undertaken at the non-restored area to achieve pre-project conditions and the site shall continue to be monitored until 80 percent re-vegetation has occurred. Impacts to areas that do not fully recover shall be offset through compensatory mitigation.

    c. If the ground photography documents that any part of the work area has not been restored to pre-existing elevations, within 30 days of receiving the post-construction information an interagency field inspection to evaluate the work area and develop mitigation alternatives shall be scheduled.

4. In-kind compensatory mitigation should be required if permanent adverse wetland impacts occur as a result of pipeline installation activities.

In response to Conservation Recommendation number 1, one shell reef area was found between MPs 2 and 3 during pole soundings in Sabine Lake. Further investigation and delineation of the reef area revealed only shell fragments and that the reef does not currently support oysters or other bivalves. However, we agree that water bottoms should be returned to pre-project conditions after construction, including restoring the original bottom elevations and replacing shell substrate.

Sempra has responded to Conservation Recommendation number 2 in its Revised Draft Wetland Mitigation Plan (**appendix G**) with the addition of its Marsh Restoration Plan, as further discussed in

section 4.4.2.2., including the possible importation of additional fill material. The monitoring plan requested in Conservation Recommendation number 3 is addressed in **Appendix D of the Revised Draft Wetland Mitigation Plan** and is further discussed in sections 4.4.2.2 and 4.4.3. Lastly, in response to Conservation Recommendation number 4, the COE requires compensatory mitigation for any permanent loss of wetlands resulting from the Project. Sempra is continuing to work with the COE and other federal and state agencies to finalize the details through the Section 10/404 permitting process.

NOAA Fisheries has indicated for previous projects in the area that it believes that a more appropriate mitigation ratio (1.5:1) should be applied for impacts on tidally influenced wetlands, both at their LNG terminal site and for wetlands along the pipeline that do not recover in 3 years. Sempra has been consulting with the agencies to determine the final mitigation ratio that would be applied to the project. The current proposal is included in the Revised Draft Wetland Mitigation Plan, which will be finalized with the appropriate agencies, including NOAA Fisheries, prior to its implementation. Therefore, in response to NOAA Fisheries comments and EFH Conservation Recommendations, **we recommend that:**

- **Sempra consult with NOAA Fisheries and address its concerns regarding restoration of shell reefs in Sabine Lake, monitoring of wetlands along the pipelines for a period of no less than 3 years and the development of appropriate mitigation ratios (and timing for development of mitigation areas) for EFH impacts and for long-term (over 3 years) impacts to tidally influenced wetlands along the pipelines. Documentation of these consultations should be filed with the Secretary before construction of any facilities.**

Conclusions. We conclude that the Project would have minimal impacts on EFH with implementation of our Procedures, the finalized Aquatic Resources Mitigation Plan that would be developed with guidance from state and federal agencies, and with the conditions and stipulations that would be attached to Sempra's Section 404 Permit. Our Procedures, Sempra's Revised Draft Wetland Mitigation Plan (**appendix G**), the Aquatic Resources Mitigation Plan (once developed and finalized), and these recommendations would further minimize potential impacts. Use of these measures would reduce the potential for unanticipated, long-term impacts, and the area that would be impacted is small relative to the available habitat in the area.

4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

To comply with Section 7 of the ESA, Sempra consulted with the FWS and NOAA Fisheries regarding the presence of federally listed or proposed threatened or endangered species and their critical habitats in the Project area. Sempra, as the FERC's non-federal representative for purposes of complying with the ESA, assisted the FERC in meeting its Section 7 obligations by conducting informal consultation with the FWS. The FERC staff also contacted the FWS and NOAA Fisheries for assistance in determining which species under FWS and NOAA Fisheries' jurisdiction would have the potential to be affected by the proposed Project. The species identified by these agencies are listed in **table 4.7-1** and described in the following sections.

4.7.1 Federally Listed Threatened and Endangered Species

NOAA Fisheries identified five species of sea turtles (hawksbill [*Eretmochelys imbricate]*, Kemp's ridley [*Lepidochelys kempii*], leatherback [*Dermochelys coriacea*], green [*Chelonia mydas*], and loggerhead sea turtle [*Caretta caretta*]), five whale species (sperm [*Physeter macrocephalus*], finback [*Balaenoptera physalus*], blue [*B. musculus*], sei [*B. borealis*], and humpback whale [*Megapetra novaeangliae*]), and two fish species (Gulf sturgeon [*Acipenser oxyrinchus desotoi*] and smalltooth sawfish [*Pristis pectinata*]) that are federally threatened or endangered and that potentially occur within coastal waters of the Project

area and may be affected by the Project. One other species of endangered whale (North Atlantic northern right whale [*Eubalaena glacialis*]) has been observed occasionally in the Gulf of Mexico.

TABLE 4.7-1

Federal or State Listed Endangered and Threatened Species Potentially Occurring in the Project Area

Common Name/ Scientific Name	Status[a]	Preferred Habitat/Potential Use of the Project Area	Determination
Marine Mammals			
Sperm whale *Physeter macrocephalus*	F – E TX – E LA – E	Abyssal and pelagic; prefers deep water (>590 feet), and is sometimes found around islands or in shallow shelf waters. Offshore in Gulf of Mexico.	Not likely to adversely affect
Blue whale *Balaenoptera musculus*	F – E TX – E LA – E	Pelagic; generally prefers cold waters and open seas, but young are born in warmer waters of lower latitudes.	Not likely to adversely affect
Sei whale *Balaenoptera borealis*	F – E TX – NL LA – E	Pelagic; generally in deep water along the edge of continental shelf and in open ocean.	Not likely to adversely affect
Fin whale *Balaenoptera physalus*	F – E TX – E LA – E	Pelagic; usually found in largest numbers 25 miles or more from shore. In the western Atlantic, occurs mainly over continental shelf in summer, in depths of 300 to 600 feet.	Not likely to adversely affect
Humpback whale *Megaptera novaeangliae*	F – E TX – NL LA – NL	Pelagic and coastal waters, sometimes frequenting inshore areas such as bays. Winters largely in tropical/subtropical waters near islands or coasts and summers in temperate and subpolar waters.	Not likely to adversely affect
North Atlantic right whale *Eubalaena glacialis*	F – E TX – E LA – NL	Coastal and shelf waters; range from wintering and calving areas in coastal waters off the southeastern U.S. to summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and Scotian Shelf.	Not likely to adversely affect
West Indian manatee *Trichechus manatus*	F – E TX – E LA - E	Rivers and estuaries with dense submerged aquatic beds or floating vegetation. Rare summer migrant along Texas coast.	Not likely to adversely affect
Reptiles			
Kemp's ridley sea turtle *Lepidochelys kempii*	F – E TX – E LA - E	Shallow coastal waters, tidal rivers, estuaries, and seagrass beds with substrates of sand and mud. Occasional transient use in SNWW and Keith Lake.	Not likely to adversely affect
Loggerhead sea turtle *Caretta caretta*	F – E TX – E LA - E	Tropical and temperate waters with temperatures above 10 C. Rare transient use in SNWW and Keith Lake.	Not likely to adversely affect
Green sea turtle *Chelonia mydas*	F – T TX – T LA - T	Found throughout Gulf of Mexico and the adjoining beaches, where the seawater temperature is above 25°C. Occasionally found on upper Texas coast. Rare transient use in Keith Lake.	Not likely to adversely affect
Hawksbill sea turtle *Eretmochelys imbricata*	F – E TX – E	Tropical and subtropical seas, including southern Florida and the northern Gulf of Mexico. Coral reefs, rocky outcrops, high energy shoals. Occasional transient use in SNWW.	Not likely to adversely affect
Leatherback sea turtle *Dermochelys coriacea*	F – E TX – E	Open sea and coastal waters. Prefer sandy beaches with deepwater approach for nesting.	Not likely to adversely affect
Alligator snapping turtle *Macroclemys temminckii*	F – NL TX – T LA - NL	Year-round resident in freshwater rivers, sloughs, oxbows, lakes, and occasionally brackish waters. Known to occur in the Neches and Sabine River watersheds in freshwater and brackish marsh habitats.	Not likely to adversely affect
American alligator *Alligator mississippiensis*	F – T[b] TX – NL LA - NL	Almost exclusively freshwater rivers, swamps, sloughs, oxbows, lakes, and occasionally brackish waters. Common throughout the Neches, Sabine, and Houston River watersheds.	Not likely to adversely affect

TABLE 4.7-1

Federal or State Listed Endangered and Threatened Species Potentially Occurring in the Project Area

Common Name/ Scientific Name	Status[(a)]	Preferred Habitat/Potential Use of the Project Area	Determination
Birds			
Bald eagle *Haliaeetus leucocephalus*	F – T TX – T LA - E	Areas with abundant sources of large open waterways such as lakes, reservoirs, seacoasts, and large rivers. In addition to waterways, the availability of perches, usually tall trees or cliffs, adjacent to foraging and nesting areas. Occasional transient on rivers for foraging or feeding.	Not likely to adversely affect
Brown pelican *Pelecanus occidentalis*	F – E TX – T LA - E	Year-round resident in coastal areas of Texas and Louisiana. Breeds on small coastal islands and forages for fish along coastal and inland waterways. Forages in the Sabine estuary, Keith Lake (J. D. Murphree WMA) and along the shoreline and adjacent mudflats during low tides.	Not likely to adversely affect
Piping plover *Charadrius melodus*	F – T TX – T LA – E/T	Winter migrant along Texas Gulf Coast. Forages on mudflats and sand beaches. Project not located in any known wintering or migratory use areas.	Not likely to adversely affect
Red-cockaded woodpecker *Picoides borealis*	F – E TX – E LA - E	Open pine forests with large, widely spaced trees. Nests in large old pines (60+ years). Forages in pine or pine-hardwood stands.	Not likely to adversely affect
Reddish egret *Egretta rufescens*	F – NL TX – T LA - NL	Year-round resident along Texas Gulf Coast. Most common in central and lower coastal areas of Texas. Forages in coastal tidal flats and marshes, lagoons, and estuarine areas. Suitable foraging habitat within J. D. Murphree WMA.	Not likely to adversely affect
White-faced ibis *Plegadis chihi*	F – NL TX – T LA - NL	Freshwater marshes and irrigated rice fields. Also use low salinity brackish wetlands. Suitable habitat in vicinity of Big Hill, Hillebrandt, and Taylor Bayous in Texas.	Not likely to adversely affect
Swallow-Tailed Kite *Elanoides forficatus*	F – NL TX – T LA - NL	Bottomland forest and associated freshwater swamps, marshes and open water. Nests in tall trees on forest edge. Breeding season mid-March to end of June. Known populations in Jefferson, northeast Orange and Newton Counties.	Not likely to adversely affect
Arctic peregrine falcon *Falco peregrinus tundrius*	F – NL TX – E LA - NL	Migratory along the Texas coast, occurring in meadows, mudflats, beaches, marshes, and lakes where shorebirds are abundant. Foraging or resting during spring and fall migrations from July/August until March/April. Forages in J. D. Murphree WMA and along shoreline.	Not likely to adversely affect

(a) Status: F = Federal, TX = Texas, LA = Louisiana, E = Endangered, T = Threatened, NL = No Listing

(b) Alligators are not considered threatened as a species, but are on the Federal list because of similarities to the American crocodile.

However, occurrences of these whale species within the Project area are extremely rare, and none are expected to be affected by the construction and operation of the Project. The smalltooth sawfish is considered rare in the northern Gulf of Mexico and is primarily confined to southern Florida and the Florida Keys. NOAA Fisheries believes that there is a low probability of a sawfish occurring in the action area. The Gulf sturgeon's present range and designated critical habitat are east of the Mississippi River, thus excluding the Project area. Therefore, there is a very low probability of this species occurring in the vicinity of the Project and the Project is not likely to adversely affect this species or its habitat.

FWS determined that there are two bird species (brown pelican [*Pelecanus occidentalis*] and red-cockaded woodpecker [*Picoides borealis*]) likely to occur in the Project area. Potential habitat for both species lies within the project area. The following sections provide additional information on the species with the potential to occur in the Project area.

4.7.1.1 Marine Mammals and Sea Turtles

Marine Mammals

Sperm Whale (*Physeter macrocephalus*).The International Whale Commission recognizes four populations of sperm whales worldwide: North Pacific, North Atlantic, Northern Indian Ocean, and southern hemisphere. Sperm whales are the most abundant large cetacean in the Gulf of Mexico, and are present throughout the year (NatureServe 2005). According to estimates based on recent surveys, there is an annual abundance of 1,349 sperm whales in the Gulf of Mexico (NOAA Fisheries 2003). Males travel to upper latitudes in the summer and return to tropical waters in the winter for mating. Females and calves remain in tropical to subtropical waters year round. Sperm whales normally inhabit deep waters; however, they can be occasionally found around islands or in shallow (130 to 230 feet) shelf waters. Sperm whales dive up to 1,640 feet to feed, generally preying on squid, octopus, and fish (NatureServe 2005). Sperm whale encounters associated with the proposed Port Arthur Project would be limited to LNG ships moving through the Gulf of Mexico to the LNG terminal.

While there are no prescribed routes for ships transiting open waters of the Gulf of Mexico, entrance into the Gulf is through the Straits of Florida, south of the Florida Keys and Florida reefs. From there, a merchant vessel would cross the Gulf by the most direct, safest route to its destination port. A system of shipping safety fairways[1] and fairway anchorages has been established for the Gulf of Mexico and is shown on some, but not all, navigation charts. These fairways are near port entrances and along coastal trade routes, but do not extend across the Gulf of Mexico or into the deep waters of the open Gulf.

LNG ships en route to the proposed Port Arthur LNG terminal would normally travel west in the Gulf of Mexico to the Sabine fairway and then enter the SNWW/Port Arthur Ship Canal to the proposed LNG terminal. The distance from where a LNG ship would enter the Gulf of Mexico to the Port Arthur sea buoy is approximately 680 nautical miles. At a transit speed of 19.5 nautical miles per hour, the inbound and outbound trips would each take approximately 35 hours.

To provide protection to marine mammals and sea turtles against vessel strikes, NOAA Fisheries developed the *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting Policy* (Vessel Strike Avoidance Policy) (see **appendix L**). These guidelines would minimize the potential for whale encounters and collisions. Therefore, if the Vessel Strike Avoidance Policy is implemented, the project is not likely to adversely affect sperm whales in the Gulf of Mexico. Port Arthur had agreed to implement the measures included in an earlier version of the Vessel Strike Avoidance Policy in its Terminal Use Agreement that would be signed between Port Arthur and LNG shippers docking at the LNG terminal. In order to ensure that the most recent mitigation is used **we recommend that**:

- **Sempra implement the mitigation measures contained in the *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting Policy* found in appendix L of the final environmental impact statement for the Port Arthur LNG Project in its Terminal Use Agreement.**

[1] 33 CFR 166.105 defines a shipping safety fairway as "a lane or corridor in which no artificial island or fixed structure, whether temporary or permanent, will be permitted."

Other Whale Species. In addition to the sperm whale, the blue, sei, fin, and humpback whale have been identified as potentially occurring in the project area. NOAA Fisheries also has recommended that we address potential impacts on the North Atlantic right whale.

The blue whale is the largest living animal on earth. Blue whales are migratory, moving toward the poles in the spring for feeding, and returning to the subtropics in the fall to mate (NOAA Fisheries 1998a). Several records of blue whale strandings (pre-1970) in the Gulf of Mexico suggest that blue whales historically strayed into Gulf waters.

Sei and fin whales are widely distributed in the temperate zones of both the northern and southern hemispheres. The similarity of the sei and fin whales has caused confusion as to the whales' actual distribution and frequency of occurrence. The sei whale tends to avoid semi-enclosed waterbodies, such as the Gulf of Mexico (NOAA Fisheries 1998b). The fin whale is known to occur in the Gulf of Mexico, though it is considered uncommon.

Humpback whales are found worldwide, generally occurring in waters over continental shelves, along their edges, and around some oceanic islands (NOAA Fisheries 1991a); however, this species rarely occurs in the Gulf of Mexico. There are only three historical sitings recorded of humpbacks in the Gulf of Mexico; two of these sitings were near Tampa Bay, Florida and the third location was not specified (NOAA Fisheries 1991a).

The North Atlantic right whale is a large baleen whale that is found in coastal and shelf waters (NOAA Fisheries 2005a). The North Atlantic right whale is among the rarest of the world's whales, due to historic commercial whaling. However in recent years, the greatest known cause of North Atlantic right whale mortality is collision with ships (NOAA Fisheries 2005a). For most of the year, North Atlantic right whale distribution is strongly correlated with that of their primary prey, copepods. Five "high use" areas were identified along the east coast of North America in the initial Recovery Plan for the North Atlantic right whale (NOAA Fisheries 1991b). Still considered to be key habitat areas, the most southerly of these areas is located within 15 miles of the Atlantic coast of Florida and Georgia (Sebastian Inlet, Florida to the Altamaha River, Georgia). While many of the remaining North Atlantic right whales gather along the coast of Florida/Georgia for the calving period between December and March, limited data suggests that a few individuals might also winter in other areas that include the waters near Bermuda and in the Gulf of Mexico (Reeves 2001). NOAA Fisheries expects North Atlantic right whales to be occasional transients in the Gulf of Mexico that would not occur with any regularity (NOAA 2005f). However, as reported by local media, two North Atlantic right whales were observed in Corpus Christi Bay on January 16, 2006.

Due to their rarity in the project area, the blue, sei, fin, humpback, and North Atlantic right whales are not likely to be encountered by LNG ships calling on the proposed LNG terminal in the Gulf of Mexico. Although the source of LNG supplies for the proposed LNG terminal have not yet been identified, LNG ships calling on the proposed terminal could be expected to arrive from production countries in North Africa, the Middle East, or the southern Caribbean. In waters of the United States, the major shipping routes into the Gulf of Mexico would not cross key habitat areas of any of these whale species. In addition, implementation of the measures included in the Vessel Strike Avoidance Policy as discussed above would minimize potential impacts on these whale species. As such, we have determined that the proposed Port Arthur Project is not likely to adversely affect on blue, sei, fin, humpback, and North Atlantic right whales. By letter dated March 16, 2006, NOAA Fisheries concurred with our determination.

West Indian Manatee (*Trichechus manatus*).[2] West Indian manatees are inhabitants of the northern Atlantic Coast of South America, the Caribbean Coast of South and Central America, and the Greater Antilles north to Florida. During warmer months individuals disperse from Florida as far west as Louisiana. They are generally restricted to rivers and estuaries with dense submerged aquatic beds or floating vegetation, though they may enter saltwater when traveling from site to site.

The potential for West Indian manatees occurring within the Project area is very low. Manatees are rarely reported on the Texas coast, and then only as summer migrants, indicating that any window of potential impact should be small. The West Indian manatee occasionally enters Lake Pontchartrain, Lake Maurepas, and their associated coastal waters and streams during the summer months (June through September), though they may sometimes be found in canals with adjacent coastal marshes. The area along the SNWW contains some marginal manatee habitat and construction activities could cause temporary displacement. Displacement would be temporary and insignificant with habitat use reverting back to normal conditions following the completion of construction. All construction personnel would be instructed to observe slow speed zone recommendations to avoid unnecessary collisions with manatees. Construction personnel also would be instructed that they are responsible for observing the presence of manatees during water-related construction activities. Because of the expected rarity of manatees in the Project vicinity, effects related to construction of the slip, including localized hypoxia/anoxia in the water column and turbidity, are considered unlikely to significantly affect manatee behavior or survival. In addition, since adequate aquatic beds or floating vegetation do not occur within the primary ship channels, the potential for occurrence of this species is extremely low; therefore, the Project is not likely to adversely affect this species.

Sea Turtles

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*).[3] Adult and juvenile Kemp's ridleys are primarily restricted to the Gulf of Mexico, although juveniles have been recorded from throughout the Atlantic Ocean. Nesting occurs from April through July and is essentially limited to an 11-mile stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico. In Texas, nesting occurs on Padre and Mustang Islands in south Texas from May to August. The TPWD reported in July 2004 that 41 Kemp's ridley nests were recorded during the most recent nesting season. No Kemp's ridley nesting is known to occur near the proposed LNG terminal site and there is no suitable nesting habitat (i.e., sandy beaches); however, one Kemp's ridley has been observed feeding in Sabine Lake (Firmin 2005). The estuarine and offshore waters of Texas and Louisiana are considered important foraging areas. Adults are primarily shallow-water benthic feeders that specialize on portunid crabs. Other food items include shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and occasionally marine plants. Juveniles typically feed on *Sargassum* spp. and associated infauna.

During the non-breeding season, Kemp's ridley sea turtles prefer warm bays, shallow coastal waters, tidal rivers, estuaries, and seagrass beds with substrates of sand and mud. According to the FWS, juvenile Kemp's ridleys are generally found in Texas' and Louisiana's coastal waters from May through October, whereas adults are common during the spring and summer near the mouth of the Mississippi River. In the winter, Kemp's ridleys typically move offshore to deeper, warmer waters, but some of the deepwater channels and estuaries in Texas and Louisiana might provide important thermal refuge.

The probability of the Kemp's ridley sea turtle nesting in the Project area is very low due to a lack of suitable nesting habitat (i.e., sandy beaches). Mud flats in the surrounding areas potentially could serve as nesting habitats for the Kemp's ridley, but nesting is typically restricted to Tamaulipas, Mexico. During

[2] LADWF 1998; FWS 2004.
[3] Pritchard and Marquez 1973; Brongersma 1972; Musick 1979; Campbell 1995; NOAA Fisheries and FWS 1992; NOAA Fisheries 2003; LADWF 2003.

the non-breeding season, however, there is a moderate probability of this species occurring as a transient in the open water habitat of the Project area. According to the FWS, Kemp's ridleys are common in Texas' and Louisiana's coastal waters and they have been reported within Sabine Lake in the past. Recently, however, Landry (2005) noted a continual decline in sea turtle numbers in the Gulf waters near Sabine Pass, relative to that initially observed in 1998. During surveys in 2000, 21 Kemp's ridley sea turtles were captured in comparison to 1999 (116 Kemp's ridley sea turtles) and to 1993, when 120 sea turtles (number of Kemp's ridley sea turtles not defined) were captured. The environmental stress due to elevated water temperatures and salinities associated with drought conditions prevalent throughout Texas combined with a decline in blue crabs (taken in trawl tows) may have pushed the sea turtles to deeper and/or more eastern waters where foraging conditions may have been more favorable than in the Gulf waters near the Sabine Pass study area. With implementation of NOAA Fisheries' recommended conservation measures, LNG vessel traffic from operation of the proposed Project in the Gulf of Mexico is not likely to adversely affect this species.

Loggerhead Sea Turtle (*Caretta caretta*).[4] The loggerhead sea turtle favors warm temperate and sub-tropical regions and is widely distributed in tropical and subtropical seas. This species typically occurs over the continental shelf, and in bays, estuaries, lagoons, creeks, and mouths of rivers, but has been found as far as 500 miles offshore. In the continental U.S., loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey and sporadically along the Gulf coast. Nesting occurs primarily on barrier islands adjacent to continental landmasses in warm-temperate and sub-tropical waters. Nest sites are typically located on open sandy beaches, above the mean high tide, and seaward of well-developed dunes.

Adults occupy a variety of habitats, ranging from turbid bays to clear waters of reefs, whereas subadults occur mainly in near shore and estuarine waters. Hatchlings move directly to sea after hatching, and often float in masses of Sargassum. The loggerhead diet consists of a wide variety of benthic and pelagic food items, including conches, shellfish, horseshoe crabs, prawns and other crustacea, squid, sponges, jellyfish, basket stars, fish, and hatchling loggerheads.

This species only occasionally occurs on the upper Texas coast. During a sea turtle capture and characterization study conducted in nearshore habitats adjacent to Sabine Pass during March through October 1995, loggerheads were only token constituents of the Sabine Pass assemblage (Landry et al. 1996). The probability of the loggerhead sea turtle nesting in the Project area is very low due to a lack of suitable nesting habitat (i.e., sandy beaches). Project area mud flats could potentially serve as nesting habitats for this species, but nesting is typically restricted to the Atlantic coast. Because loggerheads are known to occur in turbid bays, there is a moderate probability of this species occurring within the Sabine Lake estuary and, more specifically, at the LNG terminal site, as a transient. With implementation of NOAA Fisheries' recommended conservation measures, LNG vessel traffic from operation of the proposed Project in the Gulf of Mexico is not likely to adversely affect this species.

Green Sea Turtle (*Chelonia mydas*).[5] Green sea turtles have a circumglobal distribution in tropical and sub-tropical waters. In the U.S., this species occurs in the Atlantic around the Virgin Islands, Puerto Rico, and along the Atlantic and Gulf coasts of the continental U.S. from Massachusetts to Texas. Green sea turtles utilize shallow estuarine habitats and other areas with an abundance of marine algae and sea grasses, their principal food sources. Green sea turtles are listed as threatened species with the exception of the Florida and Mexican breeding populations, which are considered endangered.

[4] NOAA Fisheries and FWS 1991a; Musick 1979; Rebel 1974; Ross 1982.
[5] NOAA Fisheries FWS 1991b; Bartlett and Bartlett 1999.

Terrestrial habitats are limited to nesting sites, which are typically located on high-energy beaches with deep sand and little organic content. Hatchlings often float in masses of sea plants (e.g., Sargassum) in convergence zones, using coral reefs and rocky outcrops near feeding pastures as resting areas. Adult green turtles typically inhabit shallow bays and estuaries where sea grasses, their principal food source, grow.

Nesting within the LNG terminal site is highly unlikely, as green sea turtles prefer to nest on high-energy beaches with deep sand and little organic content. Furthermore, the Minerals Management Service (MMS) (1997) indicates that reports of green sea turtle nesting in the northern Gulf are "isolated and infrequent." There is a moderate probability of this species occurring in the open water habitats of the Project area as a transient. With implementation of NOAA Fisheries' recommended conservation measures, LNG vessel traffic from operation of the proposed Project in the Gulf of Mexico is not likely to adversely affect this species.

Hawksbill Sea Turtle (*Eretmochelys imbricata*).[6] The hawksbill sea turtle occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans, and is widely distributed in the Caribbean Sea and western Atlantic Ocean, regularly occurring in southern Florida and the northern Gulf of Mexico. Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are found at depths of less than 70 feet. Hatchlings are usually associated with floating masses of sargassum in the open ocean.

Coral reefs and other hard substrates (i.e., jetties and rocky outcrops) are the most common foraging habitats of juveniles, subadults, and adults, as their diet consists primarily of sponges. Nesting occurs on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls; these beaches are typically low-energy, with woody vegetation near the waterline. In the continental U.S., nesting sites are restricted to Florida where nesting is sporadic at best. Due to the lack of suitable foraging and nesting habitats, there is a low probability of this species occurring within the Project area. With implementation of NOAA Fisheries' recommended conservation measures, LNG vessel traffic from operation of the proposed Project in the Gulf of Mexico is not likely to adversely affect this species.

Leatherback Sea Turtle (*Dermochelys coriacea*).[7] The leatherback sea turtle has been found in the Atlantic, Pacific, and Indian oceans; as far north as British Columbia, Newfoundland, Great Britain, and Norway; as far south as Australia, Cape of Good Hope, and Argentina; and in other water bodies such as the Mediterranean Sea. Leatherbacks are mainly pelagic, inhabiting the open ocean and seldom entering coastal waters except for nesting purposes. Leatherbacks are abundant in the northern Gulf, but primarily in deep waters of the continental slope and beyond (Hansen et al. 1996; Mullin and Hoggard 1998); however, they also occur on the shelf in smaller numbers. This species has been reported as occurring in shallow coastal waters but not usually near shore (Lee and Socci 1989). The leatherback typically nests on beaches with a deepwater approach. Leatherbacks nest primarily in tropical regions; major nesting beaches include Malaysia, Mexico, French Guiana, Surinam, Costa Rica, and Trinidad. In the continental U.S., leatherbacks nest only sporadically in some of the Atlantic and Gulf states; the largest U.S. nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Because the LNG site lacks suitable nesting habitats, there is a low probability of this species occurring within the Project area. With implementation of NOAA Fisheries' recommended conservation measures, LNG vessel traffic from operation of the proposed Project in the Gulf of Mexico is not likely to adversely affect this species.

[6] NOAA Fisheries 2003; National Fish and Wildlife Laboratory (NFWL) 1980; National Research Council (NRC) 1990.
[7] NFWL 1980; Eckert 1992; Pritchard 1971; Ross 1982; Schwartz 1976; NOAA Fisheries 2003.

Conclusions

The most likely impact on marine mammals and sea turtles from construction or operation of the proposed Project include potential effects associated with dredging, pile driving, or LNG ship traffic. Sempra proposes to dredge the marine basin and berth area using a hydraulic cutterhead dredge. Although direct mortality is not documented, recent takes of sea turtles have been documented that could result in injury or death to sea turtles. A recent cold-stunning event in the shallow waters of the Laguna Madre, Texas resulted when temperatures dropped over 19 degrees Fahrenheit in less than 72 hours during late-December 2004. At least 20 juvenile green turtles stranded during this event. Two green turtles entrained by the cutterhead dredge operating in the Brazos Santiago Pass area at the time of the cold-stunning event were deposited on a beach where dredge spoil was being deposited, and were consequently found adjacent to the opening of the dredge pipeline. Cold-stunning events have not been documented in the immediate Project area. Sea turtles are occasionally found in the SNWW and Sabine Lake.

Studies have shown that the sound waves from pile driving may result in injury or trauma to fish, sea turtles, or animals with gas-filled cavities, such as swim bladders, lungs, sinuses, and hearing structures (Abbott and Sawyer 2002). Based on site stratigraphy, Sempra anticipates that impact pile drivers would be used to drive the majority of the piles for the LNG terminal because the underlying soils are predominantly silts and clays, with intermittent silty and clayey sand layers. Generally, vibratory hammers are not well suited for driving piles in these types of materials; although, the contractor may elect to use a vibratory hammer for initial pile placement due to the relatively soft clays in the upper 50 to 60 feet. Once the piles are driven through the soft clays, an impact pile driver would be used. Use of impact pile driving would result in greater acoustic impact on the surrounding aquatic environment than vibratory pile driving. However, sea turtles are rarely found in the SNWW and pile driving activities would occur approximately 10.5 miles north of the Gulf of Mexico.

Sea turtles can be vulnerable to boat strikes while feeding, swimming, or resting near the surface. However, in the open waters of the Gulf, the LNG ships would represent an incrementally small increase in vessel traffic over current conditions and would occupy a relatively small area compared to the area traversed by the sea turtles. On approach to the SNWW, LNG ship speeds would be reduced so that boat strike hazards are reduced within Sabine Pass and the Port Arthur Ship Canal. Sempra also proposes to implement the Vessel Strike Avoidance Policy (**appendix L**).

The Project would not include any other activities, such as water intake or discharge in the Gulf of Mexico, which could pose an entrainment risk to sea turtles or directly impact sea turtles or marine mammals. Given the above, we believe that the Project would not adversely affect these species or their habitats.

4.7.1.2 Bird Species

Bald Eagle (*Haliaeetus leucocephalus*).[8] Mature bald eagles display a dark brown body with a snowy white head and tail with a large robust yellow bill and talons. Mature males generally weigh 7 to 10 pounds with a wingspan of 6 to 7 feet. Mature females are larger than the males weighing up to 14 pounds with a wingspan of up to 8 feet. Habitat requirements for the bald eagle typically consist of areas with abundant sources of large open waterways such as lakes, reservoirs, seacoasts, and large rivers. In addition to waterways, the availability of perches, which are usually tall trees or cliffs, adjacent to foraging and nesting areas appear to be an important component of habitat as well. Bald eagles typically build their nests in tall trees with easy unobstructed access. Wintering habitat utilized by bald eagles in

[8] Campbell 1995; Oberholser 1974; FWS 2004.

Louisiana is characterized by abundant, readily available food sources. Most wintering areas are associated with open water where eagles feed on fish or waterfowl. Fifty percent or more of the diet of the bald eagle is fish but, especially in winter, ducks, coots, other birds, rabbits, and rodents are taken. Additional studies have shown that bald eagles commonly eat catfish and softshell turtles. Bald eagles also are known to pirate fish from ospreys (*Pandion haliaetus*) and will utilize carrion when available.

Bald eagles have been identified by FWS as being present in Cameron and Calcasieu Parishes. Field surveys conducted by Sempra found no known bald eagle nest sites within the Project area (John Chance Land Surveys, Inc. [JCLS] 2005). There is the possibility that a non-breeding or summering individual would utilize some of the larger rivers within the Project area for feeding. Moderate potential exists for bald eagles to occur within the Project vicinity for foraging. Because this species is considered a highly mobile species and there is an abundance of foraging habitat within the Project area, no impacts are anticipated to this species. Additionally, impacts to emergent marsh and open water communities would be allowed to revert to their pre-construction conditions thereby restoring function to these foraging habitats and further reducing the probability of impacts to this species. We believe the Project is not likely to adversely affect the bald eagle.

Brown Pelican (*Pelecanus occidentalis*).[9] The brown pelican is known to inhabit coastal waters that range from shallow up to 80 feet deep and are often found loafing in a variety of natural and manmade settings, including beaches, sandbars, sand pits, mudflats, piers, wharves, pilings, oil/gas platforms, and docks. Preferred nest sites include small bushes and trees, including mangroves, and in humid forests on undisturbed offshore islands free from human disturbance, flooding, and terrestrial predators such as raccoons. After nesting, many individuals overwinter near their breeding grounds. Atlantic Coast populations migrate southward to the coasts of Florida and Cuba in the fall to overwinter whereas Gulf Coast pelicans usually remain on the Gulf Coast, although individuals from Texas and Louisiana have been recovered in Mexico and Cuba. In Louisiana, known brown pelican rookeries occur on Rabbit Island in Calcasieu Lake, Raccoon Point on Isles Dernieres, Queen Bess Island, Plover Island, Wine Island, and islands in the Chandeleur Chain.

The brown pelican is known to forage in Sabine Lake and surrounding shallow estuarine waters near the proposed terminal and send-out pipeline routes. However, no brown pelicans were sighted and no suitable nest habitats were found to exist during field surveys conducted in 2004. Based on the review of available information and consultation with the FWS, there is moderate potential for brown pelicans to occur within the Project vicinity as transient residents passing over the Project area.

Because this species is considered a highly mobile species and there is an abundance of foraging and nesting habitat outside the Project area but within the Project region, no impacts are anticipated to this species. Additionally, impacts to emergent marsh and open water communities would be allowed to revert to their pre-construction conditions thereby restoring function to these foraging habitats and further reducing impacts to this species. We believe the Project is not likely to adversely affect the brown pelican.

Piping Plover (*Charadrius melodus*).[10] Piping plovers are small shorebirds that breed in the northern Great Plains of the U.S. and Canada, along beaches of the Great Lakes, and along the Atlantic coastline from North Carolina to Newfoundland. The piping plover is considered a regular migrant and winter resident along the Gulf Coast, arriving in mid to late July. Over-wintering and nesting sites include bare to sparsely vegetated sandy beaches, sandbars, causeways, tidal flats, mud flats, sand flats, dunes, offshore spoil islands, and salt encrusted bare areas of sand, gravel, or pebbly mud on interior alkaline

[9] Palmer 1962; Guzman and Schreiber 1987; FWS 1980, 2003b; Clapp et al. 1982.
[10] Haig and Oring 1985, 1987; Oberholser 1974; FWS 1995, 2003a.

lakes and ponds. The LNG terminal site occurs within the range of year-round and wintering populations of piping plover. Designated critical wintering habitat for the species occurs at Rollover Pass, Texas, approximately 40 miles to the west-southwest of the Project area. Site surveys of the proposed LNG terminal and adjacent land have confirmed that no suitable habitat exist on or adjacent to the site. Construction and operation of the LNG terminal would have no effect on the piping plover, or its critical habitat.

Red-Cockaded Woodpecker (*Picoides borealis*).[11] The red-cockaded woodpecker nests within open, park-like stands of mature pine trees (over 60 years old) containing little hardwood understory or midstory. They excavate nest and roost cavities exclusively in large, living pine trees (greater than 10 inches diameter at breast height), which take about 1 to 3 years to excavate. The cavity trees and foraging area within 200 feet of those trees are known as a cluster. Foraging habitat consists of pine and pine-hardwood stands (i.e., pine trees are 50 percent or more of the dominant species), which are over 30 years of age and located contiguous to and within 0.5 mile of the cluster.

Once a common bird distributed continuously across the southeastern U.S., the species had declined to fewer than 10,000 individuals in widely scattered, isolated, and declining populations by the time of listing. The present population in the U.S. is estimated at 5,627 groups or 14,068 individuals. The decline of the red-cockaded woodpecker has been caused by the loss of old growth pine forest due to development, shorter rotation pine management, and the encroachment of hardwood mid-story in the pine forest due to fire suppression. The FWS lists the red-cockaded woodpecker as occurring in Beauregard and Calcasieu Parishes. A portion of the proposed 70-Mile-Long Pipeline route in Beauregard Parish contains suitable red-cockaded woodpecker habitat. Potential red-cockaded woodpecker habitat was identified in two of five areas surveyed during the 2003 survey; specifically areas 1 and 5 located between MPs 33 and 34 of the 70-Mile-Long Pipeline route in Beauregard Parish. Sempra contractors surveyed the area in the spring of 2003 and again in the spring of 2005. No red-cockaded woodpeckers, cavity trees, or other signs of red-cockaded woodpecker activity were observed during those surveys. Based on the results of these surveys, in a letter to Aaron C. Landry (Sempra's contractor) dated May 20, 2005, the FWS concurred with the contractor's determination that the proposed project is not likely to adversely affect the red-cockaded woodpecker. The FWS stated in the letter that no further consultation will be required for this project unless there are changes in the scope or location of the work, or construction has not been initiated within 1 year. Since the work on this section of the pipeline would not be initiated within 1 year, follow-up consultation would be required with the FWS prior to construction.

Conclusions

The most likely impact on birds from the proposed Project is habitat loss and bird strikes. The majority of habitat existing within the Project area is of low quality and not likely to serve as a food resource or nesting habitat to the bird species of concern. Another concern is the potential for collisions with aboveground storage tanks, transmission lines, and communication towers. These collisions are likely to increase at night or during fog and overcast conditions.

In a letter dated December 14, 2005, the FWS, Albuquerque, New Mexico Office expressed concern about storage tanks or towers requiring lights for aviation safety and recommended additional monitoring and mitigation of activities that impact birds. FWS recommended the use of the Federal Aviation Administration's (FAA) obstruction avoidance lighting plan required for storage tanks and towers. Sempra has indicated that it would implement, to the extent feasible, the FAA's obstruction avoidance lighting plan, but as not provided specific details. Therefore, **we recommend that:**

[11] FWS 2001.

- **Sempra provide, prior to construction of the terminal, a lighting design plan and operational procedures to minimize impact on the bird population. This plan should be developed in consultation with FWS and appropriate state agencies.**

We believe that the Project is not likely to adversely affect these species or their habitats if the proper precautions are incorporated into standard operating procedures during construction and operation activities.

4.7.2 State-Listed Threatened, Endangered, or Species of Concern

Sempra also conducted informal consultations with TPWD and LADWF to determine the presence of state-listed endangered, threatened, and species of concern that could be affected by the Project. State-listed species for the State of Texas are provided in **table 4.7-1** and described below. We reviewed the LADWF 1998 data prepared by the heritage program to determine the potential for occurrence of state-listed species in the Project area. The protected species list for the State of Louisiana includes any species that is federally listed (described in section 4.7.1 above).

Alligator Snapping Turtle (*Macroclemys temminckii*). The alligator snapping turtle is the largest freshwater turtle in the world. Alligator snapping turtles inhabit deep waters of larger rivers, lakes, swamps, bayous, and canals. They can be found along the banks of these waterways, but they spend most of their time submerged under water concealed in the mud floor.

This species is known to occur in the Neches River and Sabine River watersheds in freshwater and brackish marsh habitats. The LNG terminal site does not provide optimum habitat for this species, but alligator snapping turtles may occasionally traverse the site enroute to more suitable habitats. However, construction and operation of the proposed facilities is not likely to adversely affect the alligator snapping turtle or its habitat.

American Alligator (*Alligator mississippiensis*). Alligators occur at the LNG terminal site year-round. Alligators are not considered threatened as a species, but are on the federal list as threatened because of their similarity to the American crocodile. The listing is to protect crocodiles due to mistaken identity as alligators. Since crocodiles do not occur in Texas, the listing status is not applicable.

Reddish Egret (*Egretta rufescens*). The reddish egret is a long-legged, long-necked wader. They are year-round residents of the Gulf Coast of Texas and Louisiana and both coasts of southern Florida and Mexico. Reddish egrets are found primarily in coastal tidal flats, salt marshes, and lagoons and feed largely on small fish, frogs, and crustaceans. Reddish Egrets are well known for their distinctive foraging habits, which include running actively through shallow water and suddenly changing direction or jumping sideways. They also employ a more quiet strategy, in which birds stand still and spread their wings above the water, apparently trying to attract small fish to the shaded water below.

Reddish Egrets typically nest in colonies. In Texas, these egrets normally nest on the ground on dry coastal thorn brush islands, while in Florida, birds typically build a platform nest 3 to 15 feet above the water in mangrove areas. The reddish egret occurs throughout the Texas coastal zone, but is more common in the central and lower Texas coast. Although tidal flats in the vicinity of the Project area fit this description, no critical habitat for this species has been designated within the Project area. Because this species is considered highly mobile and there is other available habitat in the area, we believe that the Project is not likely to adversely affect this species.

White-faced Ibis (*Plegadis chichi*). The white-faced ibis seems to prefer freshwater marshes, where it can find insects, newts, leeches, earthworms, snails and especially crayfish, frogs and fish. They roost on

low platforms of dead reed stems or on mud banks. During the nesting season, they are colonial and will construct a deep cup of dead reeds among beds of bulrushes, on floating mats of dead plants or they may nest in trees. The areas where these nests are built usually are where water is less than three feet deep. The nests are lined with grasses in preparation for the ibis nestlings. In Texas, they breed and winter along the Gulf Coast and may occur as migrants in the Panhandle and West Texas.

The white-faced ibis is declining throughout North America, where continuing threats include draining of wetlands and the widespread use of pesticides. They currently are listed as state threatened. The federal government is awaiting additional information on them before deciding if they should be given federal status as an endangered or threatened species. Although not a preferred habitat, this species will utilize brackish wetlands such as those in the southern portion of the site, which exhibit low salinities most of the time. However, because this species is considered highly mobile and there is other available habitat in the area, we believe that the Project is not likely to adversely affect this species.

Arctic Peregrine Falcon (*Falco peregrinus tundrius*). The peregrine falcon is noted for having a wide and diverse distribution. The Arctic Peregrine nests in the arctic islands and the tundra regions of Alaska, Canada, and Greenland. They are highly migratory, flying over the U.S. to winter mostly in South America. The Texas coastline plays an important role in the survival of migrating peregrines. During each migration, falcons assemble on the Texas coast, especially on Padre Island, and accumulate stores of fat to continue their flight. They take advantage of the abundant prey along the open coastline and tidal flats. Some individuals have stayed for as long as a month during either spring or fall. It mostly eats birds that are caught in mid-air chases. Although preferred habitat is not found at the site, the area could be used for resting and foraging. However, because this species is considered highly mobile and there is other available habitat in the area, we believe that the Project is not likely to adversely affect this species.

Swallow-tailed kite (*Elanoides forficatus*). The swallow-tailed kite currently nests along the Gulf Coast and other adjacent states. Occasionally, these kites are seen statewide in Texas during spring and fall migration as well as all along the Gulf Coast. When nesting in Texas, swallow-tailed kites are most likely to be seen near large rivers, particularly the lower Trinity, lower Neches, and lower Sabine River watersheds and associated bottomland hardwood forests. It is believed that they breed from mid-March through the end of June only in the southeast part of the state where preferred habitat exists. It also is believed that most of the swallow-tailed kites nesting in Texas migrate south each fall to the Coastal Prairies and then move along the Gulf of Mexico to winter in South America. Like all migrating raptors, this species rides the thermals that are only produced over land so they do not cross the Gulf waters for long distances. It is unlikely that construction and operation of the LNG terminal and associated pipelines would adversely affect the swallow-tailed kite.

4.7.3 Conclusions

Based on the presence of habitat and historical records of occurrence, the species discussed above may occur within the Project area. However, there is a low probability of these species occurring in the vicinity of the proposed Project based on surveys conducted by Sempra, related literature, and consultation with the FWS, NOAA Fisheries, TPWD, and LADWF. Therefore, the proposed Project is not likely to adversely affect any of these species. In a letter dated January 14, 2005, the FWS, Albuquerque, New Mexico Office indicated that no federally listed or proposed species under their jurisdiction are likely to occur on the Texas portion of the Project area. In a letter dated March 3, 2005, FWS, Lafayette, Louisiana Office indicated that the West Indian manatee, the bald eagle, the piping plover and its designated critical habitat, and the Gulf sturgeon are not known to occur in proximity to the Louisiana portion of the Project area. In their letter dated May 20, 2005, the FWS stated that the proposed project is not likely to adversely affect the red-cockaded woodpecker. We concur with the FWS

determination that the proposed LNG terminal and pipelines are not likely to adversely affect those species.

Since construction of most of the pipeline is not planned to begin until 2008 and construction of the terminal may be delayed. Therefore, **we recommend that:**

- **If construction of the LNG terminal or pipeline system has not begun within 1 year from the date of FERC approval of the Project, Sempra should consult with the appropriate offices of the FWS and NOAA Fisheries to update the species lists and to verify previous consultations and the need for additional surveys and survey reports (if required). The FWS and NOAA Fisheries comments and conclusions on the surveys and survey reports, if any are required, should be filed with the Secretary prior to construction.**

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

The Port Arthur LNG Project would be located in Jefferson and Orange Counties, Texas, and Beauregard, Calcasieu, and Cameron Parishes, Louisiana. The proposed LNG terminal and associated marine facilities would be located on a 198-acre site that is within more than 2,900 acres owned by Sempra in Jefferson County, Texas. The site is adjacent to the west side of the Port Arthur Ship Canal and about 5 miles south of the intersections of SH 87 and SH 82 near the City of Port Arthur (see **figure 2.1-1** in chapter 2.0 of this EIS).

Sempra proposes to construct two 36-inch-diameter natural gas send-out pipelines to connect the LNG terminal to existing interstate natural gas pipelines. One pipeline, approximately 3 miles in length, would extend south from the LNG terminal connecting with an existing NGPL interstate natural gas pipeline in Jefferson County, Texas. The other pipeline, approximately 70 miles in length, would extend, in a northeasterly direction, to interconnect with the existing Transco Compressor Station No. 45 located in Beauregard Parish, Louisiana.

Construction of the LNG terminal site would require the relocation of approximately 3.3 miles of SH 87 as well as the existing pipelines and utilities that parallel the highway in Jefferson County, Texas (see **appendix A**).

4.8.1 Land Use

Most of the land affected by the construction and operation of the Port Arthur LNG Project would be open land, including wetlands. Other land uses affected would include open water and forest. Construction would affect a total of 1,497 acres of land: 263.2 acres of land for the LNG terminal, 970.3 acres for the pipelines, 81.2 acres for pipeline project staging yards, and 182.3 acres for additional temporary work space. Operation of the Project would affect 1,497 acres of land of which 198.2 acres would be permanently converted for operation of the LNG terminal facilities and 90.42 acres would be permanently converted for operation of aboveground pipeline facilities (3.22 acres) or from forest to non-forest (87.2 acres). **Table 4.8.1-1** summarizes the acres of each land use category that would be affected by construction and operation of the proposed Project.

4.8.1.1 LNG Terminal

Sempra proposes to use approximately 263.2 acres within an approximate 540-acre parcel of more than 2,900 acres owned by Sempra near Port Arthur in Jefferson County, Texas, to construct the LNG terminal. Permanent LNG terminal facilities would include marine facilities (ship berths), LNG storage tanks, vaporization system, vapor handling system, hazard detection and response systems, and other

TABLE 4.8.1-1

Acres of Land Affected by the Construction and Operation of the Proposed Project

Project Facility	Parish or County	Agriculture		Residential		Industrial		Open Water		Open Land (including wetland)		Forest (including wetland)		Transportation Paved Roads		TOTAL	
		Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
LNG Terminal																	
Jefferson, TX		-	-	-	-	-	-	-	-	202.2	140.7	57.5	57.5	3.5	-	263.2	198.2
Subtotal Terminal		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**202.2**	**140.7**	**57.5**	**57.5**	**3.5**	**-**	**263.2**	**198.2**
Pipeline Rights-of-Way																	
Jefferson, TX		-	-	-	-	-	-	237.1	-	23.1	2.22[a]	7.8	2.4	-	-	268.0	4.62[a]
Orange, TX		-	-	-	-	-	-	128.5	-	9.6	0.02[a]	-	-	-	-	138.1	0.02[a]
Cameron, LA		-	-	-	-	-	-	-	-	35.9	-	-	-	-	-	35.9	-
Calcasieu, LA		19.9	-	2.5	-	0.8	-	0.6	-	300.3	0.06[a]	154.9	74.4	-	-	479.0	74.46[a]
Beauregard, LA		0.5	-	0.6	-	0.1	-	0.2	-	34.1	0.92[a]	13.8	10.4	-	-	49.3	8.92[a]
Subtotal Pipelines		**20.4**	**-**	**3.1**	**-**	**0.9**	**-**	**366.4**	**-**	**403.0**	**3.22[a]**	**176.5**	**87.2[a]**	**-**	**-**	**970.3**	**90.42[a]**
Additional Work Space - Pipelines																	
Jefferson, TX		-	-	-	-	-	-	15.9	-	5.4	-	-	-	-	-	21.3	-
Orange, TX		-	-	-	-	-	-	6.1	-	8.4	-	-	-	-	-	14.5	-
Cameron, LA		-	-	-	-	-	-	1.6	-	8.6	-	-	-	-	-	10.2	-
Calcasieu, LA		3.4	-	0.5	-	0.6	-	3.1	-	100.6	-	23.2	-	-	-	131.4	-
Beauregard, LA		0.2	-	-	-	0.2	-	-	-	3.2	-	1.3	-	-	-	4.9	-
Subtotal Workspace		**3.6**	**-**	**0.5**	**-**	**0.8**	**-**	**26.7**	**-**	**126.2**	**-**	**24.5**	**-**	**-**	**-**	**182.3**	**-**
Staging Yards																	
Calcasieu, LA		-	-	-	-	-	-	-	-	46.8	-	-	-	-	-	46.8	-
Beauregard, LA		-	-	-	-	34.4	-	-	-	-	-	-	-	-	-	34.4	-
Subtotal Staging Yards		**-**	**-**	**-**	**-**	**34.4**	**-**	**-**	**-**	**46.8**	**-**	**-**	**-**	**-**	**-**	**81.2**	**-**
Total Project		**24.0**	**0.0**	**3.6**	**0.0**	**36.1**	**0.0**	**393.1**	**0.0**	**778.2**	**143.92**	**258.5**	**144.7**	**3.5**	**0.0**	**1,497.0**	**288.62**

(a) Pipeline operational impacts comprise conversion of forest to non-forest along the pipeline rights-of-way and permanent aboveground facility locations, including MLVs at MPs 19.2 (0.02 acre), 29.9 (0.02 acre), 40.3 (0.02 acre), 50.0 (0.02 acre), 58.4 (0.02 acre), and the pig receiver at MP 69.9 (0.92 acre) on the 70-mile-long pipeline; the pig receiver at MP 2.6 (2.0 acres) on the 3-mile-long pipeline; and pig launchers for both pipelines at MP 0.0 (0.2 acre).

facility components (electrical systems, water system, nitrogen vaporizers, fuel gas system, and gas metering system). Within the 540-acre parcel, approximately 198.2 acres would be used for the permanent LNG terminal facilities. Included in the 198.2 acres is the approximate 82 acres that would be used for the marine facilities. Of the 198.2 acres, 82.5 acres are wetlands that would be permanently filled to build the LNG terminal facilities. In addition to the 198.2 acres that would be used for the permanent LNG terminal facilities, approximately 65 additional acres would be used for temporary construction areas, including laydown, office, and parking areas.

A portion of the proposed LNG terminal site, a strip of land about 1,100 feet wide paralleling the western edge of the Port Arthur Ship Canal, is under the jurisdiction of the City of Port Arthur and zoned industrial. The remainder of the LNG terminal site is under the jurisdiction of Jefferson County, which has no county zoning ordinances. The land is open land that was previously used as a dredged material placement area (DMPA).

The marine terminal basin would include a turnaround area for the ships partially outside of the Port Arthur Ship Canal's navigation channel and two LNG ship berths, each equipped with appropriate mooring systems and accessories for safe berthing and de-berthing of LNG ships. Sempra would convert approximately 82 acres of open land and wetlands to open water for the unloading berths and turning basin.

Land use impacts associated with the construction and operation of the LNG terminal primarily would be associated with the conversion of approximately 198.2 acres of land from existing uses to industrial use for operation of the terminal, or approximately 37 percent of the total 540-acre tract of land owned by Sempra. The remaining 341.8 acres of land would remain open. This unused area would not be disturbed by construction or operation of the LNG facility.

4.8.1.2 Pipelines

Existing land uses along the pipeline routes consist primarily of open land, with some forested, agricultural, and industrial land, as well as open water. Sempra proposes to use a 150-foot-wide construction right-of-way in Sabine and Keith Lakes, a 125-foot-wide construction right-of-way in the marsh north of Sabine Lake, a 75-foot-wide construction right-of-way in all other wetlands, and a nominal 100-foot-wide construction right-of-way in upland areas. The construction rights-of-way would comprise 41.6 acres and 928.7 acres for the 3-Mile-Long Pipeline and 70-Mile-Long Pipeline, respectively, for a total of 970.3 acres. Following construction, a 50-foot-wide permanent right-of-way would be maintained for operation of the pipelines (approximately 405 acres).

Existing Rights-of-Way

Sempra would place the 70-Mile-Long Pipeline adjacent to existing rights-of-way for approximately 28.3 miles (**table 4.8.1.2-1**). A minimum offset from the existing rights-of-way centerlines would be established for the proposed new permanent right-of-way to ensure there is adequate workspace for containment and storage of trench spoil and for construction equipment to operate at a safe distance from in-service pipelines and power lines where severe rutting might present a hazard. This offset also would avoid potentially adverse influence on adjacent active pipelines that may result from the hydrostatic pressure gradient created by the pipeline's open ditch line in incohesive, saturated soil conditions. Widths of the temporary workspace that would overlap the existing permanent rights-of-way vary depending on width and type of corridor (**table 4.8.1.2-1).**

TABLE 4.8.1.2-1 Existing Rights-of way Parallel to the Project Pipelines						
Parish or County	**Begin MP**	**End MP**	**Type of Right-of-Way**	**Width of Existing Right-of-Way (feet)**	**Width of Right-of-Way To Be Used (feet)**	**Width of New Right-of-Way (feet)**
3-Mile-Long Pipeline						
Jefferson County	N/A	N/A	N/A	N/A	N/A	N/A
70-Mile-Long Pipeline						
Calcasieu Parish	28.7	40.6	TRANSCO Pipeline	50	25	50
Calcasieu Parish	40.6	41.6	Florida Gas Transmission Pipeline	30	15	50
Calcasieu Parish	41.4	41.9	UCAR Pipeline	50	25	50
Calcasieu Parish	42.1	49.1	Florida Gas Transmission Pipeline	30	15	50
Calcasieu Parish	49.1	50.1	Dixie Pipeline	50	25	50
Calcasieu Parish	51.0	53.8	Florida Gas Transmission Pipeline	30	15	50
Calcasieu Parish and Beauregard Parish	64.5	67.3	Entergy Overhead Power Line	100	15	50
Beauregard Parish	67.3	68.5	Texas Eastern Pipeline	50	25	50
Beauregard Parish	69.3	69.4	Louisiana Gas Pipeline	50	25	50

Aboveground Facilities, Extra Workspaces, Staging Areas, and Access Roads

Construction of the proposed pipelines would temporarily disturb a total of approximately 1,233.8 acres of land. In addition to the nomimal construction rights-of-way (970.3 acres), Sempra proposes to use approximately 182.3 acres for adjacent additional work spaces, and two off-right-of-way staging yards totaling approximately 81.2 acres. Approximately 57.1 miles of proposed access roads would require some improvements. Staging areas would be required to support construction and also used for both pipe storage and contractor yards. Of the 1,233.8 total acres affected during construction of the proposed pipelines, approximately 405 acres would be maintained as permanent right-of-way. In addition, approximately 3.22 acres would be permanently precluded from other use by the construction of aboveground facilities (mainline valves and pig launchers and receivers).

The 1,233.8 acres of land temporarily affected by construction of the pipelines, including extra workspaces and staging yards, would be composed of approximately 576 acres of open land including wetlands (47 percent), 36.1 acres of industrial land (2.8 percent), 393.1 acres of open water (31.7 percent), 201 acres of forest including wetlands (16.3 percent), 24 acres of agricultural areas (1.9 percent), and 3.6 acres of residential areas (0.3 percent). **Table 4.8.1-1** shows the current land uses that would be crossed by the proposed pipeline facilities. Temporary extra workspace requirements by milepost and acreages are shown in **appendix I**, **table I-1**. The additional work areas would extend beyond the construction rights-of-way and would affect approximately 126.2 acres of open land including wetlands, 3.6 acres of agricultural land, 0.5 acre of residential land, 0.8 acre of industrial land, 26.7 acres of open water, and 24.5 acres of forest.

Part of one of the MLV sites (MP 19.2) would be built on a platform in Sabine Lake. The four remaining MLV sites (MPs 29.9, 40.3, 50.0, and 58.4) would be located within the permanent right-of-way. The pig receiver at the terminus of the 70-Mile-Long Pipeline would be within a 200-foot by 200-foot area at MP 69.9, adjacent to the Transco Compressor Station 45 site. The MLVs at MPs 29.9, 40.3, and 50.0 would be located on open lands, while the MLV at MP 58.4 would be on forested land. After construction, all of the MLV sites, except the one at MP 19.2 (platform), would be enclosed by a 30-foot by 30-foot fence and the sites would be covered with gravel. The 200-foot by 200-foot pig receiver site at

MP 69.9 also would be fenced and graveled. Pig launchers for both pipelines would be located within a 60-foot by 150-foot fenced and graveled area adjacent to the LNG terminal boundaries. The pig receiver for the 3-Mile-Long Pipeline would be within a 300-foot by 300-foot fenced and graveled area at MP 2.6. No MLVs would be required for the 3-Mile-Long Pipeline.

Existing public and private roads would be used to access the pipeline rights-of-way. Some of the roads may require improvements, such as grading, widening, and/or the addition of crushed stone to the surface to support use by heavy equipment or the installation or repair of culverts. Access roads that would require improvement are shown in chapter 2.0, **table 2.2.2-1.** Sempra states that no new temporary or permanent access roads would be required to construct the pipelines. Two permanent access roads would be constructed within the terminal site.

Two staging or contractor yards would be leased for the duration of construction and would be used as both pipe storage areas and contractor yards. One (34.4 acres) is located on industrial land within the yard of an existing compressor station in Beauregard Parish, Louisiana; the other (46.8 acres) is located on open land in Section 26, Township 9 South, Range 12, West (approximately 2 miles north of MP 43) in Calcasieu Parish, Louisiana. Two other staging area/push sites would be used during construction and are located along the 70-Mile-Long Pipeline right-of-way. Following construction, these areas would be vacated and restored per agreements with the landowners.

Land Use Impacts and Mitigation

Landuse impacts associated with the pipelines would include disturbance of existing land uses within construction work areas along the rights-of-way during construction and creation of new permanent rights-of-way for operation and maintenance of the facilities. There would be a short-term disruption to agricultural land. Sempra would incorporate the measures included in our Plan, as well as landowner requests, to minimize impacts on agricultural land. Landowners would be compensated for loss of agricultural production in terms agreed upon with the landowners.

The primary impacts on forested land would consist of the creation of a right-of-way through forested areas. Forested lands would be cleared in the construction right-of-way and additional workspace areas to install the pipeline. Following construction, all temporary rights-of-way and additional work areas would be allowed to revert to forest. In accordance with the Plan and Procedures, routine vegetation maintenance clearing would be allowed no more frequently than every 3 years. To facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width, centered on the pipeline can be maintained annually in an herbaceous state. Additionally, trees within 15 feet of the pipeline that are greater than 15 feet in height could be selectively cut and removed from the permanent right-of-way.

To avoid impacting utilities during installation of the pipeline, Sempra would coordinate with the utility owners to ensure that facilities are appropriately marked and protected. Construction across existing highways and railroads would not significantly disrupt traffic flow. Sempra would consult with the Counties and Parish Police Juries concerning easement and construction requirements. Sempra would utilize construction techniques designed to minimize disruptions to traffic flow patterns.

Open land would be cleared in the construction right-of-way and additional workspace to install the pipeline. Sempra would utilize standard overland construction techniques through open lands. In wetlands, Sempra would incorporate measures included in the Procedures to minimize impacts to wetlands. Following construction, all temporary right-of-way and additional workspace would revert to its previous use. In most areas, the permanent rights-of-way would be reverted to previous use, but would be maintained, as necessary, for operation.

Pipeline Easements

Sempra would obtain easements from landowners to construct and operate the pipeline and associated facilities. The easements would give the company the right to construct, operate, and maintain the pipeline, and establish a permanent right-of-way. In return, the company would compensate the landowner for use of the land. Easement agreements between the company and the landowner typically specify compensation for loss of use during construction, loss of non-renewable or other resources, and allowable uses and restrictions on the permanent right-of-way after construction. These terms can include restrictions on the construction of aboveground structures, including house additions, garages, patios, pools, or any other object not easily removable from the right-of-way, or the planting and cultivating of trees and orchards.

Sempra could be granted the right of eminent domain (Section 7(h) of the NGA and the procedures set forth under the Federal Rules of Civic Procedure [Rule 71A]) if easement agreements cannot be negotiated. Under these conditions, the landowner could receive compensation, but the compensation would be determined by the courts. The areas used as temporary construction right-of-way and temporary extra workspaces 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 Sempra and individual landowners. The details and content of these agreements are beyond the scope of this EIS.

4.8.2 Residences and Planned Residential Development

In residential areas, the two most significant potential impacts associated with construction and operation of natural gas facilities are disturbance during construction and encumbrance of property for future uses (e.g., the limitation on future permanent structures within the permanent right-of-way). Residences within 50 feet of construction work areas would be most likely to experience the effects of construction and operation of the Project.

Temporary construction impacts on residential areas can include inconveniences caused by noise and dust generated by construction equipment, personnel, and trenching through roads or driveways; ground disturbance of lawns; removal of trees, landscaped shrubs, or other vegetative screening between residences and/or adjacent rights-of-way; potential damage to existing septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from within the right-of-way.

4.8.2.1 LNG Terminal

There are no residences within 1 mile of the proposed LNG terminal and no known residential or commercial areas are currently planned within 0.25 mile of the proposed LNG terminal. The nearest residence is approximately 1.6 miles southeast of the proposed terminal location, on Pleasure Island.

4.8.2.2 Pipelines

There are no planned residential or commercial areas within 0.25 mile of the proposed pipeline work areas. Three residences are located within 50 feet of work areas associated with the proposed 70-mile-long-pipeline in Calcasieu and Beauregard Parishes, Louisiana. Residences are located at MPs 46.8, 47.0, and 68.5, respectively. To minimize disruption and to maintain access to these residences, Sempra has agreed to coordinate with property owners throughout the construction process to minimize impacts to landowners. Sempra would contact owners of residential property crossed by the pipeline individually to notify them of when construction would take place on their property and to keep them informed about any special construction activities that may concern them.

Sempra has prepared site-specific residential construction plans for each of these locations. Mitigation measures set forth in these plans that Sempra has agreed to implement include: reducing work space to increase the distance from each structure; and installing and maintaining safety fencing along the edge of the work area, extending at least 100 feet beyond the structures in both directions. See **table 4.8.2.2-1** for site-specific mitigation for each residence.

TABLE 4.8.2.2-1

Residences Within 50 Feet of Project Work Areas

Residence Location (MP)	Distance from Work Area Before Mitigation	Mitigation	Distance After Mitigation
46.8	10 feet	Reduce work space width; erect temporary safety fence to extend 100 feet beyond both extremes of structure; erect chain link fence around water well	19 feet
47.0	36 feet	Erect temporary safety fence to extend 100 feet beyond both extremes of structure	36 feet
68.5	29 feet	Erect temporary safety fence to extend 100 feet beyond both extremes of structure	29 feet

Other measures that Sempra could use in these areas to further minimize inconvenience to residents include: specialized construction methods (e.g., stovepipe and/or drag section construction); limiting the duration of open trench adjacent to residences; promptly restoring driveways, fences, or mailboxes removed for construction; and maintaining access to the residences. Sempra would continue to coordinate with each landowner to identify the appropriate mitigation measures to minimize temporary construction impacts.

4.8.3 Public Interest and Recreation Areas

There are no developed recreational areas, facilities, or significant recreational activities that occur on the LNG terminal site. The property may occasionally be used for hunting and bank fishing. Nearby areas around Sabine Pass, Sabine Lake, Keith Lake, and the J. D. Murphree WMA are popular for bank fishing and duck hunting. Other recreation and public interest areas in the vicinity of the Project include the Walter Umphrey State Park, McFaddin and Texas Point National Wildlife Refuges (NWR), Sea Rim State Park, Sabine Pass Battleground State Park, SNWW, and Sabine Lake in Texas; the Creole Nature Trail/National Scenic Byway (SH 27), Sabine NWR, Sabine Island WMA, and the Western Corridor Tour (SH 171) in Louisiana; and private hunting clubs in both Texas and Louisiana (**table 4.8.3-1**).

Regional recreation facilities include the state-owned J. D. Murphree WMA, Sea Rim State Park, Walter Umphrey State Park, and Sabine Pass Battleground State Park. All provide recreational opportunities. The J. D. Murphree WMA, under the management of the TPWD, is located adjacent to the proposed LNG terminal site. It is a 24,250-acre tract of fresh, intermediate, and brackish water within the prairie-marsh zone along the upper coast of Texas. The area is primarily managed to maintain high quality wintering waterfowl habitat and secondarily to provide public recreation such as hunting, sport fishing, and wildlife viewing. Additionally, Round Lake, located immediately north of the LNG terminal site, and Keith Lake, located a little over 1 mile south of the terminal, are part of the J. D. Murphree WMA. Impacts on the WMA related to the LNG terminal include both short-term and long-term noise and visual effects during construction and operation.

TABLE 4.8.3-1

Public Interest and Recreation Areas in the Vicinity of

and/or Crossed by the Proposed Project Facilities

Begin MP	End MP	Special Land Use	Crossing Length (mi)
NC	NC	Sea Rim State Park	NC
NC	NC	Walter Umphrey State Park	NC
NC	NC	Sabine Pass Battleground State Park	NC
NC	NC	McFaddin, Texas Point, and Sabine National Wildlife Refuges	NC
NC	NC	Sabine Island WMA	NC
1.3[a]	1.6[a]	Proposed Jefferson County Park near Keith Lake Cut[a]	0.3
1.9[a]	2.6[a]	Keith Lake (J. D. Murphree WMA)[a]	0.7
2.0	19.2	Sabine Lake	17.2
19.8	22.5	Hawk Club (hunting club)	2.7
23.2	28.6	Black Bayou Hydrologic Restoration Area	5.4
23.5	36.4	Grey's Estate (hunting club)	12.9
28.9	29.5	Perry Ridge Shore Protection Area	0.6
30.7	31.0	Perry Ridge Shore Protection Area	0.3
58.2	58.2	Creole Nature Trail – Louisiana Highway 27	< 0.1
62.6	62.6	Beckwith Creek[b]	< 0.1
62.6	63.6	Temple Inland Crown Point Distinctive Site	1.0
63.8	63.8	Hickory Branch (West Fork of the Calcasieu River) [b]	< 0.1
69.0	69.0	Western Corridor Tour – Louisiana Highway 171	< 0.1

[a] On the proposed 3-Mile-Long Pipeline route
[b] Would be avoided by HDD
NC – Not Crossed, but in the vicinity of the Project

Keith Lake, a 1,500-acre lake, is a part of a major drainage system for southern Jefferson County and is within the J. D. Murphree WMA. This shallow lake is actually one of several lakes in a chain. Located to the west of SH 87, just over 1 mile south of the LNG terminal site, the lake offers fishing and boating activities. The area includes the Keith Lake Cut and lands adjacent to it, which also include a proposed county park. The 3-Mile-Long Pipeline would cross the WMA in Keith Lake between MPs 1.9 and 2.6 and the proposed county park between MPs 1.3 and 1.6. Construction of the 3-Mile-Long Pipeline would have short-term effects on boating, fishing, and other recreational activities in and around Keith Lake and Keith Lake Cut. Construction activities would temporarily disrupt recreators' ability to boat and fish in the vicinity of the construction spread. Sempra likely would maintain a safety buffer around the construction spread, as it proceeds across the lake, to preclude recreational boaters from getting too near the work areas. There would not be any long-term effects on Keith Lake, Keith Lake Cut, or the proposed county-owned park during operation of the pipeline. Biological and physical impacts on Keith Lake are discussed in sections 4.3.3, 4.4, 4.6, and 4.7. In addition, operation of the terminal would have some impact on recreational boaters on the Sabine/Neches Waterway. Restrictions may be placed on recreational boaters during the LNG ship transit. On average, Sempra expects up to one LNG ship a day to arrive at the terminal. During the transit of these ships, recreational boaters would be delayed or displaced.

The nearest portion of the state-owned Sea Rim State Park to the LNG terminal is immediately west of, and adjacent to the J. D. Murphree WMA, within 1 mile of the LNG terminal location. Camping, picnicking, airboat tours, beach swimming, hunting, and an interpretive walkway are offered. Construction and operation of the LNG terminal and pipeline facilities would have no direct impact on the park or park facilities, but would have long-term, low-level noise and visual effects on the nearest portions of the Park.

The state-owned Walter Umphrey State Park is located on the eastern tip of Pleasure Island about 3.2 miles southeast of the LNG terminal site. This state park has a public viewing/observation platform, a picnic area, a 20-site recreational vehicle park, four boat ramps, and a pier. Informal user estimates indicate that the park may host 400 to 500 visitors a day during the peak months of April to October. Construction and operation of the LNG terminal and pipeline facilities would have no direct impact on the park or park facilities.

The state-owned Sabine Pass Battleground State Historic Park is located in Sabine Pass, Texas, approximately 6 miles southeast of the LNG terminal site. The park features an interpretive pavilion detailing the 1863 Battle of Sabine Pass, a 1,600-foot-long walking trail, handicapped accessible sidewalks with access to the water and views of the Sabine Pass Lighthouse, boat ramps, and campsites. Construction and operation of the LNG terminal and pipeline facilities would have no direct impact on the park or park facilities.

Sabine Lake is a 100-square-mile bay system leading to the Gulf of Mexico. The Port Arthur Ship Canal (part of the SNWW) and Pleasure Island separate Sabine Lake from the LNG terminal site, located to the west of the lake. The lake is popular for fishing, boating, sail boarding, and other water sports. Pleasure Island, which is a DMPA used by the COE, lines the west side of the lake and provides waterside activities, including a marina, several fishing piers (including a lighted pier at Walter Umphrey State Park on the south end of the island), several boat ramps, recreational vehicle parks, and areas for picnicking. These activity areas are more than 5 miles from the LNG terminal site. Construction of the 70-Mile-Long Pipeline would have short-term effects related to boating, fishing, and other recreational activities in and around the lake. There would not be any long-term effects related to operation of the pipeline. Biological and physical impacts on Sabine Lake are discussed in sections 4.3.3, 4.4, 4.6, and 4.7.

The federally owned and managed McFaddin, Texas Point, and Sabine NWRs are located in the vicinity of the Project. The McFaddin NWR, with more than 55,000 acres, is located approximately 3 miles southwest of the LNG terminal site. Texas Point NWR comprises 8,900 acres and is located approximately 6 miles southeast of the terminal site. Activities available at these NWR's include fishing, wildlife viewing, hunting, and boating. The Sabine NWR is a 124,511-acre wildlife refuge adjacent to the northeast and east shore of Sabine Lake on the opposite side of the lake from the 70-Mile-Long Pipeline route. The northwestern corner of Sabine NWR is within 1 mile of the route. The marshes between Calcasieu and Sabine Lakes comprise the Sabine NWR, which is the largest bird refuge on the Gulf Coast. Public use of this refuge includes hiking, fishing, boating, camping, and hunting. Construction and operation of the LNG terminal and pipeline facilities would have no direct impact on these NWRs.

The state-owned Sabine Island WMA is located about 4 miles west of MP 40 on the 70-Mile-Long Pipeline route between Vinton and Starks, Louisiana in Calcasieu Parish. Trapping and hunting are the primary recreational activities in this 8,103-acre area. Construction and operation of the LNG terminal and pipeline facilities would have no direct impact on this WMA.

The Creole Nature Trail is a National Scenic Byway that includes portions of SH 82 in Texas and SHs 82 and 27 in Louisiana. It is the result of a partnership between the Creole Nature Trail All-American Road, the Southwest Louisiana/Lake Charles Convention & Visitors Bureau, the Calcasieu Parish Police Jury, and the Federal Highway Administration. The proposed 70-Mile-Long Pipeline route crosses SH 82 at approximate MP 1.7 in Jefferson County, Texas, and SH 27 at approximate MP 58.2 in Calcasieu Parish, Louisiana. The pipeline would be pulled under these highway crossings utilizing the HDD construction technique; therefore, no impacts to users of the roadway are expected.

The Western Corridor Tour is a scenic byway that follows the western border of Louisiana from the north to south along SH 171. The proposed 70-Mile-Long Pipeline route crosses SH 171 at approximate MP 69.0 in Beauregard Parish, Louisiana. The pipeline would be constructed under this highway utilizing the HDD construction technique; therefore, no impacts to users of the roadway are expected.

The 70-Mile-Long Pipeline route traverses two privately-owned hunting clubs, one in Orange County, Texas (Hawk Club), and the other in Cameron and Calcasieu Parishes, Louisiana (Grey's Estate). In Orange County, land under the ownership and management for hunting by the Hawk Club is crossed by the 70-Mile-Long Pipeline route between MPs 19.8 and 22.5. In Cameron and Calcasieu Parishes, land under the ownership and management for hunting by the Grey's Estate is crossed by the 70-Mile-Long Pipeline route between MPs 23.2 and 37.2. Sempra has stated that construction of the 70-Mile-Long Pipeline would occur outside the hunting season to avoid impacts to these hunting clubs. The MLV at MP 29.9 would permanently preclude recreational use of 0.02 acre of land, but, as no forested areas would be cut in these areas, no additional long-term impacts would be expected during operation of the pipeline.

Temple-Inland is a forest products company that manages pine plantations for commercial timber harvest. The Temple-Inland Crown Point Distinctive Site, located on Temple-Inland-owned property, is an approximate 360-acre site defined and designated by Temple-Inland. It would be crossed by the 70-Mile-Long Pipeline route between MPs 62.6 and 63.6. Temple-Inland and federal and state agencies have expressed concern about this site. See sections 3.5.3.5 and 4.5.2 for a complete description and discussions regarding potential impacts and mitigation for this site.

The proposed route of the 70-Mile-Long Pipeline would cross small portions of two areas that were designed and constructed under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA, also known as the Breaux Act). The first of these areas that would be crossed is the Black Bayou Hydrologic Restoration Project area near the northwest corner of Cameron Parish and the southwest corner of Calcasieu Parish, between MPs 23.2 and 28.6. This area is bordered by the GIWW along the north boundary and Sabine River on the northwest boundary. NOAA Fisheries is the federal sponsor for this restoration and the local sponsor is the LADNR. The project area was historically a tidally influenced brackish marsh. The purpose of this 25,529-acre wetland project is to: 1) restore coastal marsh habitat; and 2) slow the conversion of wetlands to shallow, open water in the restoration project area. Wave action from boats traveling the GIWW has eroded the bank in five locations along the project boundary. The breaches have allowed salt water into the project area resulting in much of the natural wetlands dying back and reverting to shallow open water areas.

No rock dikes or weirs associated with the Black Bayou Hydrologic Restoration Project would be crossed by the pipeline route. Existing banks of the project area would not be affected as they would be crossed using the HDD technique. However, approximately 5.4 miles (roughly 65.5 acres) of marsh would be temporarily affected by construction of the pipeline between MPs 23.2 and 28.6. While this construction would result in open water areas in the short-term, the right-of-way would be restored to pre-construction conditions. Also, because no dikes or weirs would be affected, no additional salt-water intrusion would be expected to occur to the marsh. Sempra states that it would coordinate with the sponsors of this project including the federal sponsor (NOAA Fisheries) and the local sponsor (LADNR) to ensure that weirs, rock dikes, and vegetative plantings associated with the restoration of this area are not affected.

The second special management area crossed by the 70-Mile-Long Pipeline route is the Perry Ridge Shore Protection Project; sponsored by the Natural Resources Conservation Service (under the USDA) at the federal level and the LADNR at the local level. The 70-Mile-Long Pipeline would cross this area in two locations, between MPs 28.9 and 29.5 and between MPs 30.7 and 31. This 5,945-acre project is located in Calcasieu Parish, Louisiana, on the north shore of the GIWW. The severe erosion rate of

3.9 feet per year along the GIWW threatens to breach the spoil bank in this area and cause erosion of fragile, organic soils in the fresh-to-intermediate marshes north of the GIWW.

The spoil bank along the northern bank of the GIWW, as part of the Perry Ridge Shore Protection Project, would not be disturbed, as the pipeline would be installed with the HDD at this crossing of the GIWW. However, approximately 0.9 mile (roughly 11 acres) of marsh would be temporarily affected by construction of the pipeline between MPs 28.9 and 29.5 and MPs 30.7 and 31. While this construction would result in open water areas in the short-term, the right-of-way would be restored to pre-construction conditions. Also, because the spoil bank on the northern bank of the GIWW would not be affected, no additional erosion of the fragile, organic soils would be expected to occur. Sempra states that it would coordinate with the federal and local sponsors of this project including the Natural Resources Conservation Service and the LADNR, respectively, to ensure that restoration would meet their expectations.

The 70-Mile-Long Pipeline route would cross Beckwith Creek and the Hickory Branch (West Fork of the Calcasieu River) at MPs 62.6 and 63.7, respectively. These two rivers are listed as Louisiana Natural and Scenic Rivers and would require Louisiana Natural and Scenic Rivers System Permits for the crossings. Sempra is proposing to cross each of these rivers using the HDD technique; therefore, no banks or vegetation would be disturbed if the HDDs were successful, and the natural and scenic nature of these rivers would remain intact. No other federal or state natural and scenic rivers would be crossed by the proposed project.

The 70-Mile-Long Pipeline route would cross the GIWW, a waterbody considered sensitive by federal and/or state resource management agencies, as it is a navigable waterbody regulated by the COE. The GIWW is a coastal canal from Brownsville, Texas, to St. Marks, Florida. The SNWW is part of that system with channel depths in the waterway designed to safely accommodate large petrochemical tankers and cargo ships. The Texas portion of the GIWW extends 406.2 miles, from Sabine River, Texas to the Mexican border. In 2002, a total of 14,372 vessels (7,181 inbound and 7,191 outbound) traveled into and out of Port Arthur along this waterway. Port Arthur is only 19 miles from the Gulf of Mexico with 24-hour channel and dock accessibility. The waterway has a significant amount of commercial activity and is used by recreational boaters.

Summary

Impacts to recreational resources during construction are expected near the LNG terminal site. During construction of the slip, dredging operations would limit recreational boating, as boaters would be restricted from the construction area during these activities. The dredging activity would take approximately 13 months. During this time, the amount of construction activity would preclude most types of recreational activities. Environmental mitigation control measures would further restrict recreational boat use from the area for safety reasons. Once dredging of the slip area is complete, construction equipment to install the berth structures and facilities would limit recreational use of the slip area. Fishing would be limited as a result of recent construction of the slip.

Dredging and dredged material placement activities would result in impacts to recreational boaters. Prior to the onset of dredging, Sempra would provide a detailed package of information (schedule, dredging spread, contact numbers, etc.) on the dredging program to the COE, the USCG, and to the Sabine Pilots. Dredging activities would be in compliance with procedures used by the COE for maintenance dredging operations in the SNWW. A security plan would be developed in conjunction with the USCG. The plan would address, among other issues, prevention of conflicts between recreational boaters and project construction activities. Therefore, impacts to fishing and boating activities would be short-term during construction of the LNG terminal site.

Additionally, boaters may encounter delays in the immediate area of an LNG ship due to the moving safety/security zone requirements. Recreational boats coming within 50 yards of an LNG ship in transit would likely be restricted from approaching from a safety/security standpoint. Because of existing commercial traffic on the Sabine/Neches Waterway, recreational boat traffic is primarily concentrated in the area lakes and at the Sabine Pass boat launch ramp that accesses the Gulf of Mexico. Impacts from transiting LNG ships would involve delays and/or restrictions on recreational boaters. On average, up to one LNG tanker per day would arrive at the terminal.

Short-term impacts to recreational resources near the pipeline routes are anticipated during construction. Specifically, the short duration of the construction activity (45 days) and the small area of the construction activity in Keith Lake, as well as the small area of the construction activity relative to the size of Sabine Lake, would minimize the effects on recreation in these two areas. Construction of the 70-Mile-Long Pipeline in the area of the Hawk Club and Grey's Estate hunting clubs is planned to occur outside the hunting season, thereby avoiding adverse effects on hunting at these two clubs.

4.8.4 Visual Resources

The degree of visual impact that may result from a proposed project typically is determined by considering the general character of the existing landscape and the visually prominent features of the proposed facilities. The LNG terminal would be constructed in a rural part of Jefferson County, Texas, south of the city of Port Arthur and north of the town of Sabine Pass, Texas. The visual character on the west side of the Port Arthur Ship Canal has been slightly altered by industrial activities associated with oil and gas development, whereas the visual character across the channel on Pleasure Island remains relatively rural with no major industrial facilities but some disturbance associated with dredge material placement activities and scattered residences.

The primary Project components that could have a visual impact on the surrounding areas are the marine terminal basin, where large LNG ships would dock, and the six 176-foot-tall LNG storage tanks. Potential public viewpoints include SHs 87 and 82 (Creole Nature Trail) and scattered residences along these highways; the J. D. Murphree WMA; the Port Arthur Ship Canal; and Pleasure Island.

The nearest public viewpoints are the J. D. Murphree WMA and SH 87 which are and/or would be (see **appendix A**) located adjacent to the proposed LNG terminal location and would have partially screened views of the marine basin and the six LNG storage tanks, due to levees and vegetation in the area. Views from these areas would include the LNG ships, pilot boats, and tugs as the LNG ships transit the Port Arthur Ship Canal and maneuver into the marine berths. Ships transiting the ship canal are a frequent occurrence and an expected element in the viewshed; therefore, the LNG ships would not represent a new impact on views from the WMA or the highway and visual impact would be minimal. The marine berth and LNG storage tanks would represent new elements in the viewshed and the tanks would be considered a severe impact on the viewshed from the portions of the WMA that abut the terminal (e.g., Round Lake), but the impact to the viewshed would be lessened due to screening from the natural vegetation as visitors to the area move away from the terminal location.

The Creole Nature Trail/National Scenic Byway (SH 82) is located on Pleasure Island, directly across the Port Arthur Ship Canal from the proposed terminal, and would have open views of the proposed marine basin and LNG storage tanks. Pipeline construction also would be intermittently visible to motorists traveling on SHs 87 and 82, depending on intervening vegetation or structures.

There are no Federal or state regulations that protect the viewshed of the Creole Nature Trail/National Scenic Byway. The Corridor Management Plan describes the viewshed as being a 0.5-mile radius on

either side of the roadway, except where the viewing is limited by trees or levees (Creole Nature Trail, Undated). The LNG tanks, marine basin, and pipeline would be within this radius. However, visual impacts from pipeline construction would be temporary and limited to the construction period. No permanent aboveground facilities would be constructed adjacent to or within 1,000 feet of the byway. Further, the area where the pipeline would be placed adjacent to SH 82 is dominated by wetlands and water and would be restored to preconstruction conditions.

The shoreline along the Port Arthur Ship Canal within 2 miles in both directions is largely wetlands and dredged material storage, but ships transiting the Port Arthur Ship Canal are a frequent occurrence and an expected element in the viewshed. However, there are no other existing permanent structures similar in scale to the proposed LNG storage tanks within 2 miles of the proposed facility location. Based on the LNG facility location, the generally low topographic relief, and lack of comparably sized facilities, we believe that the proposed LNG facilities would dominate the area viewshed and result in both temporary and permanent changes to the surrounding visual landscape. Because of flat terrain and limited potential for screening, the visual impacts associated with the LNG terminal would be unavoidable. Due to the size of the facilities, no measures can be taken to visually screen them, although the tanks could be painted a light gray to blend in with the surrounding landscape and a non-reflective paint would help to reduce glare during daylight hours.

Construction and operation of the proposed pipelines may affect visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and as a result of the presence of new aboveground facilities. The landscape setting along the proposed pipeline routes is generally flat, and views of the construction activities may extend for some distance. Two visually scenic areas are located near the pipeline project route. The pipeline crosses the Creole Nature Trail, a National Scenic Byway, and the Western Corridor Tour, a scenic highway. The right-of-way would cross SH 27 (Creole Nature Trail) at approximate MP 58.2. The pipeline would be constructed under this highway utilizing the HDD construction technique; therefore, visual impacts would be minimized both during construction and operation. The areas north and south of the crossing are a patchwork of open and forested lands. The crossing of Highway 171 (Western Corridor Tour) is currently composed of open lands. The visual impact on these public viewpoints would be moderate in the short term; once revegetation is in place, minor impacts from these viewpoints are expected in the long term. All construction work areas would be restored as near as possible to preconstruction contours and revegetated. Once revegetation is complete, there would be no significant alteration of the landscape of the region.

Construction and operation of the MLVs and pig launchers/receivers would result in a minor permanent visual impact. The launchers at MP 0.0 would be located within the LNG terminal facility and would be amidst similar facilities. Therefore, there would be no additional visual impact from these facilities. The MLV at MP 19.2 would be very visible to occasional hunters and fishermen in the area, but few others. The remainder of the MLVs along the 70-Mile-Long Pipeline would be permanent but minor visual elements to the existing open or forested landscapes. The receivers at both pipeline termini would be either adjacent to a much larger industrial facility associated with the Transco Compressor Station 45 (70-Mile-Long Pipeline) or amidst other pipeline-related appurtenances adjacent to SH 87 (3-Mile-Long Pipeline), and would have minimal new visual impact.

4.8.5 Coastal Zone Management

Portions of the Project would be located within designated coastal zone management areas. The LNG terminal, the 3-Mile-Long Pipeline, and a portion of the 70-Mile-Long Pipeline (MPs 0.0 to 28.6) would be located within Texas and/or Louisiana CZMA. The CZMP is administered in Texas by the Coastal Coordination Council and in Louisiana by the Coastal Management Division of the LADNR.

In Texas, the proposed LNG terminal, the 3-Mile-Long Pipeline, and the 70-Mile-Long Pipeline from MP 0.0 to approximate MP 23.0 would be located within the Texas CZMA. In Louisiana, the coastal zone boundary is defined by the GIWW (approximate MP 28.6 on the 70-Mile-Long Pipeline route). The portion of the Project in Louisiana that would be within the coastal zone boundary is between MPs 23.0 and 28.6 on the 70-Mile-Long Pipeline in Cameron and Calcasieu Parishes.

The Coastal Coordination Council was established by the Texas CMP to serve as the forum to coordinate state, federal, and local programs and activities on the coast. In order to obtain a federal permit in Texas, an applicant must document consistency with the Texas CMP. In order to obtain a consistency determination in Texas for a federal action (e.g., a FERC project), applicants must submit a Section 404 permit application to the COE, along with a consistency statement. The COE will forward the Public Notice to the Coastal Coordination Council and the Railroad Commission of Texas. The Coastal Coordination Council will post the Public Notice on its website (www.glo.state.tx.us/coastal/fedactions.html) and in the Texas Register. The Railroad Commission of Texas is responsible for reviewing federal agency actions and activities to confirm they are consistent with the Texas CMP.

In Louisiana, the CZMP is administered by the Coastal Management Division of the LADNR. Sempra would be required to submit a Coastal Use Permit application to the Coastal Management Division concurrent with the COE Section 404 permit application. Sempra has held meetings with representatives of these agencies to begin the coastal zone consistency determination process. Determinations from the Railroad Commission of Texas and the LADNR that the Project is consistent with the laws and rules of CZMP must be received before we issue a notice to proceed. Therefore, **we recommend that:**

- **Sempra not begin construction of any facilities associated with the Port Arthur LNG Project until it files with the Secretary a copy of the CZMP consistency determinations issued by the Railroad Commission of Texas and the LADNR.**

4.8.6 Hazardous Waste Sites

No hazardous waste sites were identified at locations that would be affected by construction of the project facilities. Therefore, there would be no impact from hazardous waste sites on construction and operation of the proposed facilities.

4.9 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 the construction period. Other potential effects related to construction include increased traffic or disruption of normal traffic patterns in the Project vicinity and local construction expenditures by Sempra. 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 operating company.

4.9.1 Population

The LNG terminal site, the 3-Mile-Long Pipeline, and portions of 70-Mile-Long Pipeline would be located in Jefferson County, Texas. Jefferson County has a land area of 904 square miles, a population of 252,051, and an average population density of 279.0 persons per square mile. The 70-Mile-Long Pipeline would extend through Orange County, Texas, which has a land area of 356.4 square miles, a population of 84,966, and an average population density of 238.4 persons per square mile.

In Louisiana, the 70-Mile-Long Pipeline would traverse Cameron Parish, the geographically largest parish in Louisiana affected by the Project. Cameron Parish has a land area of 1,313 square miles, a population of 9,991, and an average density of 7.6 persons per square mile. The 70-Mile-Long Pipeline would continue through Calcasieu and Beauregard Parishes of Louisiana. Calcasieu Parish is located north of Cameron Parish and has a land area of 1,071.2 square miles, a population of 183,577, and an average population density of 171.4 persons per square mile. Beauregard Parish, just north of Calcasieu Parish, has a land area of 1,160 square miles, a population of 32,986, and an average population density of 28.4 persons per square mile (U.S. Census 2000). Of the three Louisiana parishes crossed by the Project, Calcasieu Parish has the greatest population density per square mile. A summary of the population data is provided in **table 4.9.1-1**.

TABLE 4.9.1-1

Existing Socioeconomic Conditions for the Port Arthur LNG Project

State/Parish or County	Population 2000[a]	Population Density 2000[b]	Per Capita Income 2002[c]	Civilian Labor Force As Noted	Unemployment Rate (percent) As Noted	Top Two Major Industries 2002[c]
Texas	20,851,820	79.6	$29,039	10,308,400[d]	5.7[d]	1. Manufacturing 2. Professional and Technical Services
Jefferson	252,051	279.0	$26,096	120,939[e]	8.9[e]	1. Manufacturing 2. Professional and Technical Services
Orange	84,966	238.4	$24,182	41,531[e]	11.1[e]	1. Manufacturing 2. Retail Trade
Louisiana	4,468,976	102.6	$25,296	1,910,800[d]	6.6[d]	1. Manufacturing 2. Health Care and Social Assistance
Cameron	9,991	7.6	$18,031	3,120[f]	6.4[f]	1. Transportation and Warehousing 2. Mining
Calcasieu	183,577	171.4	$24,708	88,300[f]	6.6[f]	1. Manufacturing 2. Construction
Beauregard	32,986	28.4	$20,089	12,080[f]	8.8[f]	1. Manufacturing 2. Retail Trade

[a] U.S. Census Bureau, *Table DP-1. Profile of General Demographic Characteristics: 2000*.
[b] U.S. Census Bureau 2000, *State and County QuickFacts 2000*. Persons per square mile, based on population and land area size: Texas (261,797 sq. mi.), Jefferson County (904 sq. mi.), Orange County (356.4 sq. mi.), Louisiana (43,562 sq. mi.), Calcasieu Parish (1071.2 sq. mi.), Cameron Parish (1,313 sq. mi), Beauregard Parish (1,160.2 sq. mi.).
[c] U.S. Department of Commerce, Bureau of Economic Analysis, *Regional Economic Accounts for 2002.*
[d] U.S. Department of Labor, Bureau of Labor Statistics, *Texas and Louisiana Economy at a Glance for June 2004.*
[e] Texas Workforce Commission, *July 2004 Texas LMI Tracer Data Analysis.*
[f] Louisiana Works Department of Labor, 2003 Annual Civilian Labor Force Summary for Cameron, Calcasieu, and Beauregard Parishes.

The socioeconomic impact area for the LNG terminal and two send-out pipelines includes Jefferson and Orange counties in Texas and the parishes of Cameron, Calcasieu, and Beauregard in Louisiana. These areas are primarily rural with low population density except for cities of Port Arthur, Beaumont, and Orange, Texas, and Lake Charles, Louisiana. In 1999, Jefferson and Orange counties reported 14.6 and 11.5 percent respectively, of the population, with incomes below the poverty level. Cameron, Calcasieu, and Beauregard Parishes reported 9.1, 12.8, and 13.0 percent, respectively, of the population below the poverty level. In Texas, 12.0 percent of the total population was below the poverty level in 1999. Louisiana had 15.8 percent of its total population below the poverty level in 1999 (U.S. Census Bureau 2000).

Table 4.9.1-2 provides ethnicity data for Texas and Louisiana. The table also provides ethnicity data for Jefferson and Orange counties and the parishes of Cameron, Calcasieu, and Beauregard. The minority populations of the counties and parishes are not greater than 50 percent. In general, the minority population percentages for the counties and parishes are lower than the percentages for the states, except for two instances. The percentage of black and American Indian or Alaska Native people in Jefferson and Orange counties is greater than the State of Texas. The percentage of American Indian or Alaska Native in Beauregard Parish is slightly larger than that for the State of Louisiana.

TABLE 4.9.1-2

Ethnicity Data for the Port Arthur LNG Project and Port Arthur Pipeline Project

Population	Texas (percent)	Jefferson County (percent)	Orange County (percent)	Louisiana (percent)	Cameron Parish (percent)	Calcasieu Parish (percent)	Beauregard Parish (percent)
White[(a)]	73.1	58.4	89	64.8	94.3	74.5	85.3
Black[(a)]	12.0	34.2	8.6	32.9	4.1	24.4	13.3
American Indian or Alaska Native[(a)]	1.0	0.7	1.1	1.0	0.6	0.7	1.3
Asian or Pacific Islander[(a)]	3.2	3.2	1.0	1.5	0.5	0.9	0.9
Hispanic[(b)]	32.0	10.5	3.6	2.4	2.2	1.3	1.4

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.
Source: U.S. Census Bureau, Census 2000.

We conclude that there would not be any disproportionately high or adverse environmental and human health impacts to low-income or minority communities or Native American programs as a result of the construction and operation of the proposed Port Arthur LNG Project.

Construction of the LNG terminal would be conducted in two phases. Phase I would require an average of 530 workers per month for the duration of the 45-month construction period. During the peak construction period, approximately 1,247 personnel would be required in month 36. Phase II construction would require an average of 429 workers per month for the duration of the 39-month construction period. During peak construction, about 861 personnel would be required in month 32. Sempra states that, if skilled and available, approximately 30 percent of local workers would be used for construction. If needed, additional skilled construction personnel such as mechanical, electrical, instrumentation, and control tradesman, would be hired from outside the Project area.

The total temporary change in population would be equal to the total number of non-local construction workers, plus any family members accompanying them. Using the average of 530 personnel per month, 159 workers (30 percent) would be local and about 371 workers would be non-local for the Phase I construction period. For the Phase II construction period, about 129 workers (30 percent) would be local; approximately 242 would be non-local. Using the 2000 census data for Jefferson County, a typical household consists of 2.41 people; therefore an average of 894 (Phase I) and 583 (Phase II) additional people (including the worker and family members) would temporarily relocate to the project area. The estimated number of people who would be temporarily relocated to the area during construction of both Phase I and Phase II would be minimal, because the population increase would be short-term and temporary in nature.

Sempra anticipates adding approximately 79 permanent staff to operate Phase I of the Project and an additional seven for Phase II, totaling 86 permanent staff when Phase II goes into service. If qualified

workers are available, local workers would be used for operations and maintenance. Sempra assumes that up to 70 percent of the operations and maintenance workforce could be local, depending on the availability of personnel with the proper training and degrees. This would result in a negligible long-term beneficial impact to local and regional employment.

Construction periods for the 3-Mile-Long and the 70-Mile-Long Pipelines are relatively short; 6 months and 10 months, respectively. Construction crews would be dispersed over the entire length of the pipeline routes and would move rapidly through each area with the workforce peaking only during the times when all pipeline activities are in progress.

The effect on population in the area where the pipelines would be constructed is expected to be minimal. The workforce would average 100 workers per month for the duration of the 3-Mile-Long Pipeline's 6-month construction period and 230 to 250 workers during the 70-Mile-Long Pipeline's 10-month construction period. During the peak construction period for the 70-Mile-Long Pipeline, about 250 personnel would be required in month 2 through month 6. When available, local workers would be used for construction. This would result in a minimal short-term beneficial impact to local and regional employment. Sempra estimates that up to 50 percent of the construction workforce could be local. If needed, additional construction personnel would be hired from outside the Project area if skilled pipeline construction specialists, supervisory personnel, and inspectors are unavailable.

Since construction of the pipelines would be temporary and of short duration, it is unlikely that workers would relocate their families to the Project area. However, should workers relocate their families to the project area, it is estimated that approximately 305 additional people would move to the area (assuming 125 local workers and typical household of 2.44 people based on 2000 census data for Calcasieu Parish). The estimated number of people that would temporarily relocate to the area during construction would not constitute a major impact on population, since workers and their families would be dispersed over the entire length of the pipeline route and throughout the affected counties and parishes.

Therefore, we conclude that the potential temporary increase of an average of 738 persons and about 86 full-time positions associated with the in-migration of the non-local workforce during construction and operation of the LNG terminal, the 3-Mile-Long and 70-Mile-Long Pipelines would not result in a major impact to the area's total population.

4.9.2 Economy and Employment

Manufacturing and the professional/technical service sectors account for the majority of total wages in Jefferson County. As shown in **table 4.9.1-1**, the 2002 per capita income for Jefferson County was $26,096, approximately 11 percent below per capita income for the state. The 2004 unemployment rate for Jefferson County is 9 percent and 5.7 percent for Texas. In Orange County, the manufacturing and retail sectors were reported as the highest sectors for total wages. As shown in **table 4.9.1-1**, the 2002 per capita income for Orange County was $24,182; the 2004 unemployment rate for Orange County is 11.1 percent.

Transportation/warehousing and mining sectors support the majority total wages in Cameron Parish. The 2002 per capita income was $18,031; the 2003 unemployment rate for Cameron Parish was 6.4 percent. For Louisiana, the 2002 per capita income was $25,296 and the 2003 unemployment rate was 6.6 percent. The highest-ranking sectors in Calcasieu Parish for 2002 were manufacturing and construction; the 2002 per capita income was $24,708. Calcasieu Parish had a 2003 unemployment rate of 6.6 percent, the same as the state's unemployment rate. Manufacturing and retail trade were the prominent industry sectors in Beauregard Parish according to 2002 data. The 2002 per capita income was $20,089. The 2003 unemployment rate for Beauregard Parish was 8.8 percent.

A summary of selected employment and income data for Jefferson and Orange Counties and the Parishes of Cameron, Calcasieu, and Beauregard; as well as the states of Texas and Louisiana are provided in **table 4.9.1-1**.

Expenditures in the Project area where the LNG terminal would be located are expected to equal approximately $250 million for goods and services over the estimated 45-month construction period for Phase I and $100 million over the estimated 39-month Phase II construction period. Total wages during that period are expected to equal approximately $119 million (Phase I) and $83 million (Phase II). Project-related expenditures on goods, services, and labor would create several cycles of income as these dollars are spent and re-spent by succeeding rounds of recipients. Expenditures in the 70-Mile-Long Pipeline project area are estimated to be approximately $30 million for construction goods and services over the 10-month construction period. Some portion of the construction payroll would be spent locally for the purchase of housing, food, gasoline, entertainment, and luxury items. Total wages during the construction period are expected to equal approximately $4.1 million and it is estimated that 50 percent or $2.05 million would be spent locally. Overall, the local and regional economy would realize a short-term increase in revenues generated as a result of Project construction.

During construction of the LNG terminal, there would be an increase in property tax revenue to five Jefferson County tax jurisdictions averaging approximately $3 to $4 million on an annual basis. This additional revenue would be a positive impact to the county. For the portion of the pipeline in Texas, the Jefferson and Orange County Appraisal Districts would determine property taxes. During pipeline construction, it is estimated that there would be an increase in tax revenue to Jefferson and Orange counties of about $150,000 per county, on an annual basis. For portions of the 70-Mile-Long Pipeline in Louisiana, the Louisiana Tax Commission would determine the property taxes. During construction, a unit approach would be used to determine the fair market value based on a percent of the cost, income, and sales. It is estimated that there would be an increase in tax revenue to local parishes on the order of $500,000; in Beauregard Parish the increase is estimated to be about $200,000.

Operation of the LNG terminal would increase local tax revenues. The increase in tax revenue is estimated to be $7 to $12 million annually and would be expected throughout the life of the Project. The actual property tax paid would depend on the assessed value of the Project during operation. Jefferson and Orange counties would realize an estimated increase in annual tax revenue of $150,000.

No agricultural/pasture land or timberland would be removed from production as a result of the construction and operation of the LNG terminal. Approximately 1.2 acres of agricultural cropland would be affected by the 100-foot-wide construction right-of-way on the 70-Mile-Long Pipeline route. Currently, the agricultural field that would be affected by pipeline construction is planted with soybeans. The value for soybean crops in the area where the pipeline route would be located ranges from $350 to $400 per acre.

Approximately 168.7 acres of timberland would be affected by construction of the 70-Mile-Long Pipeline. Timber values average $1,800 per acre, depending on the viability and maturity of the timber stand. Timber, unlike row crops, may have a future payment based on the useful life of the pipeline and the intended use of the timber. For example, in the area where the pipeline would be located, it takes on the order of 20 years to produce 10- to 12-inch-diameter trees and approximately 30 years to produce 14- to 18-inch-diameter trees. Additional payments could be made to the landowner at the end of a timber production period (20 or 30 years, depending on the timber use) should the pipeline remain in operation through these time periods.

The value of the crops or trees on agricultural or timberland crossed by the 70-Mile-Long Pipeline route lost during construction would be determined during the right-of-way easement negotiations.

4.9.3 Housing

A summary of housing statistics for Jefferson and Orange counties in Texas and the parishes of Cameron, Calcasieu, and Beauregard in Louisiana are provided in **table 4.9.3-1**. In the Texas counties affected by the proposed Project, Orange County had the higher rental vacancy rate of 15.4 percent; Jefferson County had a slightly larger owner vacancy rate of 1.6 percent (U.S. Census 2000). Approximately 102,080 housing units were reported in Jefferson County, of which 92,880 were occupied and 9,200 were vacant. Of the vacant housing units, 512 were for seasonal, recreational, or occasional use. In Orange County, there were 34,781 housing units, 31,642 units were occupied and 3,139 were vacant. Of the vacant housing units, 249 were for seasonal, recreational, or occasional use.

TABLE 4.9.3-1

2000 Housing Characteristics in Affected Counties and Parishes

for the Port Arthur LNG Project

State/Parish or County	Owner Occupied (percent)	Renter Occupied (percent)	Owner Vacancy Rate (percent)	Rental Vacancy Rate (percent)
Texas	63.8	36.2	1.8	8.5
Jefferson	66.0	34.0	1.6	9.7
Orange	77.2	22.8	1.4	15.4
Louisiana	67.9	32.1	1.6	9.3
Cameron	85.1	14.9	1.7	18.4
Calcasieu	71.6	28.4	1.7	14.1
Beauregard	79.8	20.2	2.5	14.0

Source: U.S. Census Bureau, *Table DP-1. Profile of General Demographic Characteristics: 2000*.

In the Louisiana parishes affected by the proposed Project, Cameron Parish had the highest rental vacancy rate of 18.4 percent and Beauregard Parish had the highest owner vacancy rate of 2.5 percent (U.S. Census 2000). Approximately 5,336 total housing units were reported in Cameron Parish, 3,592 units were occupied and 1,774 were vacant. Of the vacant housing units, 1,331 were for seasonal, recreational, or occasional use. Calcasieu Parish had 75,995 total housing units in 2000 and of those; 68,613 were occupied and 7,382 were vacant. Of the vacant housing units, 684 were for seasonal, recreational, or occasional use. Beauregard Parish had 14,501 total housing units in 2000, 12,104 units were occupied and 2,397 were vacant. Of the vacant housing units, 802 were for seasonal, recreational, or occasional use.

Local demand for housing during construction of the LNG terminal is expected to increase during construction; however, impacts to the local housing market would be minimal and temporary. Based on the estimated average number of relocated workers for Phase I (371 workers) and Phase II (242 workers) and the vacancy rates reported in the U.S. 2000 census, there would be 9,200 vacant housing units for sale or rent in Jefferson County.

Since the construction period would be relatively short for the pipeline, most workers prefer temporary quarters; typically, hotels/motels and rental housing units (70 percent). The remainder would generally utilize campsites and recreational vehicle sites (30 percent). Hotels and motels are located within a convenient commuting distance of the pipeline from the towns of Port Arthur, Orange, Sulphur, Lake Charles, and DeQuincy. Existing temporary housing stock, readily available in the area where the

pipeline would be constructed, is more than sufficient to meet the demand for housing associated with the construction workforce.

As previously discussed, an estimated 305 construction workers and family members would relocate into the area during construction of the pipelines. Based on housing vacancy rates provided by the 2000 census, there were 23,862 vacant housing units for sale or rent in Jefferson and Orange counties and Cameron, Calcasieu, and Beauregard parishes; therefore, the increased demand on housing during pipeline construction would be negligible.

We conclude that no adverse impacts to local housing markets would occur during construction or operation of the Port Arthur LNG Project. Additionally, it is not anticipated that any residences or businesses would be displaced during the construction or operational phases of the Project. Locations along the pipeline route where the temporary construction right-of-way comes within 50 feet would be addressed individually with a site-specific construction plan.

4.9.4 Public Services

The city of Port Arthur in Jefferson County, Texas is the nearest metropolitan area to the proposed LNG terminal site and beginning milepost of the 3-Mile-Long Pipeline route and the 70-Mile-Long Pipeline route. Port Arthur offers public services and facilities that include full-service law enforcement, paid and volunteer fire departments, schools, and hospitals. Within Jefferson County, there are 63 public schools with a 2003 to 2004 enrollment of 44,077 students (Texas Education Agency [TEA]). In 2001, Jefferson County reported eight acute care hospitals with 211 licensed beds and 1,333 staffed beds (Texas Department of Health [TDH]). The county provides emergency and law enforcement services through 5 police departments, 15 fire departments, and 1 sheriff's office (Jefferson County Sheriff's Office 2004).

The 70-Mile-Long Pipeline would extend into Orange County, Texas. Orange County has 27 public schools with a 2003 to 2004 enrollment of 16,382 students (TEA). Medical facilities with the county include one acute care hospital with 99 licensed beds and 81staffed beds in 2001 (TDH). Orange County has two sheriff's offices, 6 police departments, and 8 volunteer and paid fire departments (Orange County Sheriff's Office 2004).

The proposed pipeline route would traverse parishes in Louisiana that are primarily rural. Cameron Parish has 6 public schools with a 2003 to 2004 enrollment of 1,871 (Louisiana Department of Education [LDE]) and 1 hospital with 33 beds (Louisiana Department of Health and Hospitals [LDHH]). The parish provides fire protection services through 9 volunteer fire protection districts and law enforcement through 1 sheriff's office (Cameron Parish Sheriff's Office 2004).

Of the three Louisiana parishes, Calcasieu Parish has the most developed infrastructure and public services. There are 59 primary and secondary public schools in Calcasieu Parish, with a 2003 to 2004 enrollment of 32,124 students (LDE). Medical facilities include 9 hospitals with a total of 1,387 beds. There is 1 sheriff's office, 6 police departments, and 11 fire protection districts (Calcasieu Parish Sheriff's Office 2004).

Beauregard Parish provides 14 public schools with a student enrollment of 6,152 students (LDE). There are 2 hospitals with a total of 90 beds (LDHH). Law enforcement is provided by 1 sheriff's office and 2 police departments; there are 4 volunteer fire protection districts (Beauregard Parish Sheriff's Office 2004).

It is anticipated that government expenditures would be incremental during the approximately 45-month construction period at the LNG terminal. No additional government expenditures for public services such

as road maintenance, public safety, or public utilities are anticipated. Public schools, particularly in the City of Port Arthur, may experience a slight increase in student enrollment (potentially an estimated 152 students), as some temporary workers would move their families into the area during the construction. We conclude that the temporary increase in the population resulting from construction of the LNG terminal would slightly increase government expenditures.

During construction, impacts to public services are expected to be negligible. Additional police assistance could be required to assist with traffic flow during construction. Also, unanticipated accidents or emergencies could occur as a result of injuries during construction; however, long-term Project-related impacts to police, fire, medical, and other public services are expected to be minimal. There potentially could be a need for some additional state or City of Port Arthur Police support for security under specific Marine Security (MARSEC) levels. In spite of these potential short-term needs for support, we conclude that local communities would have adequate infrastructure and community services to meet the needs of the non-local workers and/or their families during construction and operation of the LNG terminal.

Construction and operation of the pipelines would result in little or no short-term impact on the availability of local community facilities and services such as police, fire protection, medical services, and schools because the non-local workforces would be so small relative to the current population. The local communities have adequate infrastructure and community services to meet the needs of the few non-local workers and/or their families during construction and operation of the pipelines.

4.9.5 Traffic

The primary transportation corridors in the vicinity of the Project follow the shores of Sabine Lake and the Gulf of Mexico. The main vehicle access to the proposed LNG terminal site, connecting Port Arthur with Sabine Pass, is SH 87. Currently SH 87 ends south of Sabine to the Gulf of Mexico. The other main vehicle route in the area is SH 82, which extends south from Port Arthur, crosses the SNWW to the east, follows the eastern bank of the Port Arthur Ship Canal and then proceeds in an easterly direction along the Gulf of Mexico to Cameron, Louisiana.

In the vicinity where the 70-Mile-Long Pipeline would be constructed, SH 73 would be the closest primary transportation corridor. It is located immediately north of Sabine Lake at the Jefferson County and Cameron Parish border. To the north, the primary transportation corridor in Calcasieu Parish is Interstate 10 (I-10), which connects Orange, Texas with Lake Charles, Louisiana. Other primary transportation corridors in Calcasieu and Beauregard parishes where the proposed 70-Mile-Long Pipeline would be located include SH 27 and SH 12.

Access for transporting equipment, materials, and personnel to the LNG terminal site would be provided by an existing road, SH 87. Site traffic would pass through Premcor Refinery and the intersection with SH 82. State Highway 82 intersects with SH 73, towards the town of Winnie, where it interconnects with I-10 to the north. SH 73 to the east towards the City of Groves intersects with U.S. 96/U.S. 69/U.S. 287 to the City of Beaumont and I-10.

Construction and operations worker parking and equipment storage would be provided within the proposed LNG terminal site. Material deliveries to the site would occur throughout the 45-month construction phase, peaking in month 11 and then again in months 19 and 20 (with concrete delivery for construction of the tanks). It is estimated that there would be approximately 4,045 to 4,055 deliveries per month. On average, 1,260 material deliveries per month would be anticipated throughout the remaining construction period. To the extent practical, deliveries would be scheduled during the off-peak traffic periods.

An average of about 530 workers would be employed over the 45-month construction period. In accordance with industry norms, a conservative occupancy rate of 1.3 persons per vehicle would translate to about 407 cars per day transporting workers to and from the site twice per day. At peak construction, 1,247 workers would travel to the site; calculating to 959 trips to and from the site twice per day. According to traffic survey results conducted by Sempra contractors, several recommendations were made to ensure that the roads and intersections in the Project area remain at an acceptable level of service. Recommendations included varying the maximum green light length at the intersection of SH 87 and SH 82 during different phases of the construction period. Another recommendation called for re-striping the southbound outside through-lane of SH 82 to a shared through/right turn lane. This recommendation would allow for vehicles to turn right on to SH 87 and would increase the capacity for southbound right-turn movement during the morning peak traffic period. The traffic survey concluded that, during operation, no significant delays would occur as a result of increased traffic to and from the LNG terminal site.

Along the proposed pipeline routes, the movement of construction personnel, construction equipment, and materials to the construction rights-of-way could potentially result in impacts to the transportation system. Construction equipment and materials moved on and off local roads to and from the construction rights-of-way could create traffic congestion. Once construction equipment and materials reach the construction rights-of-way, construction-related traffic would remain on the right-of-way except to cross roads, which would temporarily interrupt traffic flow. Appropriate traffic control measures, such as flagmen and signs, would be used to ensure safety of local traffic. Workers would leave their personal vehicles at the contractor yard and share rides to the construction rights-of-way and would not be allowed to park along public roads adjacent to the pipeline right-of-way. Because the construction rights-of-way are linear corridors, disruption to traffic on local roads would be limited to a few days to a week at any given location as the construction progresses along the pipeline routes.

The appropriate state or county highway/road department would issue permits for roads to be bored and open cut. All paved or improved roads and railroads would be crossed by boring under the rail or road, resulting in no traffic disruptions and no damage to the rail or road surface. Lightly traveled and unimproved rural dirt roads would be crossed by the open cut technique, which usually is completed within a 24-hour period. Provisions would be made to detour traffic away from or around the construction sites.

4.9.6 Conclusions

We conclude that construction and operation of the Port Arthur LNG Project would result in short- and long-term socioeconomic impacts. The Project would be constructed over two phases. Phase I is estimated to last over a 45-month period and would employ an average of 530 workers per month, with a workforce of approximately 1,300 workers during the peak construction period. Phase II is estimated to last over a 39-month period and would employ an average of 430 workers per month, with a workforce of approximately 860 workers during the peak construction period. The construction workforce for the pipelines is expected to average 250 workers over a 16-month period. Approximately 70 percent of the workforce would be composed of non-local workers migrating into the Project area. The temporary influx of the construction workforce would cause a short-term increase in population, which could have minor effects on the availability of temporary housing, public services, and traffic in the vicinity of the Project area. Additionally, there would be incremental fiscal benefits resulting from construction and operation of the Project in the form of additional tax revenues at the state and county level.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA, as amended, requires the FERC to consider the effects of its undertakings (including the issuance of Certificates) on any properties that are listed on or eligible for inclusion in the NRHP and to afford the ACHP an opportunity to comment. As the applicant, Sempra is gathering information to assist us in complying with Section 106, in accordance with the ACHP's regulations in 36 CFR Part 800.

4.10.1 Cultural Resource Surveys

Sempra consulted with the Louisiana and Texas SHPOs on the need for cultural resource investigations at the areas that would be potentially affected by construction of the Port Arthur LNG Project. The Texas SHPO advised that cultural resource studies would not be needed for the LNG terminal and the 3-Mile-Long Pipeline. The Texas SHPO also advised that an underwater cultural resources survey of the pipeline segment crossing Sabine Lake would be needed. The Louisiana SHPO recommended cultural resource studies for the portion of 70-Mile-Long Pipeline situated within the state of Louisiana.

Sempra performed cultural resource investigations for the proposed 70-Mile-Long Pipeline, access roads, and ancillary facilities. No new terrestrial cultural resources were identified as a result of these surveys. Two previously identified prehistoric/historic sites were found to lie within the Area of Potential Effect (APE) associated with the 70-Mile-Long Pipeline. These include sites 41OR57 and 41OR58 in Texas. Site 41OR68 has been identified as being situated near the project area but would not be impacted during the proposed construction. The underwater cultural resource investigation associated with the 70-Mile-Long Pipeline's crossing of Sabine Lake identified seven magnetic anomalies within the APE. Two of these are believed to represent pipelines or buried cables, two were identified as having the potential to be historic wrecks, and three were identified as most likely representing isolated ferrous debris.

4.10.1.1 LNG Terminal

A consultation letter submitted by Sempra to the Texas SHPO on July 12, 2004, stated that the proposed LNG terminal site has no potential for cultural resources based on the presence of dredge material, extensive fill, and wetlands. In a response stamped July 20, 2004, the Texas SHPO concurred that the proposed LNG terminal site has no potential for cultural resources and that no cultural resources surveys were required. We concur with this assessment. A subsequent letter submitted to the Texas SHPO on January 21, 2005, stated that the proposed 590-acre DMPA 1-2 also displays no potential for cultural resources based on the presence of dredge material, extensive fill, and wetlands. A response from the Texas SHPO for this aspect of the project is pending.

4.10.1.2 Pipelines

Sempra sent a consultation letter to the Texas SHPO on September 23, 2004, asking whether cultural resource field investigations would be required for the 3-Mile-Long Pipeline. The SHPO determined that no cultural resource investigations were required for this project component. We find that Sempra has conducted appropriate consultation with the Texas SHPO with respect to the proposed 3-Mile-Long Pipeline.

After consulting with the Texas and Louisiana SHPOs, cultural resource field surveys were conducted between August and October 2004 for the terrestrial portion of the proposed 70-Mile-Long Pipeline. The survey corridor utilized during the assessment was 300 feet wide. Cumulatively, 29.4 miles of pipeline corridor has been surveyed; a total of 21.5 miles of proposed right-of-way remains to be surveyed once landowner access has been obtained (see **table 4.10.1-1**). Additional surveys were performed at 78 bore

locations totaling 120.5 acres and at two staging areas totaling 81.2 acres. All other work spaces lie within the 300-foot-wide corridor that was surveyed for cultural resources during examination of the proposed pipeline route.

TABLE 4.10.1-1

70-mile Pipeline Corridor to the Transco Compressor Station

Remaining to be Surveyed as of November 2004 (excluding underwater sections)

Facility	Beginning MP	Ending MP	Length
Pipeline corridor	23.2	28.6	5.4 miles
Pipeline corridor	28.7	37.2	8.5 miles
Pipeline corridor	39.2	39.7	0.5 mile
Pipeline corridor	40.4	40.7	0.3 mile
Pipeline corridor	42.0	42.4	0.4 mile
Pipeline corridor	42.7	43.8	1.1 miles
Pipeline corridor	55.8	58.2	2.4 miles
Pipeline corridor	58.4	60.1	1.7 miles
Pipeline corridor	62.6	63.8	1.2 miles
		Total	**21.5 miles**

Of the 89 proposed roads to be used to access the right-of-way during construction, 48 did not require cultural resource survey as they are asphalt-covered or are to be unimproved gravel roads. One dirt road also was not required to have a cultural resource survey by the determination of the Texas SHPO. A total of 25 access roads measuring 164,945 feet (31.2 miles) in length would require improvements and were examined for cultural resources. No cultural resources were encountered during survey of these roadways. An additional 15 proposed access roads totaling 116,731 feet (22.1 miles) in length remain to be surveyed once landowner access has been obtained (see **table 4.10.1-2**).

TABLE 4.10.1-2

Project Access Roads Remaining to be Surveyed

Access Road	Type	Area Affected (acres)	Length (ft)
5	Dirt	15.3	13,354
6	Dirt	5.9	5,178
7	Dirt	4.8	4,178
8	Gravel	7.1	6,150
11	Dirt	33.3	28,973
12	Dirt	2.0	1,699
14	Dirt	6.0	5,223
40	Dirt	0.3	300
64	Dirt	5.6	4,921
65	Gravel	7.5	6,559
68	Dirt	2.0	1,702
78	Dirt	12.5	10,907
79	Dirt	16.7	14,574
81	Dirt	1.1	946
84	Gravel	13.9	12,067
		Total	**116,731 ft**
			22.1 miles

The draft survey report presenting the results of cultural resource investigations for the 70-Mile-Long Pipeline and its related access roads and facilities was submitted to the Louisiana and Texas SHPOs on February 17, 2005. The Louisiana and Texas SHPOs comments are pending.

No new cultural resources were identified within the terrestrial portion of the assessed 70-Mile-Long Pipeline corridor. Three previously recorded prehistoric / historic sites were identified within or in close association to the APE. These include Sites 41OR57, 41OR58, and 41OR68 in Texas.

Site 41OR57 is located north of Sabine Lake on the west side of Cow Bayou. It is a shell midden with prehistoric and historic artifact components and possible human interments. Site 41OR57 lies on both sides of the proposed right-of-way centerline and is considered potentially eligible for NRHP listing. Site 41OR58 is situated on Shell Canal west of the Sabine River. It consists of a shell midden with prehistoric and historic artifact components and also is considered potentially eligible for NRHP listing. Sempra has proposed to avoid site 41OR57 by directionally drilling beneath it. Access to the pipeline and all required temporary work spaces would be situated outside of the determined site boundaries. The intact portion of site 41OR58 lies under the water table and is currently capped by up to 3 feet of dredge spoil. Sempra has proposed to install the pipeline using the push method within the site boundaries, and to have a certified archeologist monitor the installation. Site-specific detailed treatment plans providing for avoiding impacts to sites 41OR57 and 41OR58 would be filed with the Commission and the Texas SHPO for review and approval prior to the authorization of construction.

Site 41OR68 is a prehistoric and historic shell midden site located on an unnamed canal off Cow Bayou, north of Sabine Lake. The NRHP eligibility of this property was not determined. This site lies outside of the proposed 125-foot-wide construction right-of-way and outside the proposed HDD work spaces that would be used to avoid impacts to site 41OR57.

The Texas SHPO responded to Sempra on October 25, 2004, stating that a maritime survey would be required for the 17 miles of right-of-way crossing Sabine Lake. A research design created in consultation with the Texas SHPO was supplied to that office on November 22, 2004, along with a permit application to conduct the underwater investigation. The Texas SHPO approved the application on December 14, 2004, under Archeology Permit #3622. The Louisiana SHPO also was consulted on this maritime research design and it was found to be acceptable by the SHPO. The underwater survey involved three transects spaced 82 feet apart and the use of side-scan sonar, fathometer, and magnetometer. Approximately 1 mile of the route could not be surveyed due to shallow water depths that prevented instrument function.

Research determined that seventeen known sunken vessels are within Sabine Lake, including seven lying in relative proximity to the pipeline. However, none of these sunken vessels are plotted as being within the APE. The underwater cultural resources survey identified seven magnetic and/or acoustic anomalies greater than 40 gammas total magnetic variance. Of the seven targets, two were identified as pipelines or cables, two were identified as having the potential to be historic wrecks, and three were identified as most likely representing isolated ferrous debris. Sempra would avoid all seven of the identified anomalies during construction of the pipeline. Comment from the Texas SHPO is pending.

4.10.2 Unanticipated Discoveries Plan

Sempra has submitted a Plan and Procedures Addressing Unanticipated Discoveries of Cultural Resources and Human Remains for the LNG terminal and pipeline. We find this plan acceptable.

4.10.3 Native American Consultation

On September 20, 2004, Sempra sent letters to seven federal- and/or state-recognized Native American groups to solicit any concerns they might have about the proposed LNG terminal site and pipelines, specifically with respect to potential impacts to traditional, cultural and historic properties. The Native American groups contacted included the Caddo Nation, the Alabama Coushatta Nation of Texas, the

Kickapoo Traditional Tribe of Texas, the Coushatta Tribe of Louisiana, the Chitimacha Tribe of Louisiana, the Jena Band of the Choctaw, and the Tunica-Biloxi Tribe.

A follow-up letter was sent by Sempra to the above seven Native American groups on January 17, 2005. This letter stated that Sempra wished to ensure that the tribe had received the earlier communication and had no concerns. The Jena Band of Choctaw responded on February 4, 2005, that they have no comments on the project. Responses from the remaining Native American groups have not been received. We find that Sempra has conducted appropriate consultation with Native American groups.

4.10.4 Summary

Two potentially significant archeological sites (Sites 41OR57 and 41OR58) have been discovered to date in areas that may be directly affected by the Project. In addition, seven magnetic and/or acoustic anomalies have been identified within the APE of the pipeline crossing of Sabine Lake. Sempra is to propose treatment plans to be evaluated by the Commission and the Texas SHPO, specifying the measures Sempra would take to mitigate or avoid impacts to these sites and magnetic anomalies.

Cultural resource investigations have not been completed for the areas where access has been denied and for modifications to the 70-Mile-Long Pipeline route. The comments of the SHPOs on the technical adequacy of archaeological reports are pending.

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

- **Sempra defer implementation of any treatment plans/measures (including archeological data recovery); construction of facilities, and the use of all staging, storage, temporary work areas, and new or to-be-improved access roads until:**

  a. **Sempra files with the Secretary, all cultural resources survey reports, any required treatment plans and the SHPO's comments; and**

  b. **The Director of OEP reviews and approves all cultural resources survey reports and plans, and notifies Sempra in writing that treatment plans/measures may be implemented or that construction may proceed.**

All material filed with the Commission containing location, character, and ownership information 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 proposed LNG terminal site is to be located along the Port Arthur Ship Canal, near Port Arthur, Texas. The climate in the Project area is predominantly marine with periods of modified continental influence during the colder months, when cold fronts from the northwest sometimes reach the coast. Because of its coastal location and relatively low latitude, cold fronts that do reach the area seldom have severe temperatures. However, temperatures do reach freezing for up to 14 days per year, mainly from November through March. Sea breezes prevent extremely high temperatures in the summer, except on

rare occasions. Normal monthly high temperatures range from about 61°F in January to 92°F in July and August. Average monthly lows range from about 43°F in January to 74°F in July (National Climatic Data Center 1996).

High humidity is the result of evenly distributed high normal rainfall throughout the year and prevailing southerly winds from the Gulf of Mexico from February through August. Winds generally change to northerly following cold fronts that reach the coast from September through January. The average wind speeds range from 8 to 12 knots (National Climatic Data Center 1996).

The average annual precipitation is approximately 57 inches with peak rainfall during the month of September. Precipitation is fairly well distributed throughout the other months of the year. Winter precipitation comes mainly from frontal activity and from low stratus clouds, which produce slow, steady rains. Cloudy, rainy weather is most common in the winter. Only slightly more than half the winters record even a trace of sleet or snow. Excessive rainfall may occur in any season, and on occasion, there have been months with rainfall totals amounting to a trace, followed by months in excess of 10 inches. Summer rains can be strong due to local thunderstorms and storms originating in the Gulf of Mexico (National Climatic Data Center 1996).

Severe tropical storms or hurricanes occur approximately once every 10 years, while tropical storms or hurricanes of lesser strength occur about once every 5 years. The tropical storm season is from June 1 to November 30, with the primary months of occurrence being August and September. Normally, storms entering the Gulf of Mexico from the Caribbean Sea are the strongest (National Climatic Data Center 1996).

4.11.1.2 National Ambient Air Quality Standards

The EPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutions for the purpose of protecting human health (primary standards) and welfare (secondary standards). The NAAQS are codified in 40 CFR Part 50 and are summarized in **table 4.11.1-1**. 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.

4.11.1.3 Air Quality Control Regions and Attainment Status

Air quality control regions (AQCRs) are areas in which implementation plans describe how ambient air quality standards would be achieved and maintained. The AQCRs were defined by EPA and state agencies in accordance with Section 107 of the CAA. The proposed Project would be in the Southern Louisiana-Southeast Texas Air Quality Control Region (AQCR 106) as defined at 40 CFR 81.53. Based on the NAAQS for each criteria pollutant, the EPA classifies airsheds throughout the country as attainment areas and nonattainment areas. Attainment areas are airsheds that comply with NAAQS, while nonattainment areas are those that do not. A given area can be classified as both attainment and nonattainment since the NAAQS are pollutant-specific.

<u>Existing Air Quality</u>

The Texas ambient air quality standards for criteria pollutants are the same as the federal standards as summarized in **table 4.11.1-1**. Jefferson County, Texas, is currently classified as an attainment area for all criteria pollutants, except ozone. Effective June 15, 2005, Jefferson County was re-classified as a marginal non-attainment area for the 8-hour ozone standard when the 1-hour ozone standard expired.

TABLE 4.11.1-1

National Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards: Primary Standard ($\mu g/m^3$)	National Standards: Secondary Standard ($\mu g/m^3$)
SO_2	Annual[a]	80 (0.030 ppm)	-
	24-Hour[b]	365 (0.14 ppm)	-
	3-Hour [b]	-	1,300 (0.5 ppm)
PM_{10}	Annual[a]	50	50
	24-Hour[b]	150	150
$PM_{2.5}$	Annual[a]	15	15
	24-Hour[b]	65	65
CO	8-Hour[b]	10,000 (9 ppm)	10,000 (9 ppm)
	1-Hour[b]	40,000 (35 ppm)	40,000 (35 ppm)
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)
Lead	Quarter[a]	1.5	-

[a] Arithmetic mean.
[b] Block average.
[c] Rolling average.
$\mu g/m^3$ = micrograms per cubic meter.
ppm = parts per million.
PM_{10} = particulate matter 10 microns or greater.
$PM_{2.5}$ = particulate matter 2.5 microns or greater

Existing ambient air quality for the nearest reporting stations to the Project area in Texas and Louisiana is estimated in **table 4.11.1-2**.

Non-Attainment Areas

Jefferson County, Texas, is currently classified as a marginal nonattainment area for the 8-hour ozone NAAQS. This classification requires that new stationary facilities offset the increase in emissions of ozone precursor or precursors for which the source is major (NO_x, VOC, or both) at a 1.10 to 1.0 ratio. It is classified as an attainment area for all other criteria pollutants. Jefferson County, along with Hardin and Orange counties, form the Beaumont-Port Arthur airshed. The Beaumont-Port Arthur airshed is scheduled to be in compliance with the 8-hour ozone standard by 2007.

4.11.1.4 Regulatory Requirements for Air Quality

The TCEQ is the lead air permitting authority for the Project. The TCEQ's air permitting requirements are codified in Title 30 of the Texas Administrative Code (30 TAC). These requirements incorporate the federal program requirements listed in 40 CFR Parts 50-99, and establish permit review procedures for all facilities that can emit pollutants to the ambient air. New facilities are required to obtain an air quality permit prior to initiating construction. No other pre-construction air quality permits are generally required.

Facilities can trigger additional review by EPA if emissions exceed the major source thresholds listed in 40 CFR §52.21(b)(1)(i). The water heaters to be installed at the proposed LNG terminal are to be equipped with emission control devices to prevent potential emissions from the facility from exceeding these major source thresholds. Facilities also trigger review by other states if the project location is within 50 miles of an adjacent state's border. Since the LNG terminal would be located within 1 mile of

the Louisiana state line, the LDEQ would have the opportunity to review and comment on the application and subsequent permits.

TABLE 4.11.1-2

Existing Air Quality for the Project Area

Pollutant	Monitoring Station	Averaging Period	Concentration ($\mu g/m^3$)
SO_2	Westlake, Calcasieu Parish, LA	Annual	0.006
	Jefferson County, TX	Annual	40
	Westlake, Calcasieu Parish, LA	24-hour	0.017
	Jefferson County, TX	24-hour	275
	Westlake, Calcasieu Parish, LA	3-hour	0.049
	Jefferson County, TX	3-hour	1,040
CO	Jefferson County, TX	8-hour	7,000
	Jefferson County, TX	1-hour	14,000
Ozone	Vinton, Calcasieu Parish, LA	8-hour	0.083
	Westlake, Calcasieu Parish, LA	8-hour	0.075
	Calcasieu Parish, LA	8-hour	0.084
	Vinton, Calcasieu Parish, LA	1-hour	0.098
	Westlake, Calcasieu Parish, LA	1-hour	0.87
	Calcasieu Parish, LA	1-hour	0.102
NO_2	Vinton, Calcasieu Parish, LA	Annual	0.06
	Jefferson County, TX	Annual	35
Lead	Jefferson County, TX	Quarter	0.1
PM_{10}	Jefferson County, TX	Annual	33
	Jefferson County, TX	24-hour	113
$PM_{2.5}$	Vinton, Calcasieu Parish, LA	Annual	10.3
	Lake Charles, Calcasieu Parish, LA	Annual	11.2
	Vinton, Calcasieu Parish, LA	24-hour	19
	Lake Charles, Calcasieu Parish, LA	24-hour	23

$\mu g/m^3$ = micrograms per cubic meter.
PM_{10} = particulate matter 10 microns or greater.
$PM_{2.5}$ = particulate matter 2.5 microns or greater.
NA = data not available.
Source: EPA Region 6 Air Database for Calcasieu Parish, Louisiana and TCEQ Screening Background Concentrations for Jefferson County, Texas (1998).

New Source Review

Separate pre-construction review procedures have been established for projects that are proposed to be built in attainment areas and nonattainment areas. The pre-construction review process for new or modified major sources located in attainment areas is called New Source Review, which may include a Prevention of Significant Deterioration (PSD) review. This process is intended to keep new air emission sources from causing existing air quality to deteriorate beyond acceptable levels. The pre-construction review for new or modified major sources located in nonattainment areas is commonly called Nonattainment New Source Review (NANSR). NANSR only applies to the pollutants that are classified as nonattainment. Therefore, a new facility can undergo both types of review, depending on the total emissions of each various pollutant and the regional air quality attainment status. The proposed LNG terminal facility is located in a marginal nonattainment area for ozone and would be subject to a NANSR review, if potential emissions of either NO_x or VOC exceed the 100-ton per year applicability threshold. Since potential emissions for the proposed LNG terminal would be limited to less than 100 tons per year, NANSR would not apply.

Prevention of Significant Deterioration

One of the factors considered in PSD permit review is potential impacts on protected Class I airsheds located throughout the country. Class I areas are specifically designated as pristine wilderness areas. The LNG terminal would not be located in a Class I area, nor would it be located within 100 kilometers (62 miles) of a Class I area, therefore a full Class I analysis would not be required to be included in the permit application. The closest Class I area to the LNG terminal site is the Breton Sound National Wildlife Refuge, approximately 300 miles east of the site.

PSD regulations (40 CFR 52.21) address construction in air quality attainment areas and define a major source as any source with a potential to emit listed pollutants in amounts equal to or greater than 250 tpy or 100 tpy for 28 specific source categories. The TCEQ has adopted the federal PSD requirements in 30 TAC §101.20. The LNG terminal water heaters are one of the named 28 sources and are therefore subject to the 100 tpy PSD applicability threshold. The water heaters to be installed at the proposed LNG terminal are to be equipped with emission control devices to prevent potential emissions from the facility from exceeding these major source thresholds. As a result, the facility would not be subject to PSD permitting requirements.

Title V Operating Permit

The Part 70 Operating Permit program (known as Title V), as described in 40 CFR Part 70, requires major sources of air emissions to obtain an operating permit within 1 year of initial facility startup. The EPA has delegated the authority to issue the Part 70 Operating Permits to the TCEQ, in accordance with 30 TAC §120. The major source threshold levels for determining the need for a Part 70 Operating Permit are: 100 tpy for attainment criteria pollutants (CO, particulate matter [PM], SO_2, or lead), 100 tpy of non-attainment criteria pollutants (NO_x, and volatile organic compound [VOC]), 10 tpy of any individual hazardous air pollutant (HAP) or 25 tpy of any combination of HAPs. The proposed emissions from this facility would be below the major source threshold for both criteria pollutant and HAP emissions. A TCEQ air quality permit under 30 TAC 116 is required for this facility. An application was submitted in December 2004 to TCEQ for a flexible permit under 30 TAC 116 Subchapter G. This application will include maximum allowable emission tables and should be federally enforceable.

New Source Performance Standards

New source performance standards (NSPS) are established in 40 CFR Part 60 for specific emission sources. 30 TAC §101.20 incorporates these emission standards by reference. The following NSPS requirements have been identified as potentially applicable to the specified sources at the facility.

Subpart D of 40 CFR Part 60, Standards of Performance for Fossil-Fueled Steam Generators for Which Construction Commenced After August 17, 1971, lists affected emission sources as fuel fired steam-generating units with a heat input capacity of greater than 250 MMBtu per hour. The definition of an applicable unit includes sources that produce steam or that heat water or any other heat transfer medium. Each shell and tube vaporizer (STV) hot water heater at the LNG facility is rated at 418.9 MMBtu per hour heat input; therefore, these units would be subject to the requirements of Subpart D.

Because the STV hot water heaters would be fueled exclusively with natural gas vaporized from LNG, the Subpart D emission limits for SO_2 would not be applicable. The STV hot water heaters are limited by Subpart D to the following emission limitations:

- Particulate Matter: 0.10 lb/MMBtu
- Opacity: 20 percent opacity, except for one 6-minute period per hour of not more than 27 percent opacity
- Nitrogen Oxides: 0.20 lb/MMBtu

Pursuant to 40 CFR 60.45, the STV hot water heaters must be equipped continuous monitoring systems for NO_x emissions and for either oxygen or CO_2 unless the facility demonstrates during the initial performance test that NO_x emissions are less than 70 percent of the 0.20 lb/MMBtu standard. Based on emission specifications, the hot water heaters should meet this standard, which would negate the requirement for continuous monitoring systems. If continuous monitoring systems are required, the facility would be required to submit excess emission reports to the Administrator semiannually. Excess emissions of NO_x would be defined as any 3-hour period during which the average emissions (arithmetic average of three contiguous 1-hour periods) exceed the 0.20 lb/MMBtu standard.

For compliance determinations, continuous emission monitoring systems (CEMS) would be installed, and operated to measure and record the concentrations of NO_x, CO, and diluent from the eight water heaters proposed for operation at the facility according to the TCEQ permit application currently under technical review.

Table 4.11.1-3 is a general list of emission standards and monitoring requirements that would be imposed by NSPS Subpart D for each STV hot water heater. There are applicable additional testing, recordkeeping, and reporting requirements that are not listed.

TABLE 4.11.1-3

New Source Performance Standard Subpart D Requirements

Standard	Requirement
60.42(a)(1)	Particulate Matter Limit: 0.10 lb/MMBtu higher heating value (HHV).
60.42(a)(2)	Opacity Limit: 20 percent opacity, except for one 6-minute period per hour of not more than 27 percent opacity.
60.44(a)(1)	NO_x Limit: 0.20 lb/MMBtu (HHV).
60.45(b)(1-4)	If NO_x results during the initial performance test are >70 percent of 0.20 lb/MMBtu, continuous monitoring systems are required for NO_x and oxygen or CO_2.
60.45(g)	If continuous monitoring systems are required, excess emission and monitoring system performance reports must be submitted to the Administrator semiannually.

Subparts Ka and Kb of 40 CFR Part 60, Standards of Performance for Volatile Organic Liquid (VOL) Storage Vessels, list affected emission sources as storage vessels containing VOL with regulatory applicability being dependent on the construction date of the storage vessel. The new facility would have LNG and water storage vessels. Subpart Kb defines VOL as any organic liquid which can emit VOCs (as defined in 40 CFR 51.100) into the atmosphere. This would include the components contained in LNG (i.e., propane and butane). Therefore, Subpart Kb potentially could be applicable.

However, 40 CFR 60.116b(b) states that Subpart Kb does not apply to storage vessels with a capacity greater than or equal to 151 m^3, storing a liquid with a maximum true vapor pressure less than 3.5 kilopascals (kPa) (approximately 0.5 psi absolute). By definition, the maximum true vapor pressure is the equilibrium partial pressure exerted by the VOCs in the stored VOL. The VOC content of LNG is less than 10 percent by volume with the two largest VOC constituents being propane and butane. The partial pressure of the components of LNG representing butane and propane range maintained at -260°F is

less than 3.5 kPa. Therefore, the proposed LNG tanks are exempt from the NSPS Subpart Kb requirements.

Maximum Achievable Control Technology

The source category rules, commonly referred to as the maximum achievable control technology (MACT) standards (40 CFR Part 63), apply to facilities that are classified as major sources of HAPs, and operate affected equipment as listed in each standard. A facility is a major source of HAPs if it emits any individual HAP in excess of 10 tpy or a combination of HAPs in excess of 25 tpy. The estimated HAP emissions for the proposed facility are below the major source threshold amounts. Therefore, the MACT standards do not apply to this facility.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

The NSPS 40 CFR Parts 61 and 63, as incorporated by reference in 30 TAC §101.20, are the federal emission standards that have been developed to address certain individual HAPs and HAP emissions from a variety of source categories. The individual HAP rules are found in 40 CFR Part 61 and are typically referred to as the national emission standards for hazardous air pollutants or NESHAPs. The estimated HAP emissions for the facility are below the major source threshold amounts. Therefore, the NESHAP standards do not apply to this facility.

Other Air Regulations

40 CFR Part 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 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 onsite, or the quantity of a listed substance is below the applicability threshold, the facility does not have to prepare an RMP. However, it must still comply with requirements of the general duty provisions in Section 112(r)(1) of the 1990 CAA Amendments if it has any regulated substance or other extremely hazardous substance onsite. The general duty 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."

The federal list of regulated substances includes aqueous ammonia with a threshold quantity of 20,000 pounds, if stored in a concentration 20 percent or greater. The federal list of regulated flammable substances includes methane, ethane and propane, each with a threshold quantity of 10,000 pounds. 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 Part 6010.5. In addition, storage of natural gas incidental to transportation (i.e., gas taken from a pipeline during non-peak periods and placed in storage, then returned to the pipeline when needed) is not covered. A risk management plan would be required for this facility.

Odors

Hydraulic dredging would be conducted to create the marine terminal basin and berths for the LNG transport vessels. The most likely odor to occur during dredging operations would be caused by hydrogen sulfide released by decaying organic material. However, hydrogen sulfide can be detected by smell at concentrations far lower than those that would be harmful to people.

Regulation 30 TAC 101.4 states that no person shall discharge from any source whatsoever one or more air contaminants or combinations thereof, in such concentration and of such duration as are or may tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property, or as to interfere with the normal use and enjoyment of animal life, vegetation, or property. Any charge of non-compliance with this regulation usually would be in response to an odor complaint. Because of the remote location of this operation and the method of dredge material disposal, it is not likely that the odor threshold would be exceeded.

4.11.1.5 Air Quality Construction Impacts and Mitigation

Sempra filed an air quality preconstruction permit application with the TCEQ in December 2004. Atmospheric dispersion modeling was prepared using the EPA SCREEN3 Model and included in the application. Modeling of the criteria pollutants NO_x, CO, SO_2, and PM_{10} were analyzed with respect to the state NAAQS. Modeling results indicate that additional analysis is required for the criteria pollutants NO_x and PM_{10}. The results of the remaining criteria pollutants modeled (CO and SO_2) did not indicate further evaluation was required.

Additional refined modeling was performed for property line impacts for PM_{10} and SO_2 emissions as required by TCEQ regulations. Modeling results indicate that additional refined modeling is required for PM_{10} emission. The SO_2 modeling results indicated no further evaluations will be required.

A Tier I Effects analysis was conducted for non-criteria pollutants (including Ammonia) and specific hazardous air pollutants. Modeling results did not indicate the requirement for further evaluations on the pollutants reviewed.

At the proposed site location, along service corridors, and at the offloading terminal within the Project area, air pollutant emissions resulting from operation of vehicles and marine vessels and generation of fugitive dust during construction activities are expected to be minor and temporary. Vehicular and marine vessel exhaust and crankcase emissions from gasoline and diesel engines would comply with applicable EPA mobile source emission regulations (40 CFR Part 85) by using equipment manufactured to meet these specifications. Fugitive dust may be produced at the main facility location and offloading areas. Dust suppression activities, such as watering, would be used as necessary to minimize these potential impacts.

Table 4.11.1-4 lists total construction emissions data in tpy as summarized from an emission study prepared by Sempra. Non-road sources represent equipment such as material handling and earth moving vehicles, whereas on-road sources represent transportation equipment traveling on construction-area roadways at the construction site.

The primary air impacts over the life of the construction phase (45 months) would be from NO_x and CO emissions. The primary source of emissions would be from non-road sources utilized during the LNG facility construction phase since it would take longest time to construct and would involve the largest number of sources. **Table 4.11.1-5** lists the non-road facility construction emissions that are anticipated

to occur over the life of the construction phase of the Project by year. The majority of emissions from facility construction are expected to occur during 2006 through 2008.

TABLE 4.11.1-4

Total Estimated Construction Emissions (tpy)

Emission Source	NO_x	VOC	CO	SO_2	PM_{10}
Non-Road Sources – Facility Construction[(a)]	667.9	47.5	645.2	233.0	39.1
Non-Road Sources – Pipeline Construction	49.3	5.6	110.9	2.5	15.5
Heavy Duty Motor Vehicles	116.9	5.8	35.3	3.5	0.9
Light Duty Motor Vehicles	38.4	39.4	581.9	0.4	1.2
TOTAL	**872.5**	**98.3**	**1373.3**	**239.4**	**56.7**

(a) Includes site preparation, building construction, utilities, tank and process construction, site improvements, painting and insulation.

TABLE 4.11.1-5

Estimated Non Road Facility Construction Emissions (tpy)

Operating Year	NO_x	VOC	CO	SO_2	PM_{10}
2005	11.8	0.8	11.0	4.2	0.6
2006	200.9	14.1	194.4	70.4	11.8
2007	190.5	13.6	181.1	67.1	10.7
2008	163.9	11.7	158.4	57.1	9.6
2009	67.1	4.8	66.5	22.9	4.2
2010	33.7	2.5	33.8	11.3	2.2
TOTAL	**667.9**	**47.5**	**645.2**	**233.0**	**39.1**

The non-road sources are primarily diesel fueled units. Alternative fueled construction vehicles have limited capabilities and would be unsuitable for this type of Project. For example, the remote location of the proposed site makes the use of electric powered equipment impractical.

Based on preliminary calculations of direct and indirect emission sources, the emissions during the 45-month construction period would exceed 100 tpy for NO_x. TCEQ has reviewed the preliminary emission calculations from the construction activities and stationary sources. Sempra proposed a mitigation plan to TCEQ which was reviewed and conditionally approved by the agency in August 2005

4.11.1.6 Air Quality Operation Impacts and Mitigation

LNG Terminal

The sources of air pollutants for the LNG terminal would include the following:

- eight 418.9 MMBtu/hr hot water heaters;
- two 1,500 kilowatt standby natural gas-fired generators;
- three 150 horsepower diesel-fired firewater pumps;
- two 125 horsepower diesel-fired firewater pumps; and
- fugitive emission sources (valves, flanges, sampling ports, and marine vessel offloading equipment).

Table 4.11.1-6 lists anticipated emission levels for the LNG equipment as provided by Sempra. The emission data are based on manufacturer-supplied emission factors and are supplemented where

TABLE 4.11.1-6

Air Emission Estimates for the LNG Terminal

Source	NO_X		CO		SO_X[a]		$PM_{10}/PM_{2.5}$		VOC		HAPs[b]	
	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
Hot Water Heaters (8)[c]	10.85	47.53	14.65	62.93	4.11	17.01	21.99	96.32	10.83	47.53	1.54	6.86
Standby Generators (2)[d]	4.64	0.23	20.98	1.05	0.04	0.002	0.27	0.01	10.18	0.51	NP	NP
Freshwater Firewater Pumps (3)[e]	8.91	0.45	2.48	0.12	0.99	0.05	0.41	0.02	0.14	0.01	NP	NP
Seawater Firewater Pumps (2)[f]	5.75	0.29	1.13	0.06	0.55	0.03	0.20	0.01	0.13	0.01	NP	NP
Fugitive Emissions[e]	---	--	--	--	--	---	--	---	0.24	1.06	--	---
Facility Total		**48.50**		**64.15**		**17.11**		**96.39**		**49.36**		**~7.38**[b]
PSD Thresholds[g]	--	250	--	250	--	250	--	250	--	250	--	NA
Title V Threshold	--	50	--	100	--	100	--	100	--	50	--	10/25

(a) SO_x emissions are based on a fuel gas sulfur content of 0.5 grains per 100 scf for LNG-fired sources and a fuel sulfur content of 0.3 weight percent for diesel-fired sources.

(b) Speciation of HAPs from standby generators and diesel-fired sources not provided. As a conservative estimate, VOC emissions reported were assumed HAP emissions. Maximum HAP emissions based upon this assumption are still below the major source threshold of 10/25 for HAPs.

(c) Sempra would install a total of eight (8) units at the facility. Total emissions are based on 7 hot water heaters operating continuously, 24 hours per day, 365 days per year. The hot water heaters are to be equipped with selective catalytic reduction and an oxidation catalyst. Potential emissions are based on these control devices limiting NO_x emissions to an outlet concentration of 3.1 ppmv (at 3 percent O_2 dry) and VOC emissions to an outlet concentration of 8.9 ppmv (at 3% O_2 dry).

(d) Total emissions from stand-by generators are based on firing natural gas only for a maximum of 100 operating hours per year per unit. Emission factors were obtained from specifications for a Caterpillar C3520C natural gas-fired engine. For pollutants except PM_{10} and SO. The PM_{10} emission factor was obtained from AP-42 Section 3.2, **Table 3.2-2**. SO_x emissions are based upon a fuel gas sulfur content of 0.5 grains/100 scf.

(e) Total emissions from firewater pumps are based on firing diesel fuel only for a maximum of 100 operating hours per year per unit. Emission factors were obtained from manufacturer specifications for a Caterpillar C3126 diesel engine except SO_x. The SO_x emission factors are based upon a fuel sulfur content of 0.3 weight percent for diesel-fired sources.

(f) Fugitive emissions are VOCs associated with minor equipment leaks at the valves, flanges, and seals.

(g) PSD threshold for water heater source is 100 tons per year for criteria pollutants. PSD threshold for LNG terminal is 250 tons per year for criteria pollutants

NA = Not Applicable NP = Not Provided

necessary with EPA default emission factors obtained from AP-42 (EPA 2001). The hot water heaters would operate year-round, generally with one or more unit(s) offline at any given time. The main power supply for the LNG terminal would be provided by Entergy, but the facility also would have two standby generators for emergency power. The operating hours of the standby gas-fired generators and diesel firewater pumps would be limited to 100 hours per year per unit maximum.

Additional controls would be required to lower these emissions below the major source threshold values. Control of NO_x would be accomplished by equipping the hot water heaters with selective catalytic reduction. Control of CO and VOCs would be accomplished by equipping the hot water heaters with oxidation catalysts.

LNG Ships

The LNG terminal would result in emissions from the receiving and handling of LNG carrier ships, and from tug boats used to assist in the docking of these ships. Sempra estimates that approximately 160 LNG ships per year would be handled at the facility upon completion of Phase I and 320 LNG ships per year upon completion of Phase II. Each inbound/outbound trip would involve two or three tugboats depending on the activity required. The general timeline for the entire trip for each tanker was estimated as follows:

- 3.2 hours per inbound travel time including approximately 1 hour between Sabine Fort Point to the Terminal
- 1 hour to turn and dock the ship at the Terminal
- 21.9 hours for hoteling and unloading time at the berth
- 0.8 hour for de-berthing
- 3.4 hours for departure trip

Based on transit distances, ship power settings, and 326 calls per year, the expected ship NOx emissions would be approximately 128.7 tpy. Total estimated LNG ship emissions for NO_x, CO, PM_{10}, VOC, and SO_2 are 128.7, 12.5, 43.9, 6.1, and 1004.7 tpy, respectively. Estimated NO_x emissions from annual tug operations are estimated to be 266.7 tpy based on 326 LNG calls per year at two or three tugs per call (depending on the activity required). Total estimated tug emissions for NO_x, CO, PM_{10}, VOC, and SO_2 are 266.7, 40.0, 8.0, 7.2, and 28.0 tpy, respectively. Texas air regulation 30 TAC 114 – Control of Air Pollution from Motor Vehicles includes regulations related to non-road engines. Per 30 TAC 114.427, new, non-road engines used to propel marine vessels are exempt from the regulations of Chapter 114. Additionally, the 40 CFR 70 regulations do not currently require these source types to acquire a Title V permit.

The LNG ships would be fueled with LNG and/or residual oil to provide steam to the turbines. There also may be diesel-fueled auxiliary power generators on the ships to provide power during hoteling operations. The ships would be fueled primarily with LNG while in transit from the LNG production point to the Port Arthur marine terminal offloading facility. Once the ship nears the docking area, ship propulsion would be switched mainly to residual oil. Carrier hoteling operations would be conducted with onboard generators powered with diesel fuel.

Regulation 40 CFR 94 (Federal Register, 02/28/03) imposes regulations on marine compression-ignition engines manufactured on or after January 1, 2004. This standard does not apply to engines rated less than 37 kilowatts, or engines on foreign vessels. Port Arthur would require that ships flagged or registered in the U.S. equipped with regulated compression ignition engines manufactured after January 1, 2004, meet all applicable requirements of this subpart.

General Conformity

A general federal conformity determination must be completed for projects requiring federal authorization that are undertaken in areas designated as "nonattainment" or "maintenance" for certain criteria air pollutants and for which the combined direct and indirect emissions of those air pollutants will equal or exceed certain thresholds. The EPA has designated the Beaumont-Port Arthur area as a marginal nonattainment area for the 8-hour ozone standard. Consequently, a general federal conformity determination is required for certain projects undertaken in the Beaumont-Port Arthur area for which the combined direct and indirect emissions of either NO_x or VOCs, as ozone precursors, will equal or exceed 100 tpy (40 CFR 93.153(b) and 30 TAC 101.30). The Port Arthur LNG Project terminal requires a general conformity determination because the combined direct and indirect emissions of NOx and VOCs would equal or exceed 100 tpy. On August 2, 2005, the TCEQ provided a conditional finding of general conformity for the project, which was based on its review of the project and the commitments made by Sempra to mitigate the air quality impact. On August 26, 2005, we issued the draft EIS for the Project, which included our draft general conformity determination. We did not receive any comments with regard to our conformity determination.

A Final General Conformity Determination is included in **appendix M**. Our determination concludes that the direct and indirect emissions from the LNG terminal would exceed the *de minimis* level for general conformity. Sempra is currently working with TCEQ on the general conformity certification required by the state. To ensure that Sempra meets the requirements set forth for conformity, **we recommend that**:

- **Sempra not begin construction of the Project until the Commission has issued its final conformity certification and Sempra has received written approval by the Director of OEP of its filing stating that it would comply with all requirements of the General Conformity Determination.**

4.11.2 Noise

Noise would affect the local environment during both the construction and operation of the proposed Port Arthur LNG Project. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of 1 day and throughout 1 week. 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 added to sounds occurring between the hours of 10 p.m. and 7 a.m., to account for people's greater sensitivity to sound during nighttime hours.

In 1974, an EPA publication evaluated the effects of environmental noise with respect to health and safety (EPA 1974). 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 facilities, and it is used here to evaluate the potential noise impact from operation of the Project. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate 24 hours per day at a constant level of noise. Together with the Port Arthur local noise ordinance, the FERC criterion is the basis for noise control features incorporated into the analysis.

The City of Port Arthur has noise regulations that may limit noise from the LNG terminal with the following performance standards:

- Residential Day/Night of 55/50 dBA;
- Commercial Day/Night of 70/65 dBA;
- Light Zoning Industrial of 75 dBA;
- Heavy Zoning Industrial of 85 dBA; and
- NSA Day/Night of 55/52 dBA.

The Port Arthur noise regulations have an exemption for construction noise, provided the construction occurs during daylight hours.

Aside from compliance with federal and local standards, another way of judging potential noise impact is the amount of increase over existing levels of noise at receptors around the site. In general, an increase of 3 dBA is barely detectable by the human ear and an increase of 5 dBA is considered slightly significant. Increases of greater than 10 dBA are generally considered severe.

4.11.2.1 Existing Noise Levels

The proposed LNG terminal would be located in an area along the western bank of the Port Arthur Ship Canal, south of Port Arthur. With the exception of a tall, elongated dredge material containment dike on the site, the surrounding topography is predominantly flat, consisting mainly of open marsh, water bodies and grassy fields. Stands of tall marsh grasses and short trees are present around the periphery of the waterbodies.

The primary sources of manmade noise in the area include vehicle traffic on the local roads and boat traffic in the channel. Natural sounds include birds, frogs, and insects. Sempra determined that there were no noise sensitive areas (NSAs) within a 1-mile radius of the proposed terminal site. The nearest NSAs are single-family residences about 1.6 miles and further southeast of the site along SH 82 on Pleasure Island, on the east side of the ship channel. The nearest NSA on the west side of the channel is a single-family residence 2.6 miles south-southeast of the site adjacent to SH 87 at a boat ramp (see **figure 4.11.2-1**).

The nearest residence, at 3564 Martin Luther King (SH 82), is the first in a row of residences lining the southern strip of Pleasure Island, across the Port Arthur Ship Canal, east of the proposed terminal site. This NSA is identified as NSA 1. The third residence in this row of residences is at 3596 Martin Luther King and is identified as NSA 2. The more distant residence on the west side of the ship channel at 3959 SH 87 is identified as NSA 3. Location (NSA) 4 is at the northeast corner of the proposed site at the entrance to the J. D. Murphree WMA.

Sempra conducted an ambient noise monitoring survey at these four locations. Noise levels were measured continuously between 1500 hours on September 3, 2004, and 1500 hours on September 4, 2004, at all four locations using Larson-Davis Laboratories Model 820 precision integrating sound level meters. The microphones were placed about 50 feet from the edge of the roads at a height of about 4.5 feet and they were fitted with foam windscreens to reduce wind-generated noise. The noise data were charted at 1-minute and 1-hour resolutions with the 1-minute data showing much greater variation due to high noise levels during vehicle passage and the relative quiet in between vehicles. These large variations were averaged out in the 1-hour data that were used to compute the L_{dn} levels (**table 4.11.2-1**). L_{dn} levels at the NSAs ranged from 61.6 dBA at NSA 1 to 66.7 dBA at Location 4 at the northeast corner of the site.

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Figure 4.11.2-1

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

TABLE 4.11.2-1 Measured Background Noise Levels at Noise Sensitive Areas		
Location	**Distance/Direction from LNG Terminal Site**	**Computed Ambient L_{dn}**
NSA 1 – Residence	1.6 Mile / Southeast	61.6
NSA 2 – Residence	1.8 Mile / Southeast	62.6
NSA 3 – Residence	2.6 Mile / Southwest	63.6
NSA 4 – WMA	0.5 Mile / Northeast	66.7

Weather conditions were mild, ranging from 72 to 88 degrees with light winds at 1 to 3 mph from the south. Relative humidity was near 100 percent throughout the period and a couple of very light rain showers were noted. The primary source of noise at the monitoring locations was traffic on SH 82 and SH 87 bordering the NSAs.

At NSA 1, hourly L_{eq} levels ranged from 49.2 dBA between 3 a.m. and 4 a.m. to a high of 60.9 dBA between 4 p.m. and 5 p.m. The calculated L_{dn} level was 61.6 dBA. Levels were very similar at NSA 2 about 1,000 feet south of NSA 1 because the source of noise (i.e., traffic) was the same. These levels ranged from 52.6 dBA to 60.0 dBA during the same low and high time periods as for NSA 1, and the computed Ldn was 62.6 dBA.

At NSA 3 on the west side of the ship channel, noise levels at the monitoring locations were similarly controlled by traffic on SH 87. At NSA 3, which is 2.6 miles south-southeast of the site, levels ranged from a low of 52.2 dBA between 1 a.m. and 2 a.m. to a high of 63.3 dBA between 4 p.m. and 5 p.m. The computed L_{dn} was 63.6 dBA. The same pattern was seen at Location 4 at the northeast corner of the site because both locations experience noise from the same traffic. Levels were slightly higher at Location 4 because the microphone was closer to the highway.

In summary, there are no noise sensitive areas within 1.6 miles of the proposed site. This is a significant buffer that should reduce the potential for, or degree of, any noise impacts. Noise levels at existing NSAs nearest the Port Arthur LNG site are controlled by local traffic on SH 82 and SH 87 on opposite sides of the ship channel. Noise levels experienced at the NSAs are similar in level to those in suburban areas where traffic is the primary source of noise.

4.11.2.2 Terminal Construction and Operational Impacts

Potential noise impacts from the LNG terminal could be caused by short-term increases in noise during construction and increases in noise levels associated with operation of the terminal.

Sempra evaluated the potential effects of noise by performing a noise impact evaluation. The noise impact evaluation included calculating expected increases in noise levels associated with construction and operation of the LNG terminal. The expected noise levels were then compared to the FERC standard for permissible noise at NSAs, and to the City of Port Arthur's noise ordinance, as well as the background noise levels measured at the NSAs.

Terminal Construction Noise

Noise could affect the local environment during the construction of the LNG terminal. Noise associated with construction activities would be intermittent, as equipment is operated on an as needed basis and mostly during daylight hours. Construction noise could be apparent at NSAs on an intermittent basis, but the overall impact is not expected to be significant.

The most prevalent sound source during construction is anticipated to be the internal combustion engines used to power construction equipment. The sound level impacts at NSAs from construction operations would depend on the type of equipment used, the mode of operation of the equipment, the length of time the equipment is in use, the amount of equipment used simultaneously, and the distance between the sound source and sensitive site. All of these factors would be constantly changing throughout the construction period, making the prediction of an L_{dn} or L_{eq} and, hence, the quantification of impacts difficult.

Construction noise levels for the LNG terminal would be expected to be similar to typical commercial construction, which average from 47 to 57 dBA at 2,000 feet (Hoover and Keith 1994). These levels would be reduced by more than 15 dBA at the 1.6-mile distance to the nearest NSA. Thus, expected LNG terminal construction noise levels at the nearest residential NSA would range from 32 to 42 dBA, well below the measured background level at NSA 1. Pile driving would likely be the most noticeable construction activity, particularly when compared to general construction noise levels. At the nearest residential NSA, maximum general construction noise is expected to be 42 dBA and maximum pile driving-related noise is expected to reach 60 dBA.

Pile driving noise levels would be expected to range from be about 55 to 60 dBA at the nearest residential NSA. This is below the measured background level; however, it is close enough to be heard. Sempra has stated that they would limit pile driving to daylight hours, 5 days per week, to prevent nighttime noise impacts during its expected 8-month duration per phase. We believe that this should be adequate mitigation for noise impacts. However, because the noise levels are estimates and a large number of piles would be required for this Project, which may necessitate changes in the construction schedules, **we recommend that**:

- **Sempra develop a noise mitigation plan to reduce noise associated with pile-driving activities. This plan should include an evaluation of potential mitigation measures including the use of vibratory hammers, augered piles, and/or a noise sleeve installed over the pile column to reduce pile driving noise levels. The plan should identify which mitigation measures would be used, the hours and days of the week that pile driving activities would occur, and what standards would be used to determine when the use of noise mitigation would be required. The final plan should be filed with the Secretary, for review and written approval by the Director of OEP, prior to the initiation of any construction activities.**

Terminal Operation Noise

The LNG terminal would be developed in two phases. Phase II would essentially be a doubling of the capacity and of the equipment over that of Phase I. All of the major noise-producing equipment would be located in the process area on the west side of the site. Very little noise would be produced from equipment at the dock and storage areas.

The major noise-producing equipment that would normally be in use at the terminal would include three boil off gas (BOG) compressors for each phase, five vaporizers for each phase, seven send-out pumps for each phase, two instrument air compressors for Phase I and one additional compressor for Phase II. Sempra did not include the additional units that would be installed, but on standby, in the noise assessment. Other equipment, such as the LNG in-tank pumps, vapor return blowers, metering facilities and transformers would not produce significant noise.

All of the equipment has been specified to produce a noise level of no greater than 85 dBA at 3 feet. Sempra used this level, in combination with the physical size of the equipment, to calculate the overall

sound power level used in the noise modeling. The frequency spectrum of the equipment was determined from similar equipment or from the literature (Miller et al. 1978).

Sempra did not include noise control measures, other than those required to meet the near-field level of 85 dBA, in their analysis. Although some of the equipment probably would be under sheds, the noise reduction provided by open sheds is minimal and was not included in their analysis. Shielding of noise sources by the buildings and LNG storage tanks between the noise sources and the modeled receptor points was not included in the analysis due to the large separation between the equipment and the NSAs. Actual levels at the NSAs would be expected to be lower than the predicted levels presented in the assessment.

Sempra performed computer modeling to calculate noise levels that would be generated by operation of the proposed LNG terminal. The model receptors are the same NSA locations where ambient noise monitoring was performed to allow a direct comparison with existing noise levels (see section 4.11.2.1). The commercially available CadnaA model developed by Datakustik GmBH was used for the analysis. This software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, and reflections from surfaces.

The results of the analysis for both phases (**table 4.11.2-2**) indicate that the predicted level at the NSAs would be well below the required L_{dn} of 55 dBA. The highest predicted L_{dn} is only 38.2 dBA at the nearest NSA after development of Phase II. The predicted levels at the other two NSA locations are lower.

TABLE 4.11.2-2

Phase I and Phase II Operational Noise Impact Results

NSA/Receptor Location	Predicted L_{eq} (Phase I/ Phase II) (dBA)	Predicted L_{dn} (Phase I/ Phase II) (dBA)	Existing L_{dn} with No Project (dBA)	Combined L_{dn} (Both Phases) (dBA)	Expected Increase (Both Phases) (dBA)
NSA 1 – SE (1.6 miles)	28.9/31.8	35.3/38.2	61.6	61.6	0.0
NSA 2 – SE (1.8 miles)	26.4/29.3	32.8/35.7	62.6	62.6	0.0
NSA 3 – SSE (2.6 miles)	22.4/25.3	28.8/31.7	63.6	63.6	0.0

A comparison of the predicted levels with existing levels, the combined future levels, and the expected increase in levels also is presented in **table 4.11.2-2**. In general, an increase of 3 dBA is barely detectable by the human ear and an increase of 5 dBA is considered to be slightly significant. The expected increases in noise levels at the NSAs around the LNG terminal site are all zero. Thus, development of the Project to its future expanded total operational capacity of 3.0 Bcf/d (Phase II) is not predicted to result in an increase to the existing noise levels at the NSAs.

Calculated noise levels anticipated from operation of the LNG terminal would be below 55 dBA L_{dn}. Therefore, we conclude that there would be no significant adverse noise impacts due to operation of the Project. However, since the noise analysis is based on preliminary design, **we recommend that:**

- **Sempra makes all reasonable efforts to ensure its predicted noise levels from the Port Arthur LNG Terminal are not exceeded at nearby NSAs and file noise surveys showing this with the Secretary no later than 60 days after placing the Port Arthur LNG Terminal in service. However, if the noise attributable to the operation of the Port Arthur LNG Terminal exceeds an L_{dn} of 55 dBA at any nearby NSAs, Sempra should file a report on what changes are needed and should install additional noise controls to meet the level within 1 year of the in-service date.**

Sempra should confirm compliance with this requirement by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.

4.11.2.3 Pipeline Construction and Operational Impacts

Construction of the proposed pipeline would result in a short-term increase in the ambient noise level. This noise level increase would be primarily experienced near the noise source. The magnitude of the impact would depend on the type of construction activity, noise levels generated by various pieces of construction equipment, duration of each construction phase, and distance between the noise source and receptor. Typical construction equipment produces about 70 to 90 dBA at 50 feet (15 m) from the center of construction activity (EPA 1971).

Increases in noise levels during construction of the pipeline would be limited to areas close to the construction activity. The magnitude of the impact would depend on the noise level generated by various equipment types, duration of the construction activity, and distance between the noise source and the receptor. Construction equipment would include miscellaneous trucks, bulldozers, backhoes, and side-boom tractors. Estimated noise levels at the closest residence, about 150 feet (45 m) from the pipeline route, would range from 60.5 to 80.5 dBA.

Impacts due to construction noise would be short-term at any one place because of the assembly line method of pipeline construction. Consequently, we believe that noise associated with pipeline construction would have minimal impacts on residences along the construction right-of-way.

Operational activity on the pipeline would be limited primarily to maintenance of the right-of-way and inspection activities. These activities would occur infrequently at any given location and the impact would be direct, short-term, and minor.

4.12 CUMULATIVE IMPACTS

The CEQ defines cumulative impacts as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Although the individual impact of each individual project may be minor, the additive or synergistic impacts from multiple projects could be significant. Impacts subject to cumulative effects analysis for the Port Arthur LNG Project were identified by determining the environmental impact issues associated with the proposed action, [12] establishing the geographic scope of the study area, establishing the time frame of the analysis, and identifying other past, present, or future actions that have affected, or could affect, the resources of concern.

Existing environmental conditions in the Project area reflect changes based on past projects and activities. For example, much of the coastal marsh and shoreline in southeastern Texas, southwestern Louisiana, and along the Sabine Pass Channel and Port Arthur Ship Canal has been disturbed by previous activities associated with the development of the SNWW (which includes the Sabine Pass and Port Arthur Ship Channels) and the commercial traffic associated with the ports of Sabine Pass, Port Arthur, Beaumont, and Orange, Texas. The Project area contains multiple natural gas and oil production facilities, pipelines, and storage areas, and numerous new natural gas-related facilities have been proposed to be constructed and operated in this area. Many of the proposed pipelines are currently undergoing regulatory review and have not yet been approved.

[12] Title 40 CFR Section 1508.7

Construction of the Port Arthur LNG Project would result in both short- and long-term, minor to moderate environmental impacts. Impacts associated with construction of the pipelines generally are short-term and minor because resources in the project area that would be affected during construction can generally be restored or allowed to revegetate back to their original condition following pipeline installation. Some long-term impacts occur, however, when resources can not be restored back to original conditions (e.g., cleared forest lands), or when resources are permanently affected due to operational and maintenance requirements (e.g., development of the proposed LNG terminal facilities and maintenance requirements along the proposed pipeline rights-of-way).

The environmental impact analysis contained in this final EIS indicates that pipeline construction and operation activities for the Port Arthur LNG Project would result in short-term and minor impacts associated primarily with construction across waterbodies and wetlands, fish and other wildlife habitats, recreation, socioeconomics, transportation, and noise. Long-term impacts associated with construction of the LNG terminal and pipeline-related aboveground facilities are considered more significant and may include both the temporary and permanent clearing of mature forests, disruption of sensitive wetland soils, and permanent loss of habitat and wetlands associated with construction of the terminal facilities and pipeline-related aboveground facilities, and maintenance of the permanent pipeline rights-of-way. Although these types of impacts were not considered significant for the Port Arthur LNG Project, they were considered on a cumulative impact basis in association with the review of other LNG terminal and pipeline projects proposed or approved for the area. Environmental resources such as geology, soils, and cultural would not be measurably affected by the proposed project and; therefore, have not been considered in this cumulative effects analysis.

Table 4.12-1 lists ongoing activities and reasonably foreseeable future projects that could contribute to impacts on resources that also would be affected by construction and operation of the Port Arthur LNG Project.

Table 4.12-2 depicts the resources that would be affected by construction and operation of the projects depicted in **table 4.12-1**. Construction schedules of the future projects depend on factors such as economics, funding, and politics, but all are expected, if approved for development, to be constructed in the same general timeframe associated with the Port Arthur LNG Project. Projects and activities included in this analysis are generally those of comparable magnitude and nature of impact with the proposed action, and are located within the same vicinity as the proposed Project.

TABLE 4.12-1

Existing, Approved, or Proposed Activities that Could Contribute to Cumulative Impacts Associated with Construction of the Port Arthur LNG Project

Activity/Project	Description	Time
Present Projects or Activities		
Manufacturing/Refining	Manufacturing, storage, and transportation of petroleum products	Ongoing
Dredging	Maintenance dredging of Sabine-Neches Waterway	Periodic
Recreation	Fishing, boating, and bird watching	Ongoing
Shipping	Commercial traffic on the SNWW and Intracoastal Waterway	Ongoing
Reasonably Foreseeable Future Projects or Activities		
Cameron (Hackberry) LNG Pipeline	Construction of 35.4 miles of 36-inch-diameter pipeline in Cameron, Calcasieu, and Beauregard Parishes, Louisiana to deliver gas from the Cameron LNG Terminal.	2005 to 2006
Sabine Pass LNG Project[1]	Construction of three LNG tanks with a nominal output of 2.6 Bcfd and a new 16-mile-long natural gas pipeline originating at the Sabine LNG terminal and terminating near Johnsons Bayou in Cameron Parish, Louisiana.	2005 to 2006
Golden Pass LNG Project	Construction of up to five LNG storage tanks with a nominal output of 1 Bcfd for the first phase (three LNG tanks), increasing to 2 Bcfd in the second phase (five tanks) in Jefferson County, Texas, and about 122 miles of pipelines located in Jefferson, Orange, and Newton Counties, Texas, and Calcasieu Parish, Louisiana.	2005 to 2008

TABLE 4.12-1

Existing, Approved, or Proposed Activities that Could Contribute to Cumulative Impacts Associated with Construction of the Port Arthur LNG Project

Activity/Project	Description	Time
Liberty Storage Pipeline	Construction of 23.3 miles of 30-inch-diameter pipeline and development of a salt cavern storage facility in Beauregard Parish, Louisiana.	2005 to 2006
Starks Gas Storage Pipeline	Construction of about 35.6 miles of 16-inch and 30-inch-diameter natural gas pipeline and about 1.9 miles of 10-inch-diameter brine pipeline in Calcasieu and Beauregard Parishes, Louisiana.	2006 to 2009
Creole Trail LNG Pipeline	Construction of about 116.8 miles of dual 42-inch-diameter pipeline and 6.8 miles of 20-inch-diameter pipeline starting in Cameron Parish to Acadia Parish, Louisiana. Cheniere has recently applied to expand the Sabine Pass Terminal by adding three additional tanks. Construction is planned for 2006 to 2008.	2006 to 2009
Kinder Morgan Louisiana Pipeline	Construction of about 137 miles of 30-inch-diameter pipeline starting at the Sabine Pass LNG terminal and terminating in Evangeline Parish, Louisiana.	About 2007-2008
COE/Jefferson County Navigation District – SNWW Channel Improvement Projects	Widening and deepening of the SNWW from the Gulf of Mexico to the Port of Beaumont (includes both the Sabine Pass and Port Arthur Channels).	2006 to 2010
Cameron Parish Waterworks District No. 10 Pipeline	Construction of a 12.5-mile water main pipeline to carry potable water from Johnsons Bayou to the proposed Sabine Pass LNG Terminal in Cameron Parish, Louisiana.	Undetermined

[1] Although Sabine Pass has recently filed for expansion of their facilities, we do not yet have the details for it.

TABLE 4.12-2

Resources of Concern that Could be Impacted by Construction or Development of Existing, Approved, or Proposed Projects or Activities in the Vicinity of the Port Arthur LNG Project

	Primary Environmental Impact									
Activity/Project	Water Resources	Wetlands	Wildlife/Vegetation	Aquatic Resources	Recreation	Socioeconomics	Land Use	Ship Traffic	Transportation	Air Quality/Noise
Present Projects or Activities										
Manufacturing/Refining	X			X		X	X	X	X	X
Dredging	X	X	X	X	X		X	X		X
Recreation	X		X		X	X			X	
Shipping	X			X				X	X	X
Reasonably Foreseeable Future Projects or Activities										
Cameron (Hackberry) LNG Pipeline	X	X	X	X	X	X	X			
Sabine Pass LNG Project (including planned expansion)	X	X	X	X	X	X	X	X	X	X
Golden Pass LNG Project	X	X	X	X	X	X	X	X	X	X
Liberty Storage Pipeline	X	X	X	X	X	X	X			
Starks Gas Storage Pipeline	X	X	X	X	X	X	X			
Creole Trail LNG Pipeline	X	X	X	X	X	X	X	X	X	
Kinder Morgan Louisiana Pipeline	X	X	X	X	X	X	X			
COE/Jefferson County Navigation District – SNWW Channel Improvement Projects	X	X	X	X	X	X	X	X	X	X
Cameron Parish Waterworks District No. 10 Pipeline	X	X	X	X	X	X	X			

Of the projects that may be constructed in the Project area, the ones that have generated the most comment are the three proposed LNG terminals on the SNWW: the Port Arthur LNG Project (which is

addressed in this final EIS), the Golden Pass Project in Jefferson County, Texas, and the Sabine Pass LNG and Pipeline Project (Sabine Pass Project) in Cameron Parish, Louisiana. Therefore, our analysis focuses on these three projects. Where comparable data are not available, we have estimated impacts by averaging the impacts of the other two projects. Also, the Cameron LNG Project, Creole Trail LNG Project, Liberty Storage Project, and Starks Gas Storage Project would have pipeline construction associated with them that are considered in our cumulative impacts analysis. We have not included the Kinder Morgan Louisiana Pipeline in **table 4.12-3** because we have no specific information on the project.

TABLE 4.12-3

Resources That Would Be Cumulatively Affected During Construction and Operation of Pipeline Projects in the Vicinity of the Proposed Port Arthur LNG Project Pipelines

Item	Port Arthur Pipelines	Cameron Pipeline	Sabine Pass Pipeline	Golden Pass Pipeline	Starks Gas Storage Pipeline	Liberty Storage Pipeline	Creole Trail Pipeline	Cumulative Totals
Pipeline Length (miles)	73	35.4	16	122	37.6	24.6	123.6	493.4
Water- bodies Crossed Using Open-Cut Methods (no.)	34	114	5	44	18	10	90	358.0
Dredging Required (yd^3)	310,088	None	None	None	None	None	N/A[1]	1,566,223
Total Wetlands Disturbed During Const. (acres)	308.3	148.1	99.4	267.8	48.7	46.4	144.2	1,245.3
Forested Wetlands Disturbed (acres)	32.5 (const.) 13.1 (oper.)	25.9 (const.) 11.3 (oper.)	1.4 (const.) 0.2 (oper.)	63.9 (const.) 63.9 (oper.)	30.7 (const.) 18.3 (oper.)	34.3 (const.) 27.5 (oper.)	67.8 (const.) 41.6 (oper.)	273.0 (const.) 182.5 (oper.)
Forestland Cleared (acres)	201 (const.) 87.2 (oper.)	148.3 (const.) 74.2 (oper.)	2.3 (const.) 0.8 (oper.)	515.2 (const.) 238.7 (oper.)	111.7 (const.) 64.9 (oper.)	155.5 (const.) 71.4 (oper.)	579.3 (const.) 322.8 (oper.)	1,772.6 (const.) 816.6 (oper.)

yd^3 – cubic yards
const. – construction
oper. – operation
[1] Although dredging would be required, it would occur in Calcasieu Lake and would not have cumulative effects for Sabine Lake.

For purposes of this analysis, a reasonable geographic area to consider for the inclusion of projects that could contribute to the cumulative effects of the proposed action is defined as the area between Calcasieu Lake to the east and Port Arthur to the west, and from the Gulf of Mexico coast north to the Transco System. More geographically distant projects were not included in this assessment because their impact would generally be localized elsewhere and; therefore, would not contribute significantly to cumulative impacts in the immediate Project area.

The pipeline projects that would be geographically the closest to the proposed Port Arthur LNG Project (within 0.25 mile) include the Cameron LNG Project and Liberty Storage Project pipelines between MPs 53.5 and 70.0; and the Creole Trail LNG Project pipeline between MPs 69.1 and 69.4. Environmental information associated with these projects was derived from draft and final EISs or from environmental information provided with the project applications.

Figure 4.12-1 shows reasonably foreseeable future LNG and related pipeline projects that could contribute to impacts on resources that also would be affected by construction and operation of the Port Arthur LNG Project. As shown in **figure 4.12-1** and mentioned above, several projects filed with the Commission involve pipelines proposed to be co-located within the same rights-of-way as proposed by Sempra. Therefore, to minimize construction impacts if the Port Arthur LNG Project is constructed after other projects, **we recommend that**:

- **For areas where the Port Arthur LNG Project would be co-located with one or more planned pipeline(s) adjacent to an existing right-of-way, the first pipeline to be constructed shall be constructed closest to the existing right-of-way. The Port Arthur pipeline shall be constructed with a 25-foot offset from the nearest existing pipeline. For the Port Arthur LNG Project, these areas include:**

MILEPOST	CO-LOCATING PROJECT
53.5 to 70.0	**Liberty Storage Project**
53.5 to 70.0	**Cameron LNG Project**
69.1 to 69.4	**Creole Trail LNG Project**

Prior to construction, Sempra should file alignment sheets and environmental information to support the new alignment with the Secretary for review and written approval by the Director of OEP.

Table 4.12-3 summarizes the resources (e.g., wetlands, forest land) that would experience cumulative impacts from construction and operation of the other proposed natural gas pipelines in the vicinity of the Proposed project's pipelines.

4.12.1 Water Resources

The proposed Project would involve dredging for the marine terminal basin and; therefore, would have impacts on water resources. Increased turbidity and sedimentation from initial dredging during construction and maintenance dredging during operation of the facility would temporarily decrease water quality during those periods. If dredging associated with the proposed Project was to occur concurrently with maintenance dredging of the Port Arthur Ship Canal, the proposed deepening of the SNWW by the COE, and/or dredging of the berths for the Golden Pass or Sabine Pass Projects, the reduction in water quality could be exacerbated. However, the negative effects of these activities would be temporary and water quality would be expected to return to ambient conditions soon after completion of dredging.

Cumulative impacts on water quality associated with the proposed pipelines and the other pipeline projects included in the analysis primarily would be related to the effects of trenching (open-cut) across waterbodies and dredging required for pipeline installation across Sabine Lake.

Open-cut construction activities in and adjacent to perennial waterbodies, such as clearing, grading, and trenching could modify aquatic habitat, increase sedimentation, increase turbidity, decrease dissolved oxygen concentrations, increase water temperatures, release chemical and nutrient pollutants from sediments, and introduce chemicals, such as fuels and lubricants. Turbidity resulting from the resuspended sediments could reduce light penetration and the corresponding photosynthetic oxygen production. Dredging can create suspended sediment plumes that extend as far as 1,640 feet from the active dredge (Clarke et al. 2000). Suspended sediment concentrations are known to typically return to background conditions within days or weeks of the cessation of dredging activities.

Non-Internet Public

FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR THE PORT ARTHUR LNG PROJECT

Docket Nos. CP05-83-000
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Figure 4.12-1

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

Construction of the proposed Project pipelines would involve open-cutting across a minimum of 34 perennial waterbodies. Construction of the other approved or proposed natural gas pipelines would require the open-cut crossing of 324 waterbodies. Minor increases in turbidity could occur in a river basin if the waterbody crossings for each of these projects were to take place concurrently or within a very short time frame of each other. However, since each of these projects would be required to implement our Procedures when crossing waterbodies, cumulative impacts on waterbodies are expected to be short-term and minor. The Procedures include requirements for pre-construction planning, environmental inspection, waterbody crossing methods, and restoration methods that would minimize impacts on surface waterbodies crossed during pipeline construction.

Construction of the 70-Mile-Long Pipeline would involve dredging of an estimated 310,088 yd^3 of lake sediments for pipeline installation across 17.5 miles of Sabine Lake. Although dredging of approximately 954,173 yd^3 of lake sediments would be required for the Creole Trail pipeline, it would occur in Calcasieu Lake, Louisiana, and would not cumulatively contribute to the potential turbidity and sedimentation in Sabine Lake.

The wastewater and stormwater discharges from the proposed Project also could result in a cumulative reduction in water quality when considered with other industrial and non-point discharges along the SNWW. Sempra would not discharge freshwater during operation of the LNG terminal as it would use closed-loop STVs. Thus, the wastewater discharges would not be expected to contribute to an overall reduction in water quality. Golden Pass also proposes to use STVs. The Sabine Pass Project would generate discharges primarily from its proposed SCVs, but would be required to meet Louisiana state water quality standards. All projects in the area would be required to adhere to SWPPPs during construction and operation.

Construction of the relocation project and electrical transmission facilities associated with the proposed project (**appendix A**) would have minimal additional impacts on water resources. Both would be constructed under similar environmental permitting controls and constraints using best management practices.

4.12.2 Wetlands

The permanent loss of 82.5 acres of wetlands at the proposed LNG terminal site would add to the current natural and anthropogenic losses of coastal marsh in Texas. The estimated cumulative permanent loss of wetlands for the three LNG Import terminals would be approximately 191.1 acres (60.9 acres for the Golden Pass Project and 47.7 acres for the Sabine Pass Project). Sempra also would fill approximately 583 acres of wetlands at DMPA 1-2, but would replace all 583 acres in place, in kind.

A total of 493.4 miles of pipeline construction associated with the proposed Project and the other projects listed in **table 4.12-3**, if approved and constructed, also would contribute to additional wetland impacts. In general, construction of pipelines across wetlands does not result in any "net-loss" of wetlands due to draining or filling, unless aboveground facilities required for the pipelines are placed in the wetlands. However, wetland functional values may be temporarily or permanently altered, depending on the type of wetlands being affected. The most significant change in wetlands caused by pipeline construction and operation is the temporary or permanent loss of natural vegetation cover, particularly when construction affects forested wetlands. Temporary clearing is considered a long-term impact, as forest regeneration can take 35 to 75 years. Clearing forested areas to create the pipeline operational right-of-way is considered a permanent adverse impact, or loss, because only small trees, shrubs, or emergent vegetation are allowed to grow within the operational right-of-way.

Construction of the Port Arthur LNG Project pipelines would require disturbance of approximately 308.3 acres of wetlands, including 32.5 acres of forested wetlands. Assessment of this project indicates that about 13.1 acres of forested wetland would be permanently converted to emergent or scrub-shrub wetland habitat. Additionally, 0.04 acre of wetland would be lost due to construction of MLVs 19.2 and 29.9 within the boundaries of wetlands.

Total wetland construction impacts, in combination with the other pipelines considered in this assessment, would affect a total of 1,245.3 acres of wetlands, including 273 acres of forested wetlands. This would cumulatively result in a short-term and minor impact associated with construction through emergent or scrub-shrub wetlands, which would revegetate quickly after construction (generally within 1 to 3 years) and right-of-way restoration. Construction through forested wetlands, however, would cumulatively contribute to the long-term or permanent alteration of forested wetlands in southeast Texas and southwest Louisiana to shrub or emergent wetlands. However, forested wetlands in this region are routinely cleared for production of forest products (e.g., paper pulp). Forested wetland clearing in the project area would represent a long-term, moderate, and adverse cumulative impact. However, cumulative impacts on forested wetlands are decreased when pipeline rights-of-way from these different projects are parallel and adjacent to each other, limiting forest fragmentation and associated edge effects from new pipeline rights-of-way. This would be the case where Sempra's 70-Mile-Long Pipeline would be parallel and adjacent to other proposed pipelines (between MPs 53.5 to 70.0 [Liberty Storage pipeline and Cameron pipeline]; and MPs 69.1 to 69.4 [Creole Trail pipeline]). Additionally, each project applicant would be required to work with the COE and other appropriate agencies to develop site-specific wetland mitigation plans to account for all permanent impacts on wetlands.

Construction of the relocation project and electrical transmission facilities associated with the proposed project (**appendix A**) would contribute additional wetland impacts. Approximately 102.2 acres of wetlands would be disturbed during the relocation project (including 15.8 acres of tallow-dominated forested wetlands) and an undetermined amount for the electrical facilities. A total of 23.7 acres of wetlands, a portion of which would be tallow-dominated forested wetlands, would be permanently lost as a result of the relocation project. Each project applicant would be required to work with the COE and other appropriate agencies to develop site-specific wetland mitigation plans to account for all permanent impacts on wetlands.

Sempra and the proponents for the other projects would mitigate the loss of wetlands as required by the COE's Section 404 permit requirements that would ultimately be needed for the projects to proceed. The construction and operation of the proposed Project, along with the other potential projects and activities would result in a cumulative reduction in the amount of coastal marsh in the vicinity of the Project. However, mitigation for wetlands affected by the proposed Project and the other projects listed would be required by the COE and could result in a net increase and/or improvement in the regional coastal marsh resource.

4.12.3 Biological Resources

When projects are constructed at or near the same time, the combination of construction activities could have a cumulative impact on vegetation, wildlife, and aquatic organisms living in the immediate area. Clearing and grading and other construction activities associated with the development of the LNG terminal, along with other area construction projects would result in the removal of vegetation, alteration of wildlife habitat, displacement of wildlife, and other secondary effects such as increased population stress, predation, forest fragmentation, and establishment of invasive plant species. The conversion of 198.2 acres of existing and former DMPA for the proposed LNG terminal would have permanent impacts on the vegetation and wildlife at that location. However, the remaining 341.8 acres of the 540-acre tract owned by Sempra would remain in its existing state with the exception of a 65-acre area that would be

used for temporary construction facilities and equipment laydown area, which would be cleared temporarily, but allowed to revert to current conditions after construction. The Golden Pass and Sabine Pass LNG terminals would be constructed on similarly sized sites, with similar direct and indirect effects, resulting in an estimated cumulative vegetation loss of 639.8 acres (205 acres for Golden Pass and 236.6 acres for Sabine Pass) for construction of the proposed or approved terminals.

The construction of multiple large industrial projects at or near the same time can result in a significant amount of land clearing activities that could have a cumulative impact on forest resources in the immediate area of the projects. However, the sites proposed for the LNG projects are largely devoid of large stands of trees. Our review indicates that there are no existing stands of forest, other than the invasive Chinese tallow tree, that would be cleared for the construction of the proposed Port Arthur LNG terminal, the proposed Golden Pass Project, or the Sabine Pass Project. Each of these sites has some small existing trees that would be removed, but no areas that would be considered forest are present at these locations.

Loss of coastal marsh from the Project and other projects could cumulatively decrease the amount of habitat available for aquatic organisms that require estuarine wetlands for foraging or nursery habitat. A total of approximately 191.1 acres of wetlands would be permanently lost as a result of construction of all three proposed LNG terminals (82.5 acres for the proposed Project, 60.9 acres for the Golden Pass project, and 47.7 acres for the Sabine Pass project). The other projects listed in **table 4.12-1** also would have wetland impacts associated with them. Because projects affecting coastal marsh generally require compensatory mitigation to replace lost marsh acreage, impacts resulting from loss of marsh are generally temporary, lasting only until the newly created marsh becomes functional. Depending on the location of the wetland mitigation areas in relation to the impacted wetlands, there could be reductions in available aquatic habitat at the project sites and gains in habitat at other offsite locations. Sempra is working with the COE and other agencies to develop the details of a project-specific compensatory wetland mitigation plan.

The Golden Pass and Sabine Pass Projects would require dredging for the marine terminal berths in the Port Arthur Channel and the Sabine Pass Channel, respectively. Although the construction schedules for these three projects vary, dredging would take between 6 to 12 months and it is likely that dredging for one or two of the projects would overlap. Sempra plans to place the dredged material in DMPA 1-2, with some potentially being put to beneficial use. The dredge materials for the Golden Pass Project would be placed in an existing DMPA near that site; dredge material for the Sabine Pass Project would be placed off Louisiana Point for beneficial use. In addition, the COE conducts maintenance dredging of the Port Arthur and Sabine Pass Channels on a regular basis, and is also considering improvements to them, which would include deepening and widening the channels as part of the SNWW Channel Improvement Projects – a joint venture with Jefferson County Water Navigation District. The COE is considering widening the Sabine Pass Channel from 500 feet to 700 feet and deepening it from 40 feet to 48 feet.

Although these dredging activities individually would affect aquatic resources, and cumulatively would be expected to have a more substantial effect on those resources, the impacts associated with the dredging activities would be temporary and largely restricted to the period of active dredging and a short period following completion. Given the short period of effects, the cumulative impacts associated with dredging would likely result in minor changes in aquatic resources (e.g., temporary avoidance of dredged areas by fish and other aquatic organisms).

Water would not be generated during operation of the proposed Project or the Golden Pass project since the LNG would be vaporized using closed-loop circulating solutions of intermediate heat transfer fluid in shell-and-tube heat exchangers. These types of vaporizers do not create a condensate, which would require discharging. The Sabine Pass LNG facility would use an SCV system for its LNG tanks, resulting

in approximately 320 gpm or 0.7 cfs of condensate discharge. The 0.7 cfs represents a potential 0.04 percent increase in freshwater input during the seasonal low flow period and a 0.0035 percent increase during high flow periods. Further, the Sabine Pass Project plans to use SCV water for plant operations and the firewater pond, thus reducing the amount of freshwater discharge.

Vegetation clearing and wildlife habitat alteration associated with pipeline construction is generally short-term for open, herbaceous, or scrub-shrub areas, which often revegetate within one to several growing seasons. In areas supporting these types of cover, cumulative impacts in the project area would be short-term and minor. In forested areas, cumulative impacts associated with forest clearing would be either long-term or permanent.

The 493.4 miles of pipeline shown in **table 4.12-3**, assuming an average of 110-foot-wide construction rights-of-way, would result in a total of 6,579 acres of vegetation disturbance. Although the total amount of vegetation that may be affected by the Project and other potential projects in the area may be considered substantial, much of this would occur in areas that have been previously disturbed by DMPA activities or adjacent to existing rights-of-way. Also, this disturbance, alteration, or loss of habitat would be relatively small compared to the abundance of similar resources in the Project area, and the majority of it would be allowed to return to pre-construction condition.

Construction of the associated pipeline facilities would affect a total of about 718.5 acres of woodlands for the three LNG projects; however, some of these forest lands consist of stands of planted timber grown for commercial use with an expectation of harvest. Forested land clearing resulting from the construction of the multiple pipeline projects considered in **table 4.12-3** would total 1,772.6 acres. Landowners would be compensated for raw timber removed from construction work areas, and would be allowed to replant areas outside of the permanent right-of-way following completion of construction. Although the total amount of forest land that may be affected by the Project and other potential projects in the area may be considered substantial, the linear nature of the pipelines would not require clear cutting of large areas of timber. Additionally, where the proposed pipelines would be parallel and adjacent to one another (between MPs 53.5 to 70.0 [Liberty Storage pipeline and Cameron pipeline]; and MPs 69.1 to 69.4 [Creole Trail pipeline]), additional forest impacts would be cumulative, but minimized by the overlapping rights-of-way. Also, the loss of forest land in this area would be relatively small compared to the abundance of similar resources in the Project area and would be insignificant when compared to the forest clearing in the project area required for forest management practices.

If other water-related projects were initiated in the same general area and during the same time period as the proposed project, aquatic resources could be affected by increased turbidity, sedimentation, loss of cover, and potential spills of hazardous materials. These impacts and their associated effects on aquatic organisms, habitats, and EFH would be largely dependent upon whether construction phases of the projects occur concurrently and in proximity to one another.

Pipeline installation through wetlands and across Sabine Lake and other waterbodies would individually adversely impact aquatic resources, and if concurrent with or sequential to other projects, could cumulatively have a more substantial effect on those resources. The corresponding effects on the fishery resources dependent on those habitats for survival could also increase cumulatively. However, the impacts associated with installation of the proposed pipelines would be short term and largely restricted to the period of active construction and a short period following completion. Given the short period of effects, the cumulative impacts associated with pipeline installation would likely result in minor changes in aquatic resources (e.g., temporary avoidance of dredged areas by fish and other aquatic organisms).

Compared to the natural freshwater flow, freshwater discharges from the proposed LNG projects into the estuary from hydrostatic testing operations would not even be detectable, other than in the near-field

dilution zone. Since the hydrostatic test water discharges are essentially brief episodic events, like a passing thunderstorm, and would only occur during the construction phase, no impacts on aquatic habitat or species would be anticipated and the discharges would not be expected to affect populations of any Sabine estuary aquatic species.

Construction of the relocation project and electrical transmission facilities associated with the proposed Project (**appendix A**) would have additional impacts on biological resources. Approximately 116 acres of tallow-dominated upland and wetland habitat would be disturbed during the relocation project. Approximately 19.6 acres of wildlife habitat would be converted to pavement and hard road shoulders and 96 acres would be maintained in an herbaceous state. An undetermined amount of wildlife habitat would be disturbed for the electrical facilities, which also could pose an electrocution hazard to avian species. Avian strikes with the transmission lines and structures may be reduced through the use of strobe lights and by providing adequate spacing between electrical lines to minimize the potential arc between lines.

4.12.4 Land Use, Recreation, and Visual Resources

The Port Arthur LNG Project would incrementally add to the cumulative impact on land uses in the Project area. The majority of this additional impact would be permanent. However, the proposed LNG terminal site (and those for the Golden Pass and Sabine Pass projects) has been used previously as a DMPA. Along the proposed pipeline routes, most land uses would be allowed to revert to prior uses following construction. Some land uses would be restricted or prohibited on the new permanent pipeline rights-of-way, such as construction of aboveground structures.

Fishing, boating, and bird watching activities occur throughout the coastal marsh and Sabine Lake in the vicinity of the proposed Project. The Project, in combination with the Golden Pass Project and Sabine Pass Project, as well as the other projects proposed in the project area, could negatively affect recreation, primarily during the period of active construction. The presence and movement of construction equipment, materials, and workers may be temporarily disruptive to users of the local recreation areas, particularly if more than one project is under construction at any one time in the project area. Recreation-related cumulative impacts are expected to be short-term and minor.

In general, the Texas shore along the Sabine Pass and Port Arthur Channels is largely industrial and ships transiting these channels within the SNWW are a frequent occurrence and an expected element in the viewshed. However, there are no other existing permanent structures similar in scale to the proposed Port Arthur LNG storage tanks in the immediate area of the proposed Project. Based on the proposed comparably sized facilities, we believe that each proposed LNG facility would dominate its local area viewshed and result in both temporary and permanent changes to the surrounding visual landscape. Because of the size of the facilities, there are no effective measures that can be taken to visually screen these major aboveground facilities.

Construction and operation of the proposed Port Arthur pipelines and the other pipeline projects in the Project area 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 routes in the area is generally flat and views of the construction activities may extend for some distance. However, the construction work areas would be restored, as near as possible, to pre-construction contours and revegetated. Once revegetation is complete, there would be no significant cumulative alteration of the landscape in the region. Additionally, where the proposed 70-Mile-Long Pipeline would be parallel and adjacent to other proposed pipelines (between MPs 53.5 to 70.0 [Liberty Storage pipeline and Cameron pipeline]; and MPs 69.1 to 69.4 [Creole Trail pipeline]), visual resource impacts would be cumulative but minimized to the extent possible by the overlapping rights-of-way.

4.12.5 Socioeconomics

Present and reasonably foreseeable future projects and activities could cumulatively impact socioeconomic conditions in the Project area. There may be both beneficial and detrimental effects on employment, housing, infrastructure, and public services.

4.12.5.1 Employment and Housing

In general, natural gas-related projects have a beneficial impact on local employment during the short construction period, but little impact during pipeline operation since most jobs associated with the projects would be temporary construction jobs and limited in number. If more than one LNG and/or pipeline project were to be constructed in the project area during the same time period, then the beneficial effects would be cumulative, but short-term and minor.

The proponents for the three LNG projects estimated that between 30 and 70 percent of construction workers would be local hires. The other proposed pipeline projects listed in **table 4.12-3** also likely would require similar percentages of local and non-local personnel. If the other proposed projects are built simultaneously with the Port Arthur LNG Project, the demand for workers could exceed the local supply of appropriately skilled labor. On the beneficial side, the increased demand for workers could reduce current unemployment and perhaps lead to higher wages for the duration of construction. Other indirect employment benefits could include temporary service jobs in the local area (e.g., restaurants, motels, and convenience stores).

The proposed Project would add 79 full-time positions for Phase I and an additional 7 full-time positions for Phase II. The Golden Pass Project would add a total of 60 full-time positions for the LNG terminal and 5 for the pipeline. The Sabine Pass Project would add 75 full-time positions for the LNG terminal and 5 full-time positions for operation of the pipeline. Although these additional positions would be beneficial, they would not significantly affect the permanent employment in the regional area given the Beaumont – Port Arthur MSA workforce of 161,336 in 2000. The other pipeline projects listed in **table 4.12-3** would require similar numbers of temporary personnel during construction, but usually do not require hiring of more than 2 or 3 full-time employees for operation.

Given the vacancy rates in the area and the number of hotel/motel rooms, construction crews should not encounter difficulty in finding temporary housing. The degree of cumulative impact on the housing resources would depend upon the number of other projects being constructed simultaneously and the season, specifically when construction coincides with periods of peak recreation and tourism activity. If construction occurs concurrently with other projects and during the peak recreation and tourism periods, temporary housing would still be available but may be more difficult to find and/or more expensive to secure. Regardless, these effects would be temporary, lasting only for the duration of construction, and there would be no long-term cumulative effect on housing.

4.12.5.2 Vehicular Traffic

Vehicular access to the Port Arthur LNG terminal and the Golden Pass LNG terminal would be via SH 87. Access to the Sabine Pass LNG terminal would be via SH 82 and would not have an additive effect on construction traffic on SH 87 near the Port Arthur and Golden Pass Projects, though it may affect traffic at the intersection of SH 87 and SH 82. SH 87 is a two-lane highway for most of its length, in particular that portion of the highway that would be affected by construction or operation traffic enroute to the Port Arthur facility from the intersection of SH 87 and SH 82. The roadway vehicle capacity in this area of SH 87 is 22,500 vehicles per day with a 2003 daily traffic volume of

3,750 vehicles per day. As part of the proposed Project, a section of SH 87 would be relocated (see **appendix A**). However, this is not expected to affect traffic on SH 87 as the existing section of SH 87 would not close until the relocated SH 87 section has been completed. The northern segment of the roadway, from the western Port Arthur area to the SH 82 intersection, is a four-lane highway with a 2003 daily traffic volume of 10,450 vehicles per day.

The Port Arthur and Golden Pass Projects have developed an estimated average and peak number of project-related vehicles that would travel along SH 87 to access the LNG sites during the construction period and to determine potential impacts on existing traffic and use patterns on the roadway. During an average construction month, 530 workers would access the Port Arthur site, and 440 workers would access the Golden Pass site, resulting in an average addition of 1,940 vehicle total trips per day on the roadway (not including possible reductions for more than one employee in a car). Taking into account the average construction deliveries per day (42 to Port Arthur and 60 to Golden Pass), this would result in 2,144 total cumulative average trips per day on SH 87 from the two LNG construction projects.

Peak construction traffic to the Port Arthur and Golden Pass sites is estimated at 1,247 employees, and 965 employees, respectively, resulting in a peak addition of 4,424 employee trips per day. Taking into account the peak construction deliveries per day (135 to Port Arthur and 180 to Golden Pass), this would result in 5,054 total peak trips per day on SH 87. While the peak traffic numbers are high, it is unlikely that both the Port Arthur and Golden Pass construction projects would reach peak traffic volumes simultaneously. **Table 4.12-4** presents a summary of the existing roadway traffic volumes and projected construction-related increases.

TABLE 4.12-4

Existing and Proposed Cumulative Traffic Volumes on SH 87

Roadway Segment	Existing Number of Lanes	Approximate Segment Length (miles)	AADT[(a)] (vehicles/day)	2003 Daily Traffic	Average Cumulative Project-related vehicle increase/day	Peak Cumulative Project-related vehicle increase/day	Road Capacity (vehicles/day)
SH 82 to West Port Arthur, TX	4	2.0	9,900	10,450	2,144	5,054	54,400
West Port Arthur, TX to Sabine Pass	2	17.0	3,200	3,750	2,144	5,054	22,500

[(a)] AADT – Average Annual Daily Traffic (number).

If both Port Arthur and Golden Pass construction projects were to occur at the same time, there would be an increase in area traffic volumes from the construction-related vehicles. While this increase would remain below the design capacity of SH 87 south of West Port Arthur, traffic delays may occur at the intersection of SH 87 and SH 82 and possibly other locations. Traffic at the SH 87/SH 82 intersection could be further exacerbated if the Sabine Pass Project were to be constructed at the same time as the other two projects (the average and peak construction and delivery–related vehicle trips per day for the Sabine Pass Project are estimated at 820 and 1,280, respectively).

Sempra would be working with TxDOT and City of Port Arthur planners to review traffic issues associated with construction activities at the LNG terminal to determine if any specific traffic control measures would be warranted to improve or manage highway traffic and safety issues. Sempra has stated

it would use appropriate temporary traffic control measures, such as flagmen and signs, to ensure safety of local traffic. Similar mitigation measures have been identified for the Golden Pass Project based on traffic surveys and projections of construction-related traffic. Recommendations include: varying the maximum green light length at the intersection of SH 87 and SH 82 during different phases of construction, re-striping the southbound outside through lane of capacity for southbound right turn movement during the morning peak traffic period. Coordination with TxDOT and the City of Port Arthur regarding adoption of appropriate traffic control measures would ensure cumulative project-related impacts would not be significant.

Impacts on local traffic could occur during pipeline construction on local roads north of I-10, where the Liberty Storage, Cameron, and Creole Trail pipelines would be constructed immediately adjacent to or in the vicinity of the Port Arthur pipeline right-of-way (see **figure 4.12-1**). Traffic congestion along these local roads due to construction equipment or workers is not expected to be significant, even if multiple pipeline projects are under construction during the same season. Since pipelines are constructed along progressive pipeline spreads, the chance of having construction equipment or workers from different projects located in the vicinity of one another is highly unlikely. Even if construction on multiple projects were coordinated due to the same contractor working on two projects, it would be unlikely to significantly impact local traffic patterns. Simultaneous construction of other projects listed in **table 4.12-1** would cumulatively add to potential traffic-related problems in the project area, but should disrupt traffic flow for the duration of construction, only. Consequently, there would be only minor, adverse, and short-term cumulative impacts on local traffic.

4.12.5.3 Transportation

The Project is not expected to add significantly to the cumulative impact on transportation, although LNG ship access to the LNG terminal site would require the relocation of approximately 3.3 miles of SH 87 as well as the existing pipeline and utility corridors that parallel the highway. Regardless, it is expected that most of this construction would occur while access to homes and businesses would be maintained during construction. The total length of the relocated highway would be 3.7 miles. Sempra would relocate the highway on property they own and would construct the relocation project while SH 87 remains open. The narrow portion of land between SH 87 and the Port Arthur Ship Canal is experiencing severe erosion due to wave action in the waterway. The TxDOT is in support of this relocation, as it would relieve the TxDOT of annual expenditures of $2 to $3 million to prevent or minimize the effects of the erosion on the highway. No public roads would be permanently eliminated by the proposed Project.

Road maintenance activities in the Project area could include repaving, clearing road shoulders, and similar activities. If these activities occur at the same time and place as the proposed Project, or other planned projects, cumulative impacts on traffic could occur, although access to homes and businesses would be maintained during construction. Potential cumulative impacts on transportation systems are expected to be temporary and short-term.

4.12.5.4 Infrastructure and Public Services

The cumulative impact of the Port Arthur LNG Project and other projects in the vicinity on infrastructure and public services would depend on the number of projects under construction at one time. The small incremental demands of several projects occurring at the same time could become difficult for police, fire, and emergency service personnel to address. This problem would be temporary, and occur only for the length of construction. No long-term effects on infrastructure and public services are expected.

4.12.6 SNWW

4.12.6.1 LNG Ship Traffic

The Port Arthur LNG Project would be expected to add another 180 to 360 LNG ships per year on the SNWW. The Golden Pass Project would add between 80 and 280 LNG ships per year. The Sabine Pass LNG terminal would be capable of unloading about 300 ships per year or 2 ships every 3 days. This would result in an estimated addition of up to 940 LNG ships per year, or 2 to 3 LNG ships per day. Over a 3-year period (1999 through 2001), annual traffic on the SNWW averaged about 1,450 ships per year for vessels with drafts over 18 feet (tankers and freighters) and 14,463 for smaller vessels with drafts under 18 feet (primarily shrimp and offshore supply boats).

While the addition of LNG ships from all three proposed LNG projects would not significantly add to the overall ship traffic in the SNWW, it would significantly increase the larger ship traffic. Projected forecasts, based on historical growth of vessel traffic, estimate that the annual number of larger vessels using the SNWW could total approximately 2,090 by 2008. These same models indicate that, under ideal circumstances, the maximum number of vessels that the SNWW can handle would be approximately 3,550 vessels per year. This would equate to a maximum practical capacity of about 2,662 vessels per year (75 percent of the best case).

Although the COE's proposed widening of the SNWW would help in alleviating congestion and vessel delays, the Coast Guard will impose a safety zone around LNG ships transiting the Sabine Pass and Port Arthur Channels. This could disrupt other users of the SNWW that pass through these two channels on their way to and from the Gulf of Mexico to ports in Sabine Pass, Port Arthur, Beaumont, and Orange, Texas. This impact could be alleviated by coordinating the arrival of LNG ships and other large ships through the waterway (convoying traffic) and by increasing the number of pilots that move the large ships to port. In a letter dated January 18, 2005, the Sabine Pilots stated that they could adequately handle the potential increase in vessel traffic related to the proposed Project. Additionally, the Sabine Pilots have spoken in favor of both the Sabine Pass and Golden Pass LNG Projects.

4.12.6.2 Shoreline Erosion

The Texas and Louisiana Gulf Coast is experiencing the highest rate of coastal erosion and wetland loss in the U.S. (Ruple 1993). Average coastal erosion rates are 4.2 meters per year in Louisiana and 1.8 meters per year along the northern Gulf of Mexico shoreline. However, the most serious erosion and land loss are occurring in the eastern part of the coastal area, east of Atchafalaya Bay (USGS 2003). The SNWW does not appear to be subject to the same degree of land loss, overall. Nevertheless, localized erosion along the banks of the SNWW navigation channel, including the Sabine Pass and Port Arthur Channels and the proposed marine terminal basins, is a concern due to natural processes and erosion induced by wakes from the increased number of large ships that would regularly use the channels.

There are a number of factors that contribute to overall shoreline erosion. The most commonly acknowledged are: natural effects from currents, wave action, and tides; number of and size of ships using the channel; the proportions of the ship hull (for example, a long, thin hull form has greater displacement effect than a hull with short and fat proportions); ship draught; ship speed (probably the largest single factor); proximity to the shore; and propeller action (rapidly rotating propellers, changing propeller actions, and water jets cause a higher level of wash). The most significant factors in the generation of wash energy are ship size, speed, and frequency. Mitigation measures to reduce wash and resultant shoreline erosion would include: 1) reducing the overall number of ships, ship speeds, and propeller action; 2) widening and deepening the ship channels; and 3) reinforcing the banks.

The LNG ships are large and future ships (250,000 m^3) are expected to have an overall length of up to 1,130 feet, a beam width of 180 feet, and draughts of about 39 feet. Although large, LNG ships have a higher under keel clearance that reduces the wash effect in comparison to ships of similar overall size. This, in combination with the wide and deep Sabine Pass and Port Arthur Channels and slow speeds required for LNG ships, would reduce the potential for shoreline erosion from LNG ship traffic along the SNWW. All three LNG facilities would employ bank armoring and protection measures to minimize shoreline erosion at their basins.

4.12.7 DMPAs

If all three of the LNG projects were constructed, dredging for the marine basins would total approximately 16.9 million yd^3 (6.7 million yd^3 for the Port Arthur Project, 5.7 million yd^3 for the Golden Pass Project, and 4.5 million yd^3 for the Sabine Pass Project). An additional unspecified amount of dredge materials could be generated if the SNWW Improvement Project also is approved. Yearly maintenance dredging for the three LNG projects and the SNWW Improvement Project would vary, but could easily total 500,000 yd^3 or more. This could result in a shortage of viable DMPAs over the life of these projects and may result in the need to create new DMPAs.

4.12.8 Air Quality/Noise

Construction of the Project and some of the reasonably foreseeable projects and activities listed in **table 4.12-1** would involve the use of heavy equipment that produces noise, air contaminants, and dust. Operation of the proposed Project, and the Golden Pass and Sabine Pass LNG projects, also would contribute cumulatively to air emissions and noise.

Over the long term, the Project would not contribute significantly to current air pollution levels. Although the proposed LNG terminal would emit PM_{10}, SO_2, NO_x, CO, and VOCs, the terminal would not be a major source of air emissions under the PSD regulations for any of these pollutants. NO_x and VOC emissions from the proposed Project would contribute to the regional ozone concentrations. The Beaumont – Port Arthur airshed is currently classified as a marginal nonattainment area for the 8-hour ozone NAAQS, although it is classified as an attainment area for all other criteria pollutants. In addition, the Sabine Pass project would be constructed in Louisiana across from the Beaumont – Port Arthur airshed and would contribute to the regional ozone concentrations.

The Golden Pass project also would be constructed in Texas within the Beaumont – Port Arthur airshed. The TCEQ stated that, based on commitments made by the proponent to minimize air emissions from its project, the total of direct and indirect emissions from the Golden Pass project for future years would not increase emissions with respect to future baseline emissions. It is very likely that the TCEQ would require similar commitments from Sempra relating to minimization of air emissions from the Project. However, emissions from the proposed LNG terminals would be small in comparison to the total NOx and VOCs emitted by existing sources in Jefferson County.

Emissions from the LNG ships would be generated from both the main engines and the on-board electric generators at various stages of operations related to transit, maneuvering, hoteling, and unloading activities. Emissions from the Golden Pass and Sabine Pass LNG projects along with this Sempra Project would comply with state and federal air standards and have a minimal impact on air quality.

Additional noise produced during construction of the proposed Project and other projects could create short-term annoyances to nearby residences and could disrupt nesting birds and other wildlife in the project area. These noise impacts would be localized and would attenuate quickly as the distance from the noise source increases. Therefore, cumulative noise impacts associated with construction would be

unlikely unless two or more of the projects occur at the same time and in the same location. However, these impacts would be temporary and would only occur during construction of the projects.

4.12.9 Reliability and Safety

Impacts on reliability and public safety would be mitigated through the implementation of applicable federal, state, and local rules and regulations for each individual project. The specific rules and regulations that apply to each individual project would ensure that the applicable design standards are implemented to protect the public and to prevent accidents and failures. The LNG terminal facilities would be sited, designed, constructed, operated, and maintained in compliance with the federal safety standards summarized in **table 2.7.1-1**. The pipelines and aboveground facilities associated with the Port Arthur LNG Project would be designed, constructed, operated, and maintained in accordance with DOT Minimum Federal Safety Standards in Title 49 CFR Part 192.

Several of the present or reasonably foreseeable future projects, including the proposed project, would involve cargo terminals that could be expected to ship hazardous materials. Accidents involving such materials represent a potential impact on public safety. Continued growth in international commerce is likely to result in increased quantities of hazardous materials being shipped to and from the region.

It is difficult to evaluate the cumulative risk that such growth represents or has represented. In addition, it is difficult to measure the cumulative risk for an intentional attack on the Port or the LNG facility. The addition of the LNG facility and its associated LNG ships would not significantly change the risk of an intentional attack in the Sabine Pass and Port Arthur Channels. It is reasonable to assume that the rate of ship accidents (including those involving the release of hazardous materials) is likely to rise with more vessel traffic, which could cumulatively increase the risk of an accident having an impact on public safety. As discussed in section 4.13.5, the Sabine Pilots manage vessel traffic to insure safe transit in the Sabine Pass and Port Arthur Channels. The Coast Guard would also enforce a moving safety zone and moored vessel security zone around LNG ships. These and other operational controls by the Coast Guard and Sabine Pilots would minimize the risk of accidents involving LNG ships. Furthermore, the implementation of federal, state, and local rules and regulations concerning security and the results of the WSA with its associated operations and Emergency Response Plan would minimize the risk to the LNG ship and terminal.

Emergency response time is a key aspect of public health and safety. No significant cumulative impacts on emergency services are expected because sufficient emergency services and facilities exist in the area to accommodate the cumulative projects. No significant cumulative impacts on emergency services are expected during operation of the proposed project. Section 4.13.5 includes our recommendation that Sempra prepare an Emergency Response Plan and coordinate procedures with local emergency planning groups fire departments, state and local law enforcement, the Coast Guard, and other appropriate federal agencies to be used in the event of an incident. Sempra would be required to prepare a comprehensive plan that identifies the cost sharing mechanisms for funding these emergency response costs. With the implementation of the coordination procedures in the Emergency Response Plan and the funding of additional emergency management equipment and personnel, no cumulative impacts would be expected on emergency response services during operation of the proposed project.

4.13 RELIABILITY AND SAFETY

Three federal agencies share in the oversight of the safety and security of LNG import terminals: the Coast Guard, the DOT, and the FERC. 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 the security of the LNG vessels and the entire LNG facility. In conjunction with this, the Coast Guard determines the suitability of waterways for LNG marine traffic by issuing a Letter of Recommendation (LOR). 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 Port Arthur 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 offsite 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. [13] 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 fire box which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and 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 at Skikda and that of the proposal by Sempra (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. To ensure that all potential hazards are addressed, we have provided a recommendation in section 4.13.2, Cryogenic Design and Technical Review, to address this issue.

[13] 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."

A discussion of the principal properties and hazards associated with LNG is presented in section 4.13.1. A summary of our preliminary design and technical review of the cryogenic aspects of the LNG terminal is presented in section 4.13.2. Storage and retention systems are discussed in section 4.13.3. An analysis of the thermal radiation and flammable vapor cloud hazards resulting from a credible land-based LNG spill is presented in section 4.13.4, while the safety aspects of LNG transportation by ship is discussed and summarized in section 4.13.5. A discussion on security awareness related to terrorism is presented in section 4.13.6. The reliability and safety issues related to the natural gas pipelines are discussed in section 4.13.7. Conclusions on safety issues are in section 4.13.8.

4.13.1 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 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 U.S.

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, or confined space aboard an LNG ship, 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 66 to 82 feet per second (20 to 25 meters per second) and local over pressures up to 0.2 psig have been estimated for methane rich fuels, well below the flame speeds and over pressures associated with an 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 over pressures. 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.

4.13.2 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 LNG terminal at Port Arthur, Texas, has been performed by 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 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 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, Port Arthur LNG provided written answers prior to the technical conference on May 17, 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 as indicated by each specific recommendation. Items relating to Resource Report 13, Engineering and Design Material, and security should be submitted as critical energy infrastructure information (CEII) pursuant to 18 CFR § 388.112 and PL01-1. Information pertaining to items such as: offsite emergency response; procedures for public notification and evacuation; and construction and

operating reporting requirements would be subject to public disclosure. All 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, HD-5.**

- **The location of flammable gas detectors used to shut down fired equipment should be evaluated <u>prior to initial site preparation</u>.**

  The evaluation should include:

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

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

- **A complete plan and list of the fixed and wheeled dry-chemical, fire extinguishing, high expansion foam, 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.**

- **Facility plans should be provided showing the proposed location of, and area covered by, each monitor, hydrant, deluge system, hose and sprinkler. Details of the design should be filed <u>prior to initial site preparation</u> and should include P&IDs of the proposed fire water system.**

- **A detailed plan and section drawings of the troughs, containment and segments used to calculate vapor dispersion should be provided <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> 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> should include provisions for all flammable gas and UV/IR hazard detectors to be equipped with local instrument status indication as an additional safety feature.**

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

- **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 details of the boiloff gas flow measurement system provided for each tank.**

- **The final design should include provisions to ensure that hot 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 35°F.**

- **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 and cause and effect matrices for alarms and shutdowns.**

- **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.**

- **The final design should include details of the instrumentation for detecting leaks through pass through seals. The instrumentation should be designed to continuously monitor, alarm and shut down associated equipment.**

- **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 safety procedure manuals, should be filed prior to commissioning.**

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

- **The contingency plan for failure of the LNG tank outer 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 proposed construction project should be reported in monthly reports filed with the Secretary. Details should include a summary of activities, projected schedule for completion, 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 inspecting and reporting measures 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, the Company 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 boiloff rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and December 31. 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 the outer 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. 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. In all instances, notification should be made to FERC staff within 24 hours. 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 reoccurrence of the incident.

Recent hurricane activity in the Gulf Coast region has increased concerns about the possible effects of natural disasters on existing and proposed LNG facilities. The 2005 Atlantic hurricane season was the most active season on record with hurricanes Katrina and Rita directly affecting Gulf Coast port areas where existing, under-construction, and planned terminals are located. In September of 2005, the Trunkline LNG facility in Lake Charles experienced a Category 3 hurricane with sustained winds at landfall exceeding 120 mph. The FERC staff, recognizing the recent trend in the region towards more numerous and powerful storms, has intensified its review of the design criteria for the Sempra LNG facility with respect to high wind speed and storm surge conditions.

Storm surge refers to water levels above normal tide levels caused by wind and pressure effects associated with hurricanes. Sempra used available data from the Federal Emergency Management Agency (FEMA) to assess possible storm surge levels. The FEMA 100-year base flood elevation for the site is 12 feet (datum: NGVD29). The LNG process areas, including critical and non-critical equipment, would be constructed to a raised grade elevation of 16 feet NGVD29. An earthen dike around the LNG storage tank area would have a dike elevation of 12 feet NGVD29. The base of the tank would have an elevation greater than 12 feet NGVD29. The Staff agrees that the design is adequate for predicted storm surge and wave height levels.

49 CFR 193.2067 requires LNG facilities to be designed to withstand 150 mph sustained winds without loss of structural or functional integrity. All critical structures, including storage tanks, in the proposed Sempra LNG facility are designed to meet this wind speed design requirement.

4.13.3 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);
- Full containment cylindrical metal inner tank and metal or concrete outer tank (two authorized by the Commission; several applications currently proposed to the Commission, including Sempra);
- Prestressed cylindrical concrete tank with an internal metal membrane (membrane tank); there are 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.

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 a distance of 3 to 6 feet (1 to 2 meters) 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**.

Single-, double- and full-containment LNG storage tanks have been authorized by the Commission for use at new LNG import facilities or expansions of existing terminals. To date, only single- and double-containment tanks have been constructed and operated. Several full-containment tanks have started construction in the U.S., while approximately 50 have been constructed world wide. During the review of earlier proposals, a number of issues have surfaced concerning the applicability of existing codes and regulations to full-containment tanks. Specifically, the term "full-containment" does not appear in U.S. codes or standards for LNG facilities, including the Federal Safety Standards in 49 CFR Part 193, NFPA 59A, or API 620. As a result, some project proponents have made the assumption that to design and construct a full-containment tank in accordance with the European code for LNG facilities (EN 1473) would satisfy the U.S. code and standards.

For example, it has been suggested that thermal exclusion zones are not required for a full-containment tank because EN 1473 does not consider a tank fire scenario for full-containment tanks with a pre-stressed concrete wall and concrete roof. The staffs of FERC and OPS do not agree because neither NFPA 59A nor Part 193 exclude full-containment tanks from thermal exclusion zone requirements. As a result, a thermal exclusion zone analysis is required for an LNG storage tank fire at the top of the secondary container (see section 4.13.4).

Further, EN 1473 does not specify a minimum distance to the property line for full-containment tanks because no tank fire scenario is considered. However, NFPA 59A requires a separation of 0.7 times the diameter from the property line. The proposed tank for the Port Arthur LNG Project meets the separation requirement.

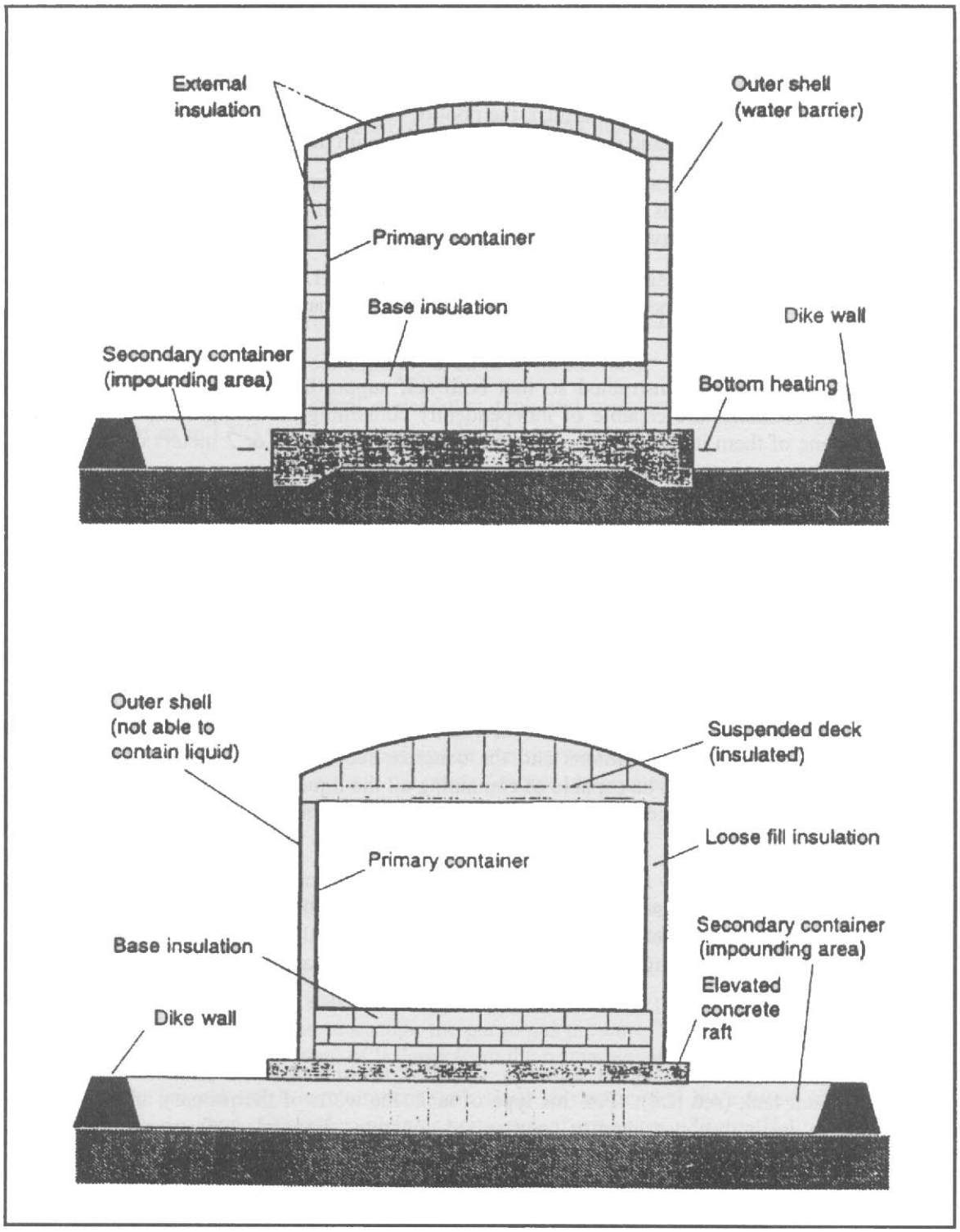

Figure H-1
Examples of Single Containment Tanks
Port Arthur LNG Project

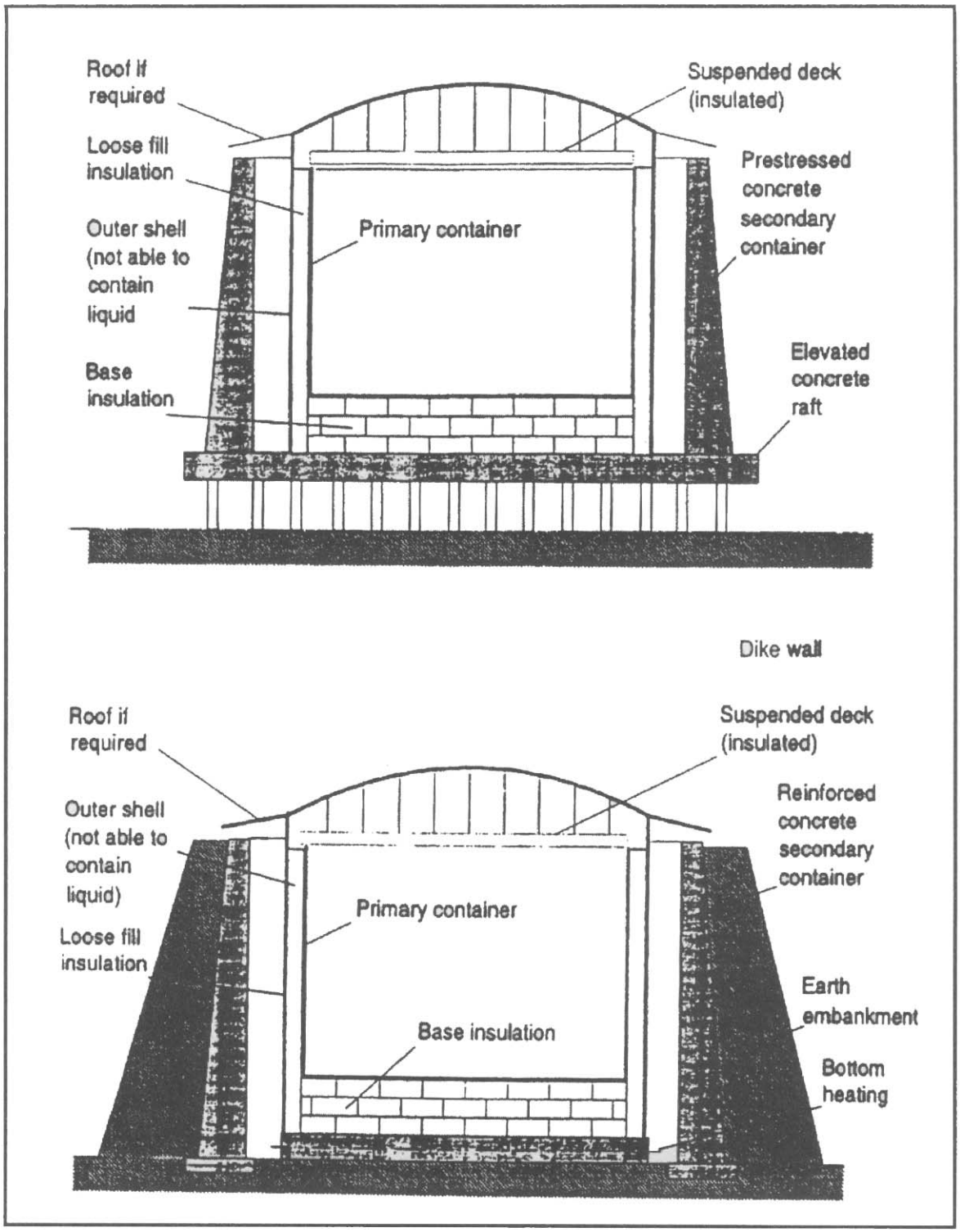

Figure H-3
Examples of Double Containment Tanks
Port Arthur LNG Project

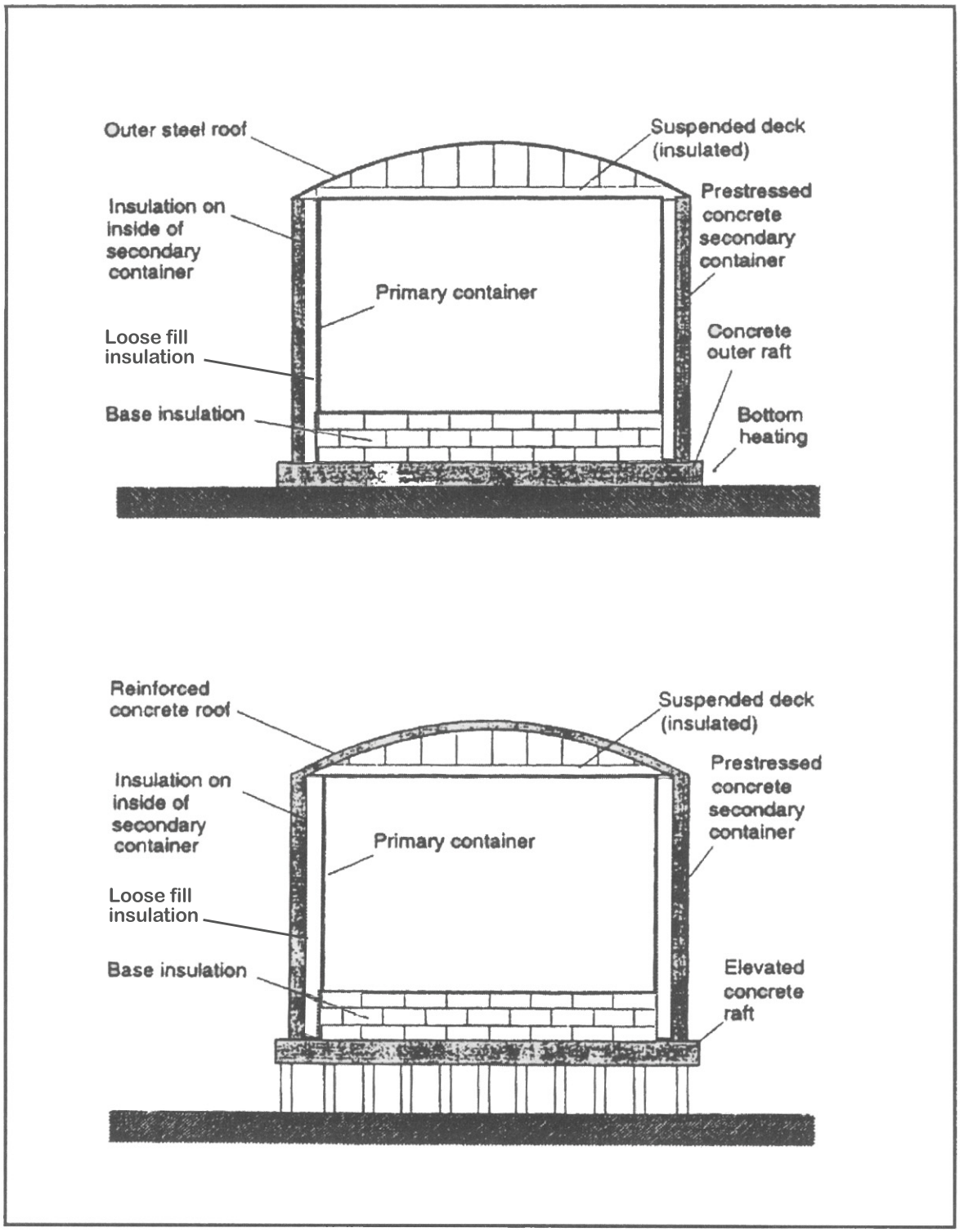

Figure H-4
Examples of Full Containment Tanks
Port Arthur LNG Project

Another issue regarding the full-containment design is that the tank outer wall (secondary containment) serves as the impoundment, a concept allowed under Parts 193.2161 and 193.2167, and under the "exception" in figure 2.2.2.6 of NFPA 59A. A specific concern is the dual function of the concrete secondary container - it serves both the operational function of holding the insulation and gas pressure, and a safety function of containing liquid in the event of an inner tank failure. Conversely, in single- and double-containment tanks, independent systems provide operational and safety functions. While recognition must be given to the benefits of a concrete secondary container with respect to external events, such as projectiles or small aircraft, its ability to provide the dual functions while retaining its integrity has not been convincingly supported for all scenarios. This becomes increasingly important as proposed site acreage is reduced and buffer zones between adjacent properties are minimized. As such, FERC staff considers prudent design practice to provide some form of barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property) in the event that the storage tank primary and secondary containers fail.

Concerns have also been expressed that the barrier could be considered a containment and prohibit certain equipment being located within the barrier and/or may conflict with other parts of the various codes with respect to hazardous and electrical code classifications. Other concerns are that the barrier could be considered an impounding area that would require new thermal and vapor cloud calculations. The purpose of the barrier is to prevent liquid from flowing off the plant property and it is not the intent to define a containment or impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements.

Sempra proposes to install full containment cylindrical metal inner tanks and concrete outer tanks with storm surge security barriers surrounding the Phase I tanks and another surrounding the Phase II tanks. Each storm surge/security barrier would be designed to contain the contents of one 160,000 m3 LNG storage tank. Rainwater collected by the barrier would be drained into a sump and pumped out in accordance with 49 CFR 193.2173. This barrier would confine LNG on the project property in the event of any hypothetical catastrophic event.

4.13.4 Siting Requirements – Thermal and Vapor Dispersion Exclusion Zones

4.13.4.1 Regulatory Requirements

The LNG facilities proposed in this project must comply with the siting requirements of 49 CFR 193, Subpart B. On March 30, 2000, 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 NFPA 59A (2001 edition) into the LNG regulations. The following sections specifically address offsite 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.

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

- Three 1,006,400-barrel (160,000 m3) full-containment 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.

- Two marine unloading berths, each with a cargo transfer system consisting of three 16-inch-diameter liquid unloading arms, one 16-inch-diameter vapor return arm, one 16-inch-diameter hybrid (vapor and liquid) unloading arm, and two 36-inch-diameter transfer lines to the storage tanks - 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.

- Nine 2,976 gpm in-tank pumps (three per tank) and eight 1,964 gpm LNG booster 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 in a process area.

- Six 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 areas 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 an 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. 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 Office of Pipeline Safety [OPS]) determines that a shorter time is acceptable. Again, given the confusion in applying the two requirements, 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 for exclusion zone calculations. 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 OPS concerning the basis for design spills and application to exclusion zone determinations for proposals before the Commission.

Impoundment Systems and Design Spills

The calculations of thermal and flammable exclusion zones for the proposed LNG facilities are based on the dimensions of the proposed impoundment systems and the spill volumes specified by Part 193 and NFPA 59A. 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. Sempra proposes a full-containment design for the LNG storage tanks in which the outer tank wall serves as the impoundment system. The outer wall would have an inner diameter of 252.5 feet and a height of 145.2 feet above the inner tank floor. Based on these dimensions, the outer tank wall would have a volumetric capacity of approximately 54,385,216 gallons. After subtracting the estimated space occupied by perlite and other significant components inside the tank, the remaining available tank volume would be 51,621,255 gallons. This would provide impoundment for about 111 percent of the inner tank's maximum design liquid level.

Potential LNG spills from piping to and from the LNG storage tanks and the piping serving the vaporization, process, and LNG transfer areas would be collected by a series of spill collecting troughs installed beneath all the LNG piping. The spill collecting troughs would slope into a single LNG spill containment sump which would be located in an area isolated from personnel and operating equipment. The LNG spill containment sump would have dimensions of 92 feet by 50 feet with a usable depth of 22.5 feet. These dimensions create an impoundment capacity of 774,180 gallons, which is sized to contain a 10-minute, full flow spill from the 36-inch diameter unloading lines. The total flow rate in these lines would be 77,056 gallons per minute (gpm), corresponding to a 10-minute spill volume of 770,560 gallons. Rainwater collected in the LNG spill containment sump would be pumped out by installed sump pumps that would be activated by a level switch.

In accordance with section 2.2.3.5 of NFPA 59A, the design spill for an LNG storage tank with no penetrations below the liquid level is defined as the largest flow from any single line that could be pumped into the impounding area with the tank withdrawal pumps considered to be operating at full rated capacity over a 10-minute period. Each LNG storage tank would be equipped with three in-tank pumps, individually rated for 2,976 gpm. The rupture of the in-tank pump withdrawal header would result in a spill volume of 89,280 gallons and would be contained by the LNG spill containment sump.

The design flow rate through the booster pump suction header would be 13,720 gpm. In the unlikely event of a rupture of the booster pump suction header, the resulting 10-minute spill of 137,200 gallons would be contained by the LNG spill containment sump. However, FERC staff also considered all small diameter attachments to transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment in the process area. It was determined that a failure

of a 2-inch diameter connection on a booster pump discharge line would be a more appropriate single accidental leakage source. This would result in a 10-minute design spill of 67,025 gallons. This spill would be contained by the LNG spill containment sump.

Table 4.13.4-1 presents the impounding areas and spill size volume for various spill scenarios. As shown in the table, the corresponding design spill volumes from the ship unloading line and booster pump would be less than the design spill for the in-tank pump withdrawal header. Therefore, since each of the design spills flow into the LNG spill containment sump, the largest spill, the in-tank pump withdrawal header design spill, would be the controlling spill and used to calculate the thermal and vapor dispersion exclusion zones.

TABLE 4.13.4-1

Impoundment Areas

Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
Impoundment sizing spills:			
LNG storage tank	46,477,200	LNG tank concrete wall	51,621,255
Ship unloading line	770,560	LNG spill containment sump	774,180
Booster pump header	137,200	LNG spill containment sump	774,180
Design spills:			
In-tank pump withdrawal header	89,280	LNG spill containment sump	774,180
Booster pump – 2" connection	67,025	LNG spill containment sump	774,180
Ship unloading line – 3" connection	32,088	LNG spill containment sump	774,180

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 miles per hour [mph] wind speed, 70°F, and 50 percent relative humidity) which are to be used in calculating the distances. However, Part 193.2057 supercedes 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, Sempra selected the following ambient conditions to produce the maximum distances: wind speed of 18.7 mph; ambient temperature of 42°F; and 45 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 Sempra's selection of atmospheric conditions.

Using these ambient criteria, FERC staff calculated thermal radiation distances for incident flux levels ranging from 1,600 to 10,000 British thermal unit per square foot per hour (Btu/ft^2-hr) for an LNG storage tank fire. The full inside diameter of the concrete outer tank (252.5 feet) was used as the pool diameter

while the flame base was set to the height of the outer tank wall (145.2 feet). Target height was set at ground level (0 feet). Thermal radiation distances were also determined for the 1,600 Btu/ft^2-hr incident flux level centered on the LNG spill containment sump.

Table 4.13.4-2 presents the calculated maximum distances for incident flux levels ranging from 1,600 to 10,000 Btu/ft^2-hr as calculated by FERC staff. The 1,600 Btu/ft^2-hr thermal radiation zones are all within the property boundaries with the exception of the radiation zones from Tanks 2001MF-A and 2001MF-B that extend over Coalingo road easement south of Round Lake. In accordance with section 2.2.3.2 of NFPA 59A, a thermal radiation flux level of 1,600 Btu/ft^2-hr cannot be exceeded outside the property line at a point used for outdoor assembly by groups of 50 or more persons. At the present time there are no such points on the Coalingo road easement. Therefore, the Port Arthur LNG Project meets the requirements of section 2.2.3.2 of NFPA 59A and 49 CFR 193.2057.

TABLE 4.13.4-2

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 Spill Containment Sump	Property line that can be built upon.	1,600	340
LNG storage tank	Outdoor assembly area occupied by 50 or more people.	1,600	918
LNG storage tank	Offsite structures used for occupancies or residences.	3,000	717
LNG storage tank	Property line that can be built upon.	10,000	369

[(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.

Sempra's application contained a vapor dispersion analysis for the LNG spill containment sump and the troughs in the marine area, the LNG tank area, and the process area which all drain into the LNG spill containment sump. Sempra used a regional temperature of 85°F, 73 percent relative humidity, and 4.5 miles per hour wind speed as input conditions.

The design spill for an LNG storage tank with no penetrations below the liquid level is determined in accordance with section 2.2.3.5 of NFPA 59A and is defined as the largest flow from any single line that could be pumped into the impounding area with the tank withdrawal pumps considered to operating at full

rated capacity over a 10-minute period. The impounding area for the LNG tanks would be the LNG spill containment sump. While Sempra has chosen a design spill based on the rupture of one of the 36-inch-diameter transfer lines, FERC staff based its analysis on the rupture of the in-tank pump withdrawal header in accordance with regulations. Such a spill would equal a rate of 8,928 gpm which after 10 minutes would result in a spill of 89,280 gallons. Using stability Class F, a wind speed of 4.5 miles per hour, 50 percent relative humidity, and an average regional temperature of 70°F, FERC staff calculated a distance of 743 feet to the 2.5 percent average gas concentration isopleth. Based on this distance, the flammable vapor exclusion zone associated with the LNG spill containment sump would not extend onto property that can be built upon.

Another issue is the lengthy distance from potential spill locations to the LNG spill containment sump. 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 also is relevant to consider the control of vapors produced in the channels or trenches leading to the sump. 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 fencing; 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:**

- **Sempra should 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. Sempra should file final drawings and specifications for these measures with the Secretary 30 days <u>prior to initial site preparation</u> for review and approval by the Director of OEP.**

4.13.5 Marine Safety[14]

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 and the suitability of waterways for LNG marine traffic. The FERC closely coordinated 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, and the suitability of waterways for LNG marine traffic.

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 4.13.5.4, History). 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:

[14] This section was written with the cooperation and assistance of the Coast Guard, Marine Safety Unit Port Arthur.

- a vessel colliding with an LNG ship in transit;
- a vessel transiting the Sabine Pass and Port Arthur Channels colliding with an LNG ship in the turning basin;
- an LNG ship alliding with the terminal or a structure in the Sabine Pass and Port Arthur Channels;
- 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 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 a conceptual LNG ship voyage, as proposed by the applicant, from the liquefaction facility to the import terminal, disclosing the risks at each step and how they would be 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.

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 International Convention for the Safety of Life at Sea (SOLAS), and 46 CFR 154, which contain the U.S. safety standards for vessel carrying bulk liquefied natural gas. Foreign flag LNG tankers would be 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 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:

For the ships, these requirements must include:

- Ships must develop security plans and have a Ship Security Officer (SSO);

- Ships must be provided with a ship security alert system. These systems 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 it has been compromised;

- Ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships; and

- Ships may have certain equipment onboard to help maintain or enhance the physical security of the ship.

- Port facility security plan;

- Facility Security Officer (FSO); and

- Certain security equipment may be required to maintain or enhance the physical security of the facility.

- Monitoring and controlling access;

- Monitoring the activities of people and cargo;

- Ensuring security communications and that they are readily available; and

- Completion of Declaration of Security.

For the port facilities, the requirements must include:

- Port facility security plan;

- Facility Security Officer (FSO); and
- Certain security equipment may be required to maintain or enhance the physical security of the facility.

Both ships and ports must include the following:

- Monitoring and controlling access;
- Monitoring the activities of people and cargo;
- Ensuring security communications and that they are readily available; and
- Completion of Declaration of Security.

LNG Vessel Transit in the Sabine-Neches Waterway

The Sabine-Neches Waterway (SNWW) provides access to the Gulf of Mexico for the harbor facilities of Sabine Pass, Port Arthur, Beaumont, and Orange, Texas. North of Sabine Pass are Sabine Lake and the Port Arthur and Sabine-Neches Canals that serve Port Arthur. At the north end of Sabine Lake and the Sabine-Neches Canal, the Sabine and Neches Rivers converge with the Sabine River continuing northeast to Orange and the Neches River continuing northwest to Beaumont. The Intracoastal Waterway, a 12 foot-deep channel, crosses the Sabine River north of Port Arthur. The Intracoastal Waterway parallels the Gulf coast from New Orleans, Louisiana to Port Isabel, Texas, and allows for smaller vessels (i.e., tugs, barges, and pleasure craft) to move between ports along the Gulf coast without actually crossing the Gulf of Mexico.

The proposed LNG marine terminal would be located on the west side of the Port Arthur Channel at milepost 14 about 32 miles from the Sabine Bank buoy. There are currently no major ports or facilities on Sabine Pass and Port Arthur Channels between the proposed LNG facility and the Gulf of Mexico. However, both Sabine Pass LNG and Golden Pass LNG have begun construction of LNG import terminals at mileposts 8 and 10, respectively.

If the Coast Guard issues a LOR, as described in Section 1.3 “Permits, Approvals, and Regulatory Requirements”, finding the waterway suitable for LNG marine traffic, LNG ships entering the SNWW would be boarded by a pilot(s) from the Sabine Pilots at the Sabine Bank buoy in the Gulf of Mexico. The pilot(s) would direct the entire voyage through the approach channels in the Gulf and the Sabine Pass and Port Arthur Channels to the proposed marine terminal. The vessel master would be on the bridge monitoring the pilot’s commands and would retain overall responsibility for the safe navigation of the LNG ship. The Coast Guard may have a security boarding team onboard during the transit. Other security measures may be required by the Coast Guard.

In Sempra’s Ship Traffic Study for the Sabine-Neches Waterway, it was stated that the movement of LNG vessels within the waterway would require three tugs per LNG vessel that can provide, at the least, a 70 ton bollard pull. Sempra would provide the necessary tugs for its terminal. The size and number of tugs is consistent with the Sabine Pass and Golden Pass projects.

Unless specified by the charter, tugs would meet the ship at a predetermined location and help turn and berth the LNG ship. A minimum of three tugs would aid in the straightening and slowing of the LNG

ship as it passes through the jetties and maneuvers into the berth. One tug would remain with the LNG ship while at berth.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, in addition to the Sabine Pilots, the Coast Guard would monitor 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 a security sweep. Other requirements are likely to 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 en route and during unloading operations; an inspection of the dock safety systems prior to commencing cargo transfer; monitoring all operations until the vessel departs; and maintaining security of the dock and vessel (see section 4.13.5.2, Requirements for LNG Ship Operations).

LNG Vessel Casualties

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the operational controls that would be imposed by the Coast Guard and the Sabine Pilots, as well as the characteristics of the Sabine Pass and Port Arthur Channels reduce the possibility of an LNG cargo spill from groundings, collisions, and allisions. The generally even and soft sea bottom (without rocky protrusions) of the Sabine Pass and Port Arthur Channels makes an LNG spill from cargo tanks highly unlikely in a grounding incident.

The moving safety zone imposed by the Sabine Pilots and the moving safety zone that the Coast Guard is likely to enforce would clear the channel of the vessels with the tonnage and speed required to cause an LNG spill (see section 4.13.5.4 Vessel Construction). To minimize the potential of a transiting ship alliding with LNG ships moored at the north and south berths at the terminal, an Allision Risk study was performed to examine its vulnerability from a disabled vessel. The study found that having a tug available for the pilot to use as needed significantly reduces the likelihood of a ship transiting past the LNG terminal alliding with an LNG vessel at berth. As stated previously, one tug would remain with the LNG ship while at berth. As a result, the risk of an LNG cargo release and subsequent formation of a flammable vapor cloud or fire from a LNG vessel casualty is minimal.

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 would be the responsibility of the owner/operator and the master of the vessel. Security of the LNG facility would be 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, Sempra's security staff, and state and local law enforcement. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, 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 moving safety zone around the LNG vessels in transit and/or a security zone around the LNG vessels while docked. Only personnel or vessels authorized by the Captain of the Port or the District Commander would be permitted in the safety and security zone.

Sempra would provide security for the terminal according to a Facility Security Plan that must be prepared under 33 CFR Part 105. This plan would need to be approved by the Coast Guard Captain of the Port (see section 4.13.6). 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 FSO 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 3 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. Sempra has contacted the Captain of the Port regarding their Facility Security Plan. Sempra would be required to submit their Facility Security Plan to the Captain of the Port for approval 60 days prior to commencement of operations. In order to ensure that the responsibilities of Sempra's security staff enhance overall security, **we recommend that:**

- **<u>Prior to commissioning</u>, Sempra should coordinate, as needed, with the Coast Guard to define the responsibilities of Sempra's security staff in supplementing other security personnel and in protecting the LNG ships and terminal.**

The Department of Energy (DOE) has released a study by Sandia National Laboratories entitled, *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 square meters 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 square meters. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 square meters, which is a more appropriate range to use in calculating potential hazards from spills. These hole sizes are equivalent to circular hole diameters of 2.5 and 3 meters.

The FERC commissioned a study by ABSG Consulting Inc. (ABSG) 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. 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 distances for several holes ranging in diameter from 1 meter to 3.9 meters. Using the methodology, we have estimated distances for a nominal 2.5-meter and 3-meter-diameter hole to range from 4,182 to 4,652 feet for a thermal radiation of 1,600 Btu/ft2-hr, the level which is hazardous for

persons located outdoors and unprotected; from 3,232 to 3,591 feet for 3,000 Btu/ft2-hr, an acceptable level for wooden structures; and from 1,934 to 2,143 feet for 10,000 Btu/ft2-hr, a level sufficient to damage process equipment for these size holes respectively.

These intentional breach scenarios provide guidance to the Coast Guard in developing the operating restrictions for LNG vessel movements in the Sabine Pass and Port Arthur Channels, as well as in establishing potential impact areas for emergency response and evacuation planning. Except for the 8.8 mile transit through the Sabine Pass and Port Arthur Channels to the LNG berth, the transit would be in the open waters of the Gulf of Mexico. Within 4,652 feet of the Sabine Pass and Port Arthur Channels are low density permanent residences in the community of Sabine, Sabine Pass, and Pleasure Island, Texas. Outdoor public use areas within 4,652 feet include Texas Point NWR, the Sabine Pass Lighthouse, the Sabine Pass Battleground State Historic Park, Walter Umphrey State Park, J. D. Murphree WMA, and public boat ramps in Sabine Pass and Pleasure Island. Assuming an LNG ship would transit through the channel at 5 to 7 knots, these areas would be exposed to a potential transient hazard of less than 18 minutes. In addition, a temporary hazard would exist around the ship unloading facility during part of the 10- to 12-hour period while the LNG vessel is at the dock and unloading cargo.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the operational restrictions to be imposed by the Sabine Pass Pilots on LNG vessel movements through this area, as well as the requirements to be developed by the Coast Guard in its Liquefied Natural Gas Vessel Management and Emergency Plan (see section 4.13.5.2), would minimize the possibility of a hazardous event occurring along the vessel transit.

Emergency Response and Evacuation Planning

Prior to commencing service, Sempra would be required to 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 193.2059(b)(3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…"

While the worst-case scenarios evaluated for the onshore facility in section 4.13.4 and for marine spills in section 4.13.5 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 would determine what area needs to be evacuated, if any, rather than a worst-case maximum zone. It is anticipated that the emergency evacuation plans would identify evacuation distances based upon increasing severity of events.

On several LNG import terminal proposals, a number of organizations and individuals commented on the need to consider emergency response procedures. Subsequently, Section 3A(e) of the Natural Gas Act, added by Section 311 of the Energy Policy Act of 2005, stipulated that in any order authorizing an LNG terminal the Commission shall require the LNG terminal operator to develop an Emergency Response Plan in consultation with the Coast Guard and state and local agencies. The FERC must approve the Emergency Response Plan prior to any final approval to begin construction. Therefore, **we recommend that:**

- **Sempra should develop an Emergency Response Plan (including evacuation) and coordinate procedures with the Coast Guard, state, county, and 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/methods for residents of Sabine, Sabine Pass, Pleasure Island and other public use areas that are within any transient hazard areas;**

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 written approval by the Director of OEP <u>prior to initial site preparation</u>. Sempra should notify FERC staff of all planning meetings in advance and should report progress on the development of its Emergency Response Plan at <u>3-month</u> intervals.

FERC also has received comments on other LNG terminal proposals expressing concern that the local community would have to bear some of the cost of ensuring the security and emergency management of the LNG facility and the LNG vessels while in transit and unloading at the berth. In addition, Section 3A(e) specifies that the Emergency Response Plan shall include a Cost-Sharing Plan that contains a description of any direct cost reimbursements the applicant agrees to provide to any state and local agencies with responsibility for security and safety at the LNG terminal and near vessels that serve the facility. To allow the FERC an opportunity to review the plan, **we recommend that:**

- **The Emergency Response Plan should include a Cost-Sharing Plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. In addition to the funding of direct transit-related security/emergency management costs, this comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. The Cost-Sharing Plan should be filed with the Secretary for review and written approval by the Director of OEP <u>prior to initial site preparation</u>.**

4.13.5.1 Sabine Pass and Port Arthur Channels

The Sabine Pass Channel is one segment of the SNWW and is approximately 4.3 miles long from the shoreline on the Gulf of Mexico to the mouth of the Port Arthur Channel. The Sempra Port Arthur marine terminal would be situated an additional 4.5 miles into the Port Arthur Channel. The SNWW extends north from the shoreline to Port Arthur, Beaumont, and Orange, Texas and connects the Intracoastal Waterway near Port Arthur with the Gulf. South of the shoreline, the Jetty and Outer Bar Channels extend from the shoreline into the Gulf of Mexico. These entrance channels are maintained at a depth of 42 feet with a width of 800 feet. The Sabine Pass and Port Arthur Channels are maintained at a depth of 40 feet with a width of 500 feet.

The proposed berth area would consist of a slip of approximately 1,310 feet by 1,890 feet and would be dredged to a minimum depth of minus 40 feet MLLW. The berth would be sized to accommodate LNG carriers with capacities up to 250,000 m3.

Current Ship Traffic

Several thousand small commercial vessels (tugs and barges) and fewer large vessels transit the SNWW and the Sabine River (see **Table 4.13.5-1**). Most of the smaller vessels use the Intracoastal Waterway to enter the Sabine River north of Sabine Pass and do not use the channel entrance (Outer Bar Channel) from the Gulf of Mexico and the Sabine Pass Channel. As shown on **Table 4.13.5-2**, the number of large vessels (over 18 feet draft) operating near Sabine Pass each year is relatively low and most of the traffic is associated with tug/tow boats used to move traffic on the Intracoastal Waterway north of the LNG terminal site. Traffic flow has been relatively constant over the 3-year period (1991 to 2001), although there was a significant drop in tug/tow traffic (under 18 feet draft) for 2001, for which there are no explanations.

Larger vessels (tankers and freighters with drafts in excess of 18 feet) make up the bulk of channel traffic transiting past the proposed LNG terminal site. The other two types of ocean-going commercial traffic that frequently use the Sabine Pass Channel include shrimp boats and offshore supply boats. Both the offshore supply boats and most of the shrimp boat fleet operate out of the communities of Sabine Pass and Sabine, Texas, located south of the LNG marine terminal. These boats do not operate on any specific schedule, although the shrimp industry does have "seasons" imposed by TPWD.

Table 4.13.5-2 breaks down the vessel traffic in 2001 by the various ports that make up the SNWW. The destination ports for the majority of the traffic are Beaumont and Port Arthur. The larger vessels (over 18 feet draft) are those that require pilots and, due to their size, use the Sabine Pass Channel. The Sabine Pilots Association indicated that, on average, 150 to 165 vessels per month (5 to 6 vessels per day) require pilots.

Although not a frequent occurrence, oil rigs occasionally anchor or drydock in the Sabine Pass Anchorage, located south of the marine terminal on the east side of the Sabine Channel. Typically, the rigs are waiting for repair facilities that are north of Sabine Pass, mostly in Port Arthur. The number of oil rigs anchored in the waterway at any given time is a function of the oil and gas market and is not predictable.

Future Ship Traffic

No significant expansion projects have been planned for the Orange, Beaumont, or Port Arthur ports. However, Sabine Pass LNG, L.P. received approval from FERC (Docket No. CP04-47-000) to construct

TABLE 4.13.5-1

Sabine-Neches Waterway Traffic – 1999 to 2001

Ship Traffic	1999	2000	2001
Traffic Over 18 feet Draft			
Tug/tow	24	47	14
Tankers	1,139	1,145	1,154
Dry cargo	251	269	302
Traffic Under 18 feet Draft			
Tug/tow	12,674	14,392	8,739
Tankers	96	66	65
Dry cargo	2,771	2,455	2,133

TABLE 4.13.5-2 Port Destinations in 2001				
Ship Traffic	**Orange**	**Beaumont**	**Port Arthur**	**Sabine Pass**
Traffic Over 18 feet Draft				
Tug/tow	0	8	5	1
Tankers	3	889	261	1
Dry cargo	0	134	167	1
Traffic Under 18 feet Draft				
Tug/tow	378	4,735	3,193	433
Tankers	0	44	21	0
Dry cargo	5	54	107	1,967

an LNG terminal on the Louisiana side of the Sabine Pass Channel, approximately 4 miles southeast of the proposed LNG terminal site. The Sabine Pass LNG and Pipeline Project would have up to 300 LNG ships per year that would use the Sabine Pass Channel to deliver LNG to its terminal. Golden Pass LNG also received approval from FERC (Docket No. CP04-386-000) to construct an LNG terminal on the Port Arthur Channel, about 2 miles southeast of the proposed terminal site. The Golden Pass LNG Terminal and Pipeline Project would have up to 200 LNG ships per year that would use the Sabine Pass and Port Arthur Channels to deliver LNG to its terminal.

Sabine Pass and Port Arthur Channel Capacity

There are a number of factors that influence the movement of ship traffic in the Sabine Pass and Port Arthur Channels. These include:

- ***SNWW Channel Entrance*** – The COE maintains the jetty entrance to the Sabine Pass Channel at a width of 800 feet and a depth of 45 feet.

- ***Sabine Pass and Port Arthur Channel Draft*** – The Sabine Pass and Port Arthur Channels are 500 feet wide and are currently maintained at a nominal depth of -40 feet MLT, meaning that the COE dredges the channel to -42 feet plus up to 2 feet more for over depth allowance, then allows the channel to shoal up to -40 feet MLT before dredging again. The MLT datum is arbitrarily set low versus mean sea level. Under normal tides there is usually 2 feet, typically providing a minimum of 47 feet of water. The largest LNG ships (250,000 m3) planned would have a draft of up to 40 feet; the more common LNG ship (140,000 m3) would have a draft of 37.4 feet. If a 10 percent under keel clearance were desired, then a depth of about 41.1 to 44 feet would be required. The COE is currently making channel improvements (deepening and widening selected reaches) to the SNWW. Plans include widening the Sabine Pass Channel to 700 feet and deepening it to 48 feet.

- ***Daylight Transit and One-way*** Traffic – The Sabine Pilots currently restrict vessels that meet any one of the following criteria to daylight transit only above the Texas Island Intersection: vessels with over 85,000 dead weight tonnage; 125 feet in beam, or over 875 feet in length. Vessels of these dimensions can move inbound at 5:00 am from the anchorage to make the daylight requirements at Texas Island. Consequently, the Sabine Pilots have a policy of lining up all vessels at anchor each morning and maneuvering through the channel like a convoy, with the vessel traveling to the furthest

dock at the head of the line. Sempra does not anticipate a "daylight only" restriction on vessel movement through the channel and plans to dock LNG ships around the clock.

- ***Tugs*** – Sempra has committed to providing the required tractor tugs to satisfy the Sabine Pilot's requirements. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, three tugs would be required per LNG ship, with each tug providing at least a 70-ton bollard pull.

- ***Moving Safety Zone*** – If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard would likely impose a moving safety zone for LNG ships that restricts other traffic ahead, astern, and to the sides. Other vessels would be restricted to moving in the same direction the LNG ship is traveling. Sempra estimates that it would take approximately 3.5 hours to move the LNG ship from the Sabine Bank Buoy to the marine terminal.

- ***Reduced Visibility*** – Fog is most frequent in midwinter and usually dissipates before noon. During this period, visibility under 0.5 mile occurs 3 to 4 days per month. The Sabine Pilots Association confirm that although traffic is usually moving by noon, reduced visibility has historically closed the channel for a 24-hour period 3 or 4 times per month during midwinter. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may implement transit restrictions on LNG vessels during periods of reduced visibility.

- ***High Winds*** – The Sabine Pilots Association reported that winds in excess of 20 knots occurred in every month of the year in 2002. The high winds lasted as long as 24 hours, but usually not more than 12 hours at each occurrence. The Coast Guard may establish a specific limit for LNG ship movement and berthing in high winds (typically 25 knots). The Sabine 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.

- ***Pilot Availability*** – The Sabine Pilots Association has a total of 22 pilots, working on a rotating 14 day schedule during which time 11 are on call. In July 2005, the number of pilots will increase to 26, with 13 pilots on call working on a 14-day schedule. Since an average of 6 vessels per day currently requires pilots when transiting the SNWW, pilot availability should not be problem.

Sempra has discussed ship traffic with the Sabine Pilots Association, the COE, and representatives of the Coast Guard.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, additional navigational safety measures may be necessary for LNG ships based on the procedures to be developed in the Coast Guard's *Liquefied Natural Gas Vessel Management and Emergency Plan.*

Vessel Simulation Studies

A Navigation Study was prepared for a similar LNG terminal proposed in the Port Arthur Channel, the Golden Pass LNG terminal (milepost 10). The study was performed at Marine Safety International in Middletown, Rhode Island, in June 2004, and filed under Confidential Energy Infrastructure Information (CEII). We believe the results of this study would be applicable to Sempra's proposed LNG terminal (MP 14). This evaluation involved a four day, computer generated, ship handling simulation involving 37 simulated runs focusing on the key areas of the navigation channels, the LNG terminal turning basin and dredged docking slip area. Two active Sabine pilots participated in this evaluation and provided comments and recommendations to ensure that LNG carriers calling at the Golden Pass terminal would be handled in a safe and prudent manner when navigating local waterways. The LNG carrier modeled for

this evaluation was a conceptual 250,000 m3 spherical 5 tank design yet to be built. The study evaluated vessel maneuvering during transit from the breakwater entrance to the berth under a variety of environmental conditions including the most credible difficult tidal flows (3 knots at ebb and flow) and wind conditions (30 knots) likely to be encountered. In all cases, assistance was provided by three ASD tractor tugs.

In conclusion, the pilots found a LNG vessel of the characteristics used for this simulation can move from pilot boarding area to the LNG terminal and return in a safe manner providing some limitations are observed. The study recommended the following:

- Transits to and from should be limited to sustained winds of 25 knots or less.
- When sustained beam winds of more than 25 knots are being experienced, docking and undocking operations should be delayed.
- There is insufficient space in the area of terminal for other traffic when maneuvering the LNG vessel. A moving safety zone should be established around the LNG vessel while transiting between the sea buoy to the dock. Other shipping should be prevented from moving in the area while the LNG vessel is maneuvering.
- Sabine Pilots have very little experience with tractor tugs. A training program is recommended that brings pilots and tug masters together for joint integrated training before the anticipated first tractor tug delivery.
- Because some concern was noted about the 60-ton bollard-pull ASD tugs in the worst conditions, consideration should be given to 70-ton tugs.

4.13.5.2 Requirements for LNG Ship Operations

The Coast Guard exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173; the Magnuson Act (50 USC section 191); the Ports and Waterways Safety Act of 1972, as amended (33 USC section 1221, et seq.); and the Maritime Transportation Security Act of 2002 (46 USC section 701). The Coast Guard is responsible for matters related to navigation safety, vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the receiving tanks. The Coast Guard also has authority for LNG facility security plan review, approval, and compliance verification as provided in Title 33 CFR Part 105, and siting as it pertains to the management of vessel traffic in and around the LNG facility.

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. Title 33 CFR 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, fire fighting, and security of LNG waterfront facilities. The safety systems, including the communications, emergency shut down, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Sempra would be required to submit two copies of its Operations and Emergency Manual to the Captain of the Port, Port Arthur for examination.

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).

As required by its regulations (section 127.009), the Coast Guard is responsible for issuing a LOR as to the suitability of the waterway for LNG marine traffic with respect to the following items:

- Density and character of marine traffic;
- Locks, bridges, or other manmade obstructions in the waterway; and
- The following factors adjacent to the facility:
- Depth of water;
- Tidal range;
- Protection from high seas
- Natural hazards, including reefs, rocks, and sandbars;
- Underwater pipelines and cables; and
- Distance of berthed vessels from the channel and the width of the channel.

On June 14, 2005, the Coast Guard published a *Navigation and Vessel Inspection Circular – Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic* (NVIC 05-05). The purpose of NVIC 05-05 is to provide Coast Guard Captains of the Port (COTP)/Federal Maritime Security Coordinators (FMSC), 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 LOI/LOR process, but in addition, also will take completely into account maritime security implications. In accordance with this guidance, each LNG project applicant is to submit a Waterway Suitability Assessment (WSA) to the cognizant COTP. The WSA is to address the transportation of LNG from the LNG tanker's entrance into U.S. territorial waters, through its transit to and from the LNG receiving facility, including operations at the vessel/facility interface. In addition, the WSA should address the navigational safety issues and port security issues introduced by the proposed LNG operations. NVIC 05-05 also provides specific guidance on the timing and scope of the WSA.

The process of preparing the LOR begins when an applicant submits a Letter of Intent (LOI) to the local COTP. In accordance with 33 CFR 127.007, Sempra submitted a LOI to the Coast Guard on December 10, 2004 (see Appendix H). In preparation for issuance of a LOR and the completion of certain other regulatory mandates, any comments received would be incorporated into a formalized risk assessment process to assess the safety and security aspects of the facility, adjacent port areas, and navigable waterways.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the arrival, transit, cargo transfer, and departure of LNG ships in the SNWW would be required to adhere to the procedures of a *Liquefied Natural Gas Vessel Management and Emergency Plan* to be developed by the Coast Guard Marine Safety Unit Port Arthur. In addition, Sempra 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 *Liquefied Natural Gas Vessel Management and Emergency Plan* would contain specific requirements for the LNG ship, pre-arrival notification, transit through the SNWW, the waterfront facility, cargo transfer operations, Coast Guard inspection and monitoring activities, and emergency operations. The Coast Guard Marine Safety Unit Port Arthur would monitor each LNG ship in accordance with the *Liquefied Natural Gas Vessel Management and Emergency Plan*.

Some of the anticipated key provisions of the *Liquefied Natural Gas Vessel Management and Emergency Plan* to be developed by the Coast Guard Marine Safety Unit Port Arthur would be the establishment of a moving safety and/or security zone for all inbound and moored LNG ships, the use of tugs to assist in the SNWW and to maneuver the ship into the berth, and the requirement that tug(s) remain with the LNG ship while it is moored at the berth. Additional provisions may be necessary given changing circumstances.

Sempra Waterway Suitability Assessment

In December 2005, Sempra submitted a WSA for the proposed project to the Captain of the Port. The Coast Guard, with input from various LNG stakeholders, which included marine pilots, towing industry representatives, members of the Area Harbor Safety Committee, and the Area Maritime Security Committee, has completed a review of Sempra's WSA in accordance with the guidance in NVIC 05-05. The WSA review focused on the navigation safety and maritime security risks posed by LNG marine traffic, and the measures needed to responsibly manage these security risks.

Coast Guard Letter to the FERC

On March 20, 2006, the Coast Guard sent a letter to FERC, based on the above WSA review, providing input on the capability of the port community to implement the risk management measures necessary to responsibly manage the risks of LNG marine traffic in the port (see Appendix H). As described in this document, the Coast Guard has preliminarily determined that the SNWW to the proposed LNG terminal in Port Arthur, Texas, may be suitable for accommodating the type and frequency of LNG vessels being proposed by the applicant. This determination, however, is preliminary because the required NEPA analysis has not yet been completed. This determination is also contingent upon the Coast Guard and other participating agencies having the appropriate resources to implement all of the measures necessary to responsibly manage the safety and security risks of LNG marine traffic in this area.

The Coast Guard's letter to FERC discusses the relevant safety and security issues from the broad viewpoint of impact on the entire port, as well as provides a detailed review of specific points of concern along the LNG tanker's proposed transit route. A detailed supplemental letter, also based on the WSA review, describing the conceptual prevention/mitigation strategies, along with resource needs, has also been sent from the Coast Guard to the FERC on March 21, 2006. Specific details of these measures have been designated Sensitive Security Information as defined in Title 49 CFR Part 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, it is not available to the public. Additionally, any security plan is a dynamic document that is subject to change with advances in technologies and improvements in intelligence gathering.

As a result of the WSA review, the Coast Guard has preliminarily identified additional resources, public and/or private, that would be needed to implement prevention and mitigation strategies necessary for LNG operations. Consequently, we have recommended that Sempra submit, concurrent with its Emergency Response Plan, a comprehensive plan identifying the mechanisms for funding all project-specific security/emergency management costs (see section 4.13.5 "Emergency Response and Evacuation Planning").

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the security measures outlined in the letter to the FERC and the above mentioned supplemental report would be further developed into a detailed *Liquefied Natural Gas Vessel Management and Emergency Plan*, which would be become the basis for appropriate security measures for each Maritime Security threat level. This plan would clearly spell out roles, responsibilities, and specific procedures for an LNG vessel transiting the SNWW up to the proposed Port Arthur LNG terminal, as well as all agencies involved in

implementing security and safety during the operation. It would be required that, prior to the LNG vessel being granted permission to enter the SNWW, both the vessel and facility must be in full compliance with the appropriate requirements of the Maritime Transportation Security Act and International Ship and Port Facility Security Code, and the security protocols to be established by the COTP in the *Liquefied Natural Gas Vessel Management and Emergency Plan*. The plan may include security measures such as: Coast Guard and other law enforcement agency vessels to enforce safety and security zones around the LNG vessels while in transit and moored at the terminal; shoreside surveillance and monitoring along designated sections of the transit route; and other prevention/mitigation strategies.

We recognize that the *Liquefied Natural Gas Vessel Management and Emergency Plan* will be a dynamic document that would be prepared well before import operations would commence, and that the port's overall 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:**

- **Sempra should <u>annually</u> review its waterway suitability assessment relating to LNG vessel traffic for the project; update the assessment to reflect changing conditions which may impact the suitability of the waterway for LNG marine traffic; provide the updated assessment to the cognizant Captain of the Port/Federal Maritime Security Coordinator (COTP/FMSC) for review and validation if appropriate, further action by the COTP/FMSC relating to LNG vessel traffic; and provide a copy to the FERC staff.**

<u>Impact of Vessel and Facility Security Requirements</u>

The potential impacts of the proposed LNG vessel traffic on other commercial and recreational boaters can be addressed in relation to several general security requirements: 1) a moving safety zone for inbound LNG vessels; 2) a security zone around a moored LNG vessel; and 3) other measures as deemed appropriate.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic the Coast Guard would promulgate a moving safety zone which would affect other vessels. Pursuant to such a regulation, no vessel would be allowed to enter the safety zone without first obtaining permission from the Coast Guard Captain of the Port. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, it is anticipated that the LNG ships would transit about 8.8 miles through the Sabine Pass and Port Arthur Channels to the proposed Port Arthur LNG terminal. In the offshore portion of the channel, LNG vessels would travel at about 9 knots. Once inland, an LNG vessel would travel at approximately 5 to 7 knots. Based on these assumed speeds, it would take about 5.5 hours for LNG ships to complete the trip from the SB buoy the LNG. Minimum visibility conditions would have to be satisfied before the LNG ship would be allowed to proceed inbound from the Gulf, ensuring that the Coast Guard could adequately monitor the safety zone.

If moving safety zones, security zones at the terminal, and one-way traffic were implemented, they would affect other commercial and recreational traffic using the channel. The magnitude of the effect would also be influenced by three other factors: the amount of time it takes to obtain a pilot and other competing ship traffic in the federal navigation channel.

The moving safety zones, if implemented, may have the effect of temporarily limiting the channel to one-way traffic. It is expected that if the proposed LNG terminal is constructed, and if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, as many as 180 (Phase I) to 360 (Phase II) LNG ships for the Port Arthur LNG terminal could potentially move in and out of Sabine Pass and Port

Arthur Channels every year. This would be a 8 to 18 percent increase over the existing 2,000 vessels per year currently requiring pilots and transiting these waterways.

The moving safety zone could cause impacts on recreational and other commercial vessels but the impacts would be temporary while the LNG vessel is in transit or moored at the unloading facility. Because the safety zone would be a moving zone around the ship, the impacts would be of short duration at any given point along the shipping route. A recreational craft attempting to travel in the opposite direction of an LNG ship traveling at 7 knots may need to wait up to 18 minutes for the LNG ship to pass before proceeding on its way. The delay would increase to up to 36 minutes when the LNG ship is traveling at 5 knots and up to 60 minutes when the LNG ship is traveling at 3 knots. For other vessels near or upstream of the facility, an additional 60 minute delay may be experienced while the LNG ship is berthed. Because of the relatively low volume of recreational boating in the immediate project area, any impacts are expected to be minor. Moreover, the Coast Guard moving safety and moored vessel security zones would not be treated as absolute exclusion zones that would preclude all other vessel movements. Rather, other vessels may be allowed to transit through the moving safety and moored vessel security zones with the permission of the Captain of the Port.

The Coast Guard has preliminarily determined that if appropriate resources were available to implement certain necessary security measures, the SNWW could accommodate the number of LNG carriers Sempra has proposed to supply the LNG terminal. This determination is preliminary because the required NEPA analysis has not yet been completed. This determination also is contingent upon the port security community having the appropriate resources to implement all the measures necessary to responsibly manage the safety and security risks of LNG marine traffic in this area. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, in addition to the moving safety and security zones around the LNG vessels, the *Liquefied Natural Gas Vessel Management and Emergency Plan* to be developed by the Coast Guard Marine Safety Unit Port Arthur, would minimize impact to other ship traffic, escorts by armed law enforcement officials, and a variety of waterway and shoreline surveillance measures.

FERC has received comments on other LNG terminal proposals expressing concern about the cost of applying additional security measures and the potential burden on local taxpayers. To meet its anticipated security responsibilities the Coast Guard most likely would need to request additional resources through its internal resource reprogramming process for inclusion in future appropriations. Additional funding for state and local resources would be provided by Sempra. In order to precisely determine the additional resources that would be necessary to provide the additional security to ensure safe transit of the LNG vessels, it would be necessary to develop and finalize the Coast Guard's *Liquefied Natural Gas Vessel Management and Emergency Plan*. Funding for security and management costs are discussed further in section 4.13.5 "Emergency Response and Evacuation Planning".

While the LOR would address the suitability of the Sabine Pass and Port Arthur Channels for LNG ship transportation, it would not constitute a final authority to commence LNG operations. The Coast Guard's recommendation is subject to certain safety and security provisions to be developed in its *Liquefied Natural Gas Vessel Management and Emergency Plan*. This plan would be reviewed and updated as necessary to address issues specific to the Sabine Pass and Port Arthur Channels and the proposed LNG terminal. In addition, the Coast Guard may establish a safety and security zone under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port would be permitted in the safety and security zone.

4.13.5.3 Environmental Impacts Associated with Coast Guard Actions

The Coast Guard's issuance of a LOR is a federal action which requires compliance with NEPA, just as the FERC's authorization for construction and operation of a LNG facility requires compliance with NEPA. Alternatives regarding these actions are discussed in section 3.

Some of the potential environmental impacts resulting from LNG vessel activities and transit would not be unique to LNG carriers and may also be addressed by previous Coast Guard NEPA analyses for existing regulations. Per the Coast Guard NVIC 05-05, all required Coast Guard NEPA analysis and documentation must be complete prior to the issuance of any LOR.

Potential impacts on wildlife and aquatic resources are discussed in sections 4.3 and 4.6. The potential impacts that result from LNG vessels in transit would be similar to those resulting from other ships using the navigation channel. Impacts include those related to prop wash, invasive species, and water withdrawal for ballast and cooling. No significant impact on wildlife or aquatic resources as a result of LNG marine traffic is expected.

LNG ships and support vessels would emit criteria pollutants, VOCs and HAPS during transit. We have identified the magnitude of these emissions in section 4.11.1. LNG vessel emissions while in transit and during maneuvers are considered indirect emissions and are applicable towards the general conformity determination (see Appendix M). The emissions from the LNG ships while at berth would be included in the general conformity determination. All LNG ship and support vessel emissions while in transit would be required to conform to the Texas State Implementation Plan.

The LNG tanker would be operating in the federally approved channel en route to the terminal. We believe the use of this channel is consistent with the coastal zone management plan. Consistency with the Coastal Zone plans would be determined by Texas and Louisiana, as applicable. The coastal effects associated with this project, including coastal effects resulting from vessel transit, are addressed in section 4.8.5 to the extent this statute is applicable. As such, consistency with the CZMA is required as appropriate. We have recommended conditions in section 4.8.5 that Sempra obtain CZMA consistency from each state.

The potential impacts associated with a release of LNG are discussed generally in the preceding and following sections. The establishment of temporary safety and security zones by the Coast Guard has been considered as a potential effect on recreational use of the waterway (see section 4.8.3). However, we do not expect these zones to have a significant effect on environmental resources.

As a linear feature, the LNG transit corridor is an assemblage of varying socioeconomic characters determined by the presence of the waterway or other adjacent features. Further, the shipping route used by the LNG vessels is not discretional. That is, the corridor was developed prior to the concept of its use for LNG traffic and alternative corridors are not available. Therefore, it is not possible to determine the vessel transit corridor based on environmental justice considerations.

The transit corridor for the LNG carriers would traverse open water and estuarine habitats. Approximately 8.8 miles of the transit corridor are within confined waters where shoreline could be affected by accidental spills. The transit corridor from the Gulf entrance is proximal to shoreline habitats. Shoreline habitats adjacent to the transit corridor include salt marsh, emergent wetlands, forested wetlands, grasslands, and shrublands. The aquatic and shoreline habitats support a variety of wildlife which are described in sections 4.6 and 4.7. **Figure 4.13.5-1** shows the locations of significant parks, refuges, and other public recreation areas along the transit corridor.

LNG is less dense than fresh or sea water, so it floats on the surface. Immediately upon contact with any warmer substance such as water or air, it begins to evaporate. As the LNG vaporizes, a vapor cloud may form which is initially heavier than air and may be dispersed by wind. An LNG vapor cloud cannot explode in the open atmosphere, but it could burn.

Since LNG is a cryogenic liquid, the greatest threat to aquatic life from an LNG spill would be thermal stress. Any aquatic life (including plankton, fish, birds, sea turtles, marine mammals, and any federally-listed species) that came into direct contact with the LNG would probably experience a sudden cold shock, and, depending in what context that contact occurred, the exposure could be lethal, especially to non-motile species. Most mobile underwater organisms would detect the temperature change and avoid the area. Wildlife occupying the water's surface near the release could intercept the vapor cloud and suffer asphyxiation. However, the duration of this exposure is short, as noted below. Impacts to shoreline habitats and associated wildlife could occur, primarily, through the subsequent ignition of the LNG. The potential damage could involve the combustion of both vegetation and wildlife.

The accident scenarios evaluated in section 4.13.5.4 include release and ignition of natural gas formed by evaporation of spilled LNG. Natural gas combustion typically is not complete in spill scenarios. The products of incomplete combustion of natural gas include criteria pollutants, ozone precursors, toxic air contaminants, and soot (carbon particulates). It should be noted that LNG fires typically do not last as long as liquid petroleum fires.

The duration of an ignited accidental LNG spill detailed in section 4.13.5.4 is approximately 48 minutes. For an ignited intentional LNG spill, the duration is approximately 11 minutes. The maximum increases in ambient pollutant concentrations due to the natural gas fire would occur downwind of the LNG spill. Ambient air pollutant concentrations in downwind areas could potentially exceed short-term NAAQS and State Ambient Air Quality Standards over the duration of the fire as well as soot deposition and diminished visibility due to soot transport. Given the distance to shore from a potential fire from most of the transit route in the SNWW, it is unlikely that sensitive receptors (i.e., schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) would be exposed to substantial pollutant concentrations for a significant period. There would be no long-term effects.

The pool formed from an unignited accidental LNG spill would completely evaporate in approximately 94 minutes. For an ignited intentional LNG spill, the pool would completely evaporate in approximately 7 minutes. As natural gas is not a criteria pollutant, no air quality impact would be expected from the evaporation of the LNG spill. However, methane, the primary component of LNG, is considered a greenhouse gas and may contribute to global warming. (Coast Guard 2005)

However, the history of LNG shipping has been free of major incidents, and none have resulted in significant quantities of LNG being released. No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargoes being released. Historically, the events most likely to cause a significant release of LNG were ship casualties such as collisions, allisions, or groundings. Any event causing a release of LNG would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. During the 44,000 voyages that have been completed since the inception of LNG maritime transportation, there has not been a serious accident at sea or in a port which resulted in a spill due to rupturing of the cargo tanks. Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and local pilots, the likelihood of a cargo containment

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Figure 4.13.5-1

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failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision[15] – is highly unlikely. However, the possibility of an LNG spill from a ship over the duration of the proposed project must be considered.

Given that an LNG cargo spill is highly unlikely, no significant socioeconomic impact associated with an accidental LNG release along the transit route would be expected. As described below, the duration of an LNG pool fire would be of short duration, i.e., from 1 to 2.5 hours. If there is an LNG spill on the transit route, it may result in a temporary interruption in ship traffic in the navigation channel; however, traffic in the navigation channel would quickly resume normal operations and any economic impact on the maritime industry would be minimal.

If a pool fire occurred where the transit route is closer to shore, businesses within 2,200 feet of the center of a spill could be subject to a long-term loss of use. Vegetation and wooden structures subjected to greater than 3,000 Btu/ft^2-hr[16] may ignite. However, because the hazard area surrounding an LNG cargo vessel is transient (moving with the vessel along its route) it is not possible to accurately quantify the economic impact of an incident. Section 4.13.5.4 discusses the effects of an LNG spill in greater detail.

In accordance with Section 311 of the Energy Policy Act of 2005, we recommend in section 4.13.5 that Sempra develop an Emergency Response Plan in consultation with the Coast Guard and state and local agencies that includes a Cost-Sharing Plan before any final approval to begin construction. Therefore, no long-term impact relating to emergency evacuation of communities would be expected.

The December 2004 Sandia Report, discussed in section 4.13.5.4 "Deliberate Attack on an LNG Vessel," included an analysis of potential LNG cargo tank breaches due to accidental causes. The report found that accidental groundings, collisions with small vessels and low speed collisions with large vessels could cause minor ship damage but would not result in a cargo spill. This is due to the protection provided by the double hull structure, the insulation layer and the primary cargo tank of an LNG vessel. We do not believe that there would be any environmental significance attributed to these types of accidents.

High speed collisions with large vessels striking at 90 degrees were found to potentially cause cargo tank breach areas of 0.5 to 1.5 square meters. For the resulting LNG spill and pool fire on water, the report determined that the most significant impact to public safety and property would exist within about 800 feet, with minimal impact beyond 2,400 feet. Depending on the actual size of the cargo tank breach, the duration of the spill and ensuing pool fire could range from approximately 1 to 2.5 hours. Using the methodology in the ABSG study, FERC staff determined that the site-specific distance to the 1,600 Btu/ft^2-hr transient hazard area for an accidental cargo tank breach in the SNWW would be approximately 2,790 feet.

However, if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, it must also be recognized that the operational controls imposed by the Coast Guard and local pilots, such as a moving LNG vessel safety zone and one-way traffic in narrow channels, would be specifically designed to prevent the collision scenarios that could result in an LNG cargo tank breach. As a result, the likelihood of an LNG spill from accidental causes is considered to be negligible.

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[15] "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.

[16] 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.

In the unlikely event of an LNG spill, the physical properties of LNG would limit any potential impacts. If spilled into water, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water over a period of approximately 1 to 2.5 hours. 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.

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 the unlikely event that ignition did not occur, an LNG spill would rapidly vaporize on water and form a potentially flammable cloud. If the flammable vapor cloud encountered an ignition source, the cloud would burn back to the spill site, rather than outward towards shoreline habitats.

Given these considerations, impacts to shoreline habitats as a result of an accidental LNG spill are unlikely to occur. A spill would be unlikely to result in significant impacts to shoreline habitats and wildlife that occur along the transit route. Hazard distances for intentional breaches are discussed in section 4.13.5.4. Although an intentional breach scenario may result in greater hazard distances, such scenarios are associated with the desire to inflict damage to major infrastructure, population and commercial centers, rather than to environmentally sensitive areas along the vessel route. Also, given the navigation controls and safety and security procedures in place to specifically prevent such accidents and intentional spill scenarios, the indirect impact associated with Coast Guard actions are not reasonably foreseeable events.

As discussed in section 4.13.5.2, if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may establish a moving safety zone, moored vessel security zone, and/or regulated navigation areas around the transiting LNG vessels and provide some level of escort as part of finalizing the *Liquefied Natural Gas Vessel Management and Emergency Plan*. The LNG vessels would also undergo safety and security inspections to ensure compliance with U.S. and international standards. In addition, the LNG facility would submit a facility security plan for review and approval by the Coast Guard. However, due to uncertainty in the scope, frequency, prevailing maritime security levels, and the number of resources that would be dedicated on a recurring or episodic basis, the Coast Guard would ensure the appropriate NEPA environmental documentation for such actions is complete prior to commencement of these activities rather than in this EIS.

4.13.5.4 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 680 cargoes, with volumes ranging from 60,000 to 125,000 m^3, have been delivered into the Port of Boston without incident. During 2005, a total of 631billion cubic feet (241 cargoes) of LNG was imported into the U.S. For 35 years, LNG shipping operations have been safely conducted in the U.S. The world's LNG ship fleet currently exceeds 173 carriers.

Over the last 45 years, LNG ships have made over 44,000 voyages. 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.

<u>History</u>

During the 44,000 voyages that have been completed since the inception of LNG maritime transportation, there has not been a serious accident at sea or in a port which resulted in spills due to rupturing of the

cargo tanks. However, insurance records, industry sources, and public websites identify a number of incidents involving LNG vessels, including minor collisions with other vessels of all sizes, groundings, minor LNG releases during cargo unloading operations, and mechanical/equipment failures typical of large vessels. Some of the more significant LNG vessel 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.

- ***El Paso Paul Kayser*** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the U.S. 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 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.

- ***Mostefa Ben Boulaid*** had LNG spill onto its deck during loading operations in Algeria in 2002. The spill, which is believed to have been caused by overflow rather than a mechanical failure, caused significant brittle fracturing of the steelwork. The ship was required to discharge its cargo, after which it proceeded to dock for repair.

- ***Khannur*** had a cargo tank overfill into the ship's vapor handling system on September 10, 2001 during unloading at Everett, Massachusetts. Approximately 100 gallons of LNG were vented and sprayed onto the protective decking over the cargo tank dome, resulting in several cracks. After re inspection by the Coast Guard, the Khannur was allowed to discharge its LNG cargo.

- ***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 cubic meter 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.

- ***Tenaga Lima*** grounded on rocks while proceeding to open sea east of Mopko, South Korea due to strong current in November 2004. The shell plating was torn open and fractured over an approximate area of 20 feet by 80 feet, and internal breaches allowed water to enter the insulation space between the primary and secondary membranes. The ship was refloated, repaired and returned to service.

- ***Golar Freeze*** moved away from its docking berth during unloading on March 14, 2006 in Savannah, Georgia. The powered emergency release couplings on the unloading arms activated as designed and transfer operations were shutdown.

Ship 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 LNG carriers 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 Part 154 were being developed. LNG carriers used in the U.S. waters must also be constructed in accordance with the IMO Code for the Construction and Equipment 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 the 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 CO2 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 the inner and outer hulls of an LNG ship. An earlier Federal Power Commission (FPC, 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 FPC study estimated the additional protection afforded by the double-hull would be effective in low energy collisions, and 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 4.13.5-3** for the two principal cargo systems.

TABLE 4.13.5-3

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 on-beam 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.

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 Sandia 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, collisions with small vessels and low speed (less than 7 knots) collisions with large vessels striking at 90 degrees could cause minor ship damage but would not result in a cargo spill. This is due to the protection provided by the double hull structure, the insulation layer, and the primary cargo tank of an LNG vessel. High speed (12 knots) collisions with large vessels striking at 90 degrees were found to potentially cause cargo tank breach areas of 0.5 to 1.5 square meters.

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 either case, an LNG spill would rapidly vaporize from contact with 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, Louisiana) (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-ft2 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 U.S. Department of Energy 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/ft2-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.

Since the 2001 Quest study, 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/ft2-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, FERC commissioned a study by ABSG 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. In addition, the model was updated to include a lower limit on the characteristic wind speed. The revised study provides the methodology 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 under 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 average most probable "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.

The December 2004 Sandia 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 square meters 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 square meters. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 square meters, 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 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 or 6,300 to 6,825 feet), but would increase the expected fire duration. Rapid phase transitions (RPTs) 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 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 typical 140,000 cubic meter LNG ship, a potential spill of 23,000 cubic meters is estimated for the volume of LNG above the waterline. The estimated pool spread results and thermal radiation hazard distances are identified in **table 4.13.5-4**. Thermal radiation calculations are based on an ambient temperature of 50ºF, a relative humidity of 50 percent, and a 20 mile per hour wind speed.

However, Sempra proposes the potential use of up to a 250,000 cubic meter LNG ship. The limited information available regarding the design of future 250,000 cubic meter LNG ships suggests that the draft of the larger ships would remain the same due to the limited draft of the channel, while the length and width of the larger ships would increase. This would in effect increase the length and width of the cargo tanks, but not change the height, therefore no change the hydrostatic head. Preliminary information shows that the larger class ships would have five cargo tanks instead of four as on the 140,000 cubic meter ships. For a 250,000 cubic meter LNG ship compared to the results for a 140,000 cubic meter LNG ship, the estimated distance to the 1,600 Btu/ft^2-hr zone would be less than 5 percent farther and the fire duration would be extended by about 39 percent.

TABLE 4.13.5-4 LNG Spills on Water					
LNG Release and Spread					
Hole Diameter	1.0 m	1.4 m	2.5 m	3.0 m	3.9 m
Hole Area	0.8 m^2	1.5 m^2	5 m^2	7 m^2	12 m^2
Spill Time	94.0 min	48.0 min	15.0 min	10.4 min	6.2 min
Pool Fire Calculations					
Maximum Pool Radius	341 ft	476 ft	817 ft	938 ft	1,102 ft
Fire Duration	94.1 min	48.1 min	15.2 min	10.7 min	6.5 min
Distance to:					
1,600 BTU/ft2-hr	2,164 ft	2,790 ft	4,182 ft	4,652 ft	5,250 ft
3,000 BTU/ft2-hr	1,690 ft	2,169 ft	3,232 ft	3,591 ft	4,047 ft
10,000 BTU/ft2-hr	1,031 ft	1,312 ft	1,934 ft	2,143 ft	2,409 ft

Although Sempra would design the terminal and unloading berth for LNG ships with capacities up to 250,000 m^3, detailed dimensions of these future ships and the associated cargo tanks is unavailable. FERC staff was required to make assumptions in order to analyze the LNG spills on water from these larger ships. Therefore, in order to allow the Coast Guard to determine the continued suitability of the waterway for LNG marine traffic, **we recommend that:**

- **<u>Prior to accepting</u> ships greater than 140,000 m^3 in capacity, Sempra should provide the necessary information to demonstrate that the transient hazard areas identified in the final EIS are applicable. Sempra should file this information with the Secretary for review and written approval of the Director of OEP. This information should also be provided to the Coast Guard**.

Flammable vapor dispersion calculations were based on an ambient temperature of 70°F, 50 percent relative humidity, a 4.5-mile-per-hour 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 9,776 feet to the lower flammability limit and 14,377 feet to one half the lower flammability limit. 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.

The LNG ship would transit primarily in offshore waters with the exception of approximately 8.8 miles from the Sabine-Neches Waterway through the Sabine Pass and Port Arthur Channels. The LNG vessel would transit the channel at a speed of 5 to 7 knots, resulting in the adjacent communities located within the 4,652-foot distance to the 1,600 Btu/ft^2-hr thermal radiation level for a nominal 3-meter diameter hole to be exposed to a potential transient thermal hazard for less than 18 minutes. Located within 4,652 feet of the Sabine Pass and Port Arthur Channels are the low density permanent and vacation residences in the communities of Sabine, Sabine Pass, and Pleasure Island, Texas. The communities are actually a part of

the City of Port Arthur and population and housing data is not published for those communities separately. The population has been historically less than 1,000 persons per square mile and the housing units are primarily low density permanent and vacation residences. Moreover, Hurricane Rita in September 2005 caused extensive damage to structures in the area, which has further diminished housing and population. Nonetheless, the communities devastated by the storm are anticipated to rebuild to original levels. Additionally, outdoor public use areas within 4,652 feet include the Texas Point National Wildlife Reserve, Sabine Pass lighthouse, the Sabine Pass Battleground State Historic Park, Walter Umphrey State Park, J.D. Murphree WMA, and public boat ramps in Sabine Pass and Pleasure Island. In addition, a temporary hazard would exist around the slip during part of the 10- to 12-hour period while the LNG vessel is at the dock and unloading cargo.

In addition, the potential impact on the infrastructure and industrial development was also evaluated. A thermal radiation level of 10,000 Btu/ft^2-hr is associated with potential damage to equipment and infrastructure. A fire associated with a potential spill resulting from a nominal cargo tank hole of an intentional event could expose the following infrastructure and industry within approximately 2,143 feet to a thermal radiation level of 10,000 Btu/ft^2-hr for 10 to 15 minutes: the Sabine Pass LNG, L.P. terminal currently under construction in Louisiana and the Golden Pass LNG terminal currently under construction in Texas. In addition, a fire associated with a potential spill in the vicinity of Sempra's dock resulting from a nominal cargo tank hole of an intentional event could expose the proposed LNG storage tanks to a thermal radiation level of 10,000 Btu/ft^2-hr for 10 to 15 minutes.

For potential spills due to an accidental breach, the residences on Pleasure Island, Texas and a portion of the residences in Sabine and Sabine Pass, Texas would be within the 2,790-foot distance to the 1,600 Btu/ft^2-hr transient hazard area. In addition, the commercial and industrial facilities along the channel in Sabine and Sabine Pass would also be within the 1,600 Btu/ft^2-hr transient hazard area.

The operational restrictions to be imposed by the Sabine Pass Pilots on LNG vessel movements through the Sabine Pass and Port Arthur Channels, as well as the requirements that the Coast Guard would impose in its operating plan would minimize the possibility of a hazardous event occurring along the vessel transit.

By focusing on the "worst case" intentional breach scenarios 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 ensured 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 "worst case" intentional breach scenarios should not be misconstrued as defining an exclusionary zone. Rather the average most probable "worst case" scenarios provide guidance in developing the operating restrictions for LNG vessel movements in the Sabine Pass and Port Arthur Channels, as well as in establishing potential impact areas for emergency response and evacuation planning.

4.13.5.5 Conclusions on Marine Traffic Safety

The operational safety of LNG ships is under the jurisdiction of the Coast Guard. LNG ships have safely transited the nearby 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 Sabine Pass Pilots would minimize the potential for a hazardous event occurring in the Sabine Pass or Port Arthur Channels and affecting the safety of the nearby public.

The additional LNG vessel traffic should have only a minimal impact on other vessel traffic in the Sabine Pass and Port Arthur Channels. Further, Sempra's commitment for a minimum of three 70-ton bollard pull tractor tugs would provide safe transit, maneuvering, and berthing for the LNG ships, and reduce vessel delays. With the mitigation measures discussed above, 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.

4.13.6 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 the Coast Guard regulations in 33 CFR Part 127. Requirements for maintaining security of the marine terminal are in 33 CFR Part 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 U.S. The FERC continues to coordinate with theses 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 6 months that responds to the five threat levels defined by the Office of Homeland Security. 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 Maritime Transportation Security Act of 2002: Implementation of National Maritime Security Initiatives; Area Maritime Security; Vessel Security; Facility Security; Outer 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, terminal owners or operators subject to 33 CFR Part 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 Facility Security Officer 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 Maritime Security (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 3 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 U.S. 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 Sempra Port Arthur LNG 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 by the threat of any such unpredictable acts.

4.13.7 Pipeline Facilities

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 1,000ºF 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.

4.13.7.1 Safety Standards

The DOT is mandated to provide pipeline safety under Title 49, U.S.C. Chapter 601. The PHMSA, 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 PHMSA 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 Golden Pass LNG Terminal and Pipeline Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 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 on at least 5 days a week for 10 weeks in any 12-month period.

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. 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 routes would be in Class 2 locations, with some Class 3 pipe where required. No portions of the pipeline routes would be in Class 4 areas.

If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location for the pipeline, Sempra would be required to reduce the maximum allowable operating pressure 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 passed an act to strengthen the Nation's 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 §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 Federal Register 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 §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 U.S.C. 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

- The HCAs may be defined in one of two ways. In the first method an HCA includes:
- current class 3 and 4 locations,

- any area in Class 1 or 2 where the potential impact radius[17] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle[18], or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.[19]

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 § 192.911.

The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every 7 years.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. 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. Golden Pass 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.

[17] The potential impact radius is calculated as the product of 0.69 and the square root of the maximum allowable operating pressure of the pipeline in psi multiplied by the pipeline diameter in inches.

[18] The potential impact circle is a circle of radius equal to the potential impact radius.

[19] 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 5 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.

4.13.7.2 Pipeline Accident Data

Since February 9, 1970, 49 CFR Part 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 4.13.7-1** presents a summary of incident data for the 1970 to 1984 period, as well as more recent incident data for 1986 through 2003, 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.[20]

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 4.13.7-1** 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; weather effects such as winds, storms, and thermal strains; and willful damage. **Table 4.13.7-2** 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

[20] 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.

location of pipes, cables, and culverts. The 1986 through 2003 data show that the portion of incidents caused by outside forces has decreased to 38.4 percent.

TABLE 4.13.7-1

Natural Gas Service Incidents by Cause

Cause	Incidents per 1,000 miles of Pipeline (percentage) 1970-1984	1986-2003
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

TABLE 4.13.7-2

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 4.13.7-1** 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 4.13.7-3 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 4.13.7-3 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

4.13.7.3 Impact on Public Safety

The service incident data summarized in **table 4.13.7-1** 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 4.13.7-4 presents the average annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 2003. 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 2003 decreased to 3.8 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 2.9 fatalities per year for this period.

TABLE 4.13.7-4 Annual Average Fatalities - Natural Gas Transmission and Gathering Systems [(a),(b)]			
Year	**Employees**	**Nonemployees**	**Total**
1970-June 1984	2.4	2.6	5.0
1984-2003[(c)]	-	-	3.8
1984-2003[(c)]	-	-	2.9[(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 7 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 4.13.7-5** 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 of 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, tornados, floods, earthquakes, etc.

TABLE 4.13.7-5

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 (1978-87 average) [b]	27
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 U.S. 118th Edition."
[b] U.S. Department of Transportation, "Annual Report on Pipeline Safety - Calendar Year 1987."
[c] American Gas Association, 1986.

The available data show that natural gas pipelines continue to be a safe, reliable means of energy transportation. Based on approximately 306,000 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 Sempra Port Arthur LNG Project might result in a public fatality every 1,430 years. This would represent a slight increase in risk to the nearby public.

4.13.8 Conclusions on Safety Issues

Much of the recent safety debate has centered on the perceived size of worst case scenarios; the distance to various thermal radiation heat levels for LNG fires; the range of potentially flammable vapors; and the population and infrastructure that are located within the various hazard areas. These are components of a consequence analysis.

However, the evaluation of safety is more than an exercise in calculating the consequences of worst case scenarios. Rather, safety is a determination of the acceptability of risk which considers: (1) the probability of events; (2) the effect of mitigation; and (3) the consequences of events.

Accidental Causes - Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should be considered negligible.

Intentional Attacks - Unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG vessel or onshore storage facility. For a new LNG import terminal proposal, having a large volume of energy transported and stored near populated areas, the perceived threat of a terrorist attack may be considered as highly probable to the local population.

However, at the national level, potential terrorist targets are plentiful, many having national significance, while others with a large concentration of the public (major sporting events, skyscrapers, etc.) or critical infrastructure facilities. Currently, the U.S. has over 500 chemical facilities operating near large populations. U.S. waterways also transport over 100,000 annual shipments of hazardous marine cargo, including LPG, ammonia, and other volatile chemicals. Many of these substances pose a similar hazard to that of LNG.

Risk Management - While the risks associated with the transportation of any hazardous cargo can never be entirely eliminated, they can be managed. For potential targets where the threat is perceived to be high, resources can be directed to mitigate possible attack paths. Such efforts may deter potential attacks on one target, but shift efforts to those that are less protected. As a result, the issue is how to best direct finite resources.

For the proposed project, it may be possible to apply risk management resources to manage realistic threats; however, an even greater level of resources may be required to manage the threats as perceived at the local level. The issue for the decision makers is whether the resources required to manage the risks are justified by the benefits, while recognizing that the risks cannot be entirely eliminated.