ENVIRONMENTAL IMPACT ANALYSIS

SECTION 4

4.0 ENVIRONMENTAL IMPACT ANALYSIS

The environmental consequence of constructing and operating the Terminal Expansion and Pipeline Expansion facilities would vary in duration and significance. Four levels of impact duration were considered: temporary, short-term, long-term, and permanent. A temporary impact would generally occur during construction, with the resource returning to preconstruction conditions almost immediately afterward. A short-term impact could continue for up to 3 years following construction. An 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 an 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 and operational impact of an LNG storage tank or a compressor station. We considered an impact to be significant if it would result in a substantial beneficial or adverse change in the physical environment and the relationship of people with the environment.

In this section, we discuss the affected environment, general construction and operational impacts, and proposed mitigation measures for each resource. We also discuss the design and construction of the facility to resist natural hazards. Cameron LNG and Cameron Interstate, as part of their proposals, agreed to implement certain measures to reduce impacts on environmental resources. We evaluated the proposed mitigation measures to determine whether additional measures would be necessary to reduce impacts. Where we identified the need for additional mitigation, the 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 Cameron LNG and Cameron Interstate. Conclusions in this EIS are based on our analysis of the environmental impact and the following assumptions:

- Cameron LNG and Cameron Interstate would comply with all applicable federal laws and regulations;
- the proposed facilities would be constructed as described in section 2.0 of this document; and
- Cameron LNG and Cameron Interstate would implement the mitigation measures included in the applications and supplemental filings to the FERC.

4.1 GEOLOGIC CONDITIONS, RESOURCES, AND HAZARDS

4.1.1 Geologic Setting

The proposed Project lies within the Gulf Coastal Plain geomorphic province and is immediately underlain by sediments deposited during the Holocene and Pleistocene epochs of the Quaternary period. In Cameron, Beauregard, and Calcasieu Parishes, these sediments are underlain by southward-dipping sedimentary rocks of pre-Pleistocene Cenozoic age that are present in surficial outcrops in Texas and northern Louisiana.

4.1.1.1 Terminal Expansion

The site is gently sloping with existing grade elevations ranging between 2 and 22 feet above current mean sea level (MSL). Much of the Project site is covered with dredge soil material from historic maintenance dredging of the Calcasieu Ship Channel conducted by the

COE. Additional excavated materials were placed on the property during construction of the existing Cameron LNG Terminal. Figure 4.1-1 is a detailed geologic map of the area in the vicinity of the terminal expansion.

Geotechnical investigations indicate that the subsurface sediments immediately underlying the proposed site consist of a 2- to 8-foot-thick layer of dredged and man-made fill material (Fugro 2012b). Below that depth, there is a 70- to 80-foot-deep layer of very soft to stiff cohesive soils and loose to medium-dense cohesionless soils over layers of stiff to very stiff Pleistocene-aged cohesive deposits that extend to a depth of about 200 feet (Fugro 2012b). The geotechnical studies suggest that bedrock is not present at the site. Therefore, Cameron LNG would not conduct blasting during construction.

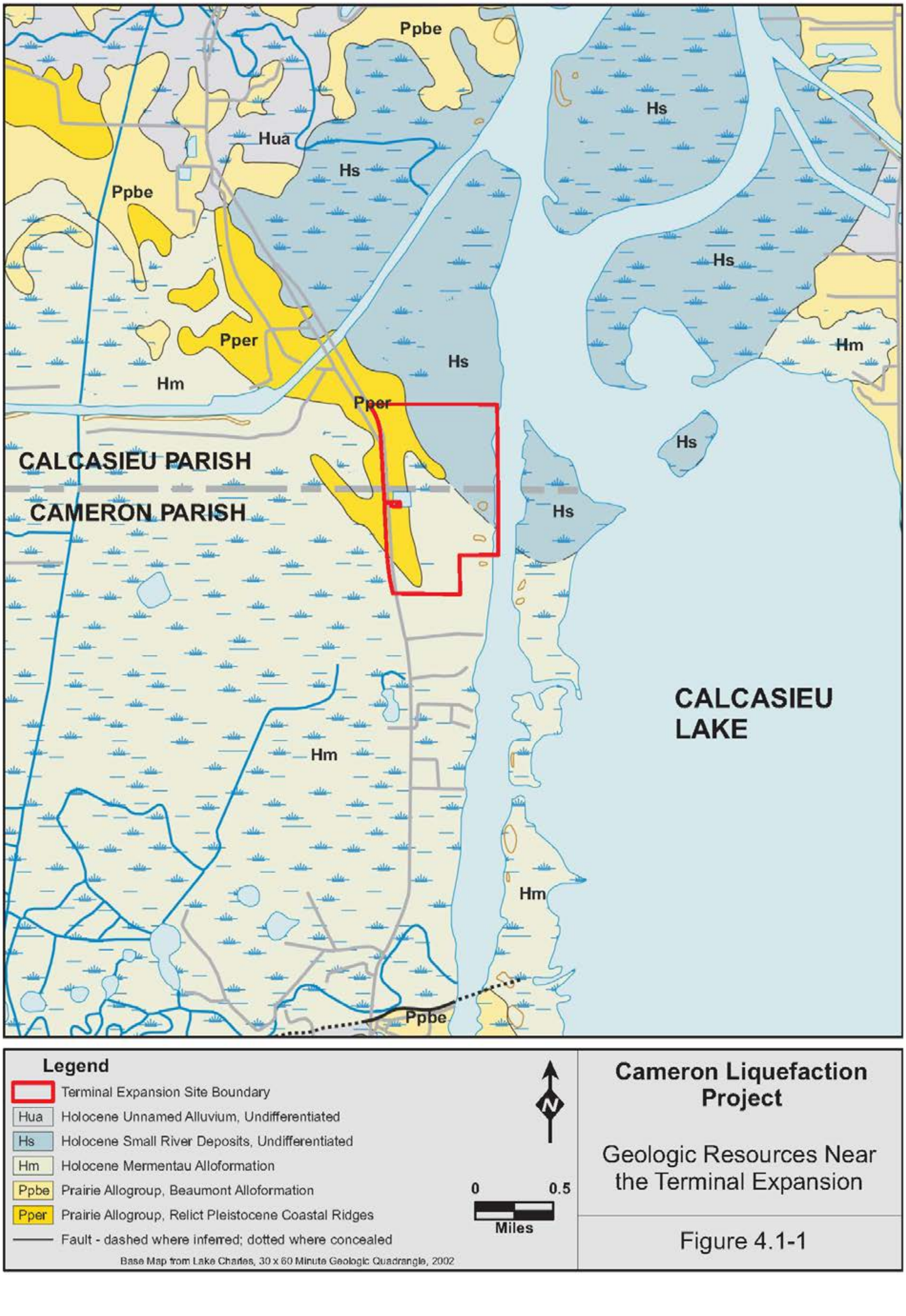
Cameron LNG would clear, grade, and fill the Terminal Expansion site to the extent necessary to install the liquefaction facilities on a level platform with sufficient space to execute the work safely. The final grade elevations would be above predicted hurricane storm surge elevations, based on Federal Emergency Management Agency (FEMA) and COE data, and sloped as necessary to provide for site drainage. Cameron LNG would use on-site materials as structural backfill, to the extent permitted by the engineering specifications, and use clean imported fill to supplement the onsite materials. Final grade surfacing and landscape would consist of gravel, asphalt, concrete, topsoil, and grass surface areas. Cameron LNG would drive precast concrete piles to support all key terminal expansion components and structures. These key components and structures include the LNG storage tanks, liquefaction trains, combustion turbine shelters, machinery structures and interconnecting pipe racks, structures, and sleepers.

4.1.1.2 Pipeline Expansion

The southern portion of the proposed pipeline route lies predominantly within sediments of the late Pleistocene Beaumont Formation in the extensive Gulf Coast geomorphic province. To the northeast, the route extends predominantly through sediments of the early Pleistocene Lissie Allo formation, and the terrain consists of gently rolling hills underlain by interbedded sand, gravelly sand, sandy gravel, and gravel rich fluvial deposits. The relief of the pipeline route ranges from 5 feet to approximately 65 feet above MSL.

Geotechnical investigations indicate that the subsurface sediments underlying the proposed route consist of silt and clayey silt over moderate to highly plastic cohesive soils consisting of silty clay (firm to stiff) (Fugro 2007). Below that level are layers of noncohesive soils containing sandy silt and sandy clay from 8 to 25 feet below the ground surface (Fugro 2012b). Bedrock does not occur near the surface; therefore, Cameron Interstate would not conduct blasting.

Cameron Interstate committed to conducting geotechnical studies to determine general subsurface conditions and to evaluate the potential for settlement at the Holbrook Compressor Station site.   Further, Cameron Interstate would develop engineering designs to avoid or minimize any geotechnical hazards, such as settlement, at the site. That work would consist of development and implementation of a subsurface exploration program and a laboratory testing program. In general, we believe these methods would identify the geotechnical conditions at the site, including settlement potential, and provide the basis for developing mitigation measures to limit settlement impacts on the Holbrook Compressor Station.



Ppbe
Hua
Hs
Ppbe
Hs
Hs
Pper
Hs
Hm
Hm
Pper
Hs
CALCASIEU PARISH
CAMERON PARISH
Hs
CALCASIEU
LAKE
Hm
Hm
Ppbe
Legend
Terminal Expansion Site Boundary
Hua Holocene Unnamed Alluvium, Undifferentiated
Hs Holocene Small River Deposits, Undifferentiated
Hm Holocene Mermentau Alloformation
Ppbe Prairie Allogroup, Beaumont Alloformation
Pper Prairie Allogroup, Relict Pleistocene Coastal Ridges
Fault - dashed where inferred; dotted where concealed
Base Map from Lake Charles, 30 x 60 Minute Geologic Quadrangle, 2002
N
0
0.5
Miles
Cameron Liquefaction Project
Geologic Resources Near the Terminal Expansion

Figure 4.1-1

4.1.2 Mineral Resources

4.1.2.1 Terminal Expansion

Except for oil and gas, the only known potentially economic mineral resource in the general vicinity of the Terminal Expansion is salt. However, no mineral resources considered to be potentially exploitable are known to occur within the Terminal Expansion and no known mining resources exist within a 1-mile radius of the proposed site (USGS 2001).

Oil and gas exploration and production occur in the general area west of the site, in the West Hackberry Oil Field. However, construction and operation of the expanded terminal would not affect those activities. Therefore, we conclude that the Terminal Expansion would not impact mining or oil and gas exploration activities.

4.1.2.2 Pipeline Expansion

The Pipeline Expansion would not cross any identified oil or gas production areas, and is therefore unlikely to affect present or future oil or gas activities in the vicinity of the route. Potentially exploitable mineral resources that are known to occur within the general vicinity of the proposed pipeline route include salt (salt domes), construction-grade sand and gravel, and crushed stone. However, the proposed route does not cross historic, current, or proposed mining areas; therefore, we believe construction of the pipeline would not affect mining activities.

4.1.3 Geologic Hazards

Geologic hazards are defined by the American Geological Institute as "geologic conditions or phenomena that present a risk or are a potential danger to life and property, either naturally occurring or man-made" (Bates and Jackson 1984). Potential geologic hazards in the vicinity of the Project include seismic ground shaking, fault offsets, soil liquefaction, slope failures/landslides, tsunamis, erosion, flooding, and ground subsidence. Neither volcanism nor karst topography occurs within the vicinity of the proposed Project and these geologic hazards were excluded from further consideration.

4.1.3.1 Geotechnical Site Characterization

A geotechnical investigation was performed at the site of the Terminal Expansion facility by Fugro in April and May of 2012 (Fugro 2012). The investigation consisted of 6 soil borings to depths of 115 to 200 feet and 25 cone penetration tests to depths of 50 to 120 feet, with the results presented in Fugro's August 2012 report. The site grades ranged between 2 feet and 22 feet above MSL at the boring and cone penetrometer locations.

The subsurface conditions consist of 2 to 8 feet of fill underlain by very soft to firm recently deposited cohesive soils that extend to depths ranging from 10 to 30 feet below site grade. These soils are underlain by firm-to-stiff cohesive soils and loose-to-medium dense sands to depths of 70 to 80 feet. In the areas explored between 70 and 200 feet deep, very stiff-to-hard Pleistocene clays and medium-dense to very dense sands were encountered.

The Terminal Expansion site would be cleared, graded, and filled to achieve a general site grade of 13 feet above sea level. Due to the presence of very soft normally consolidated soils, Cameron LNG would support all settlement sensitive structures on deep foundations. Lightly loaded structure or equipment insensitive to settlement may be supported on concrete pads.

Due to raising the site grade up to 11 feet, settlement of the soft soils will continue for a long time and create downdrag on piles. Therefore, piles must be designed for downdrag loads. The foundations would be supported on 14- or 18-inch-square prestressed concrete piles designed for downdrag using the pile capacity curves and the recommended factors of safety in the Fugro (2012) geotechnical report.

Cameron LNG's Terminal Expansion must be constructed to satisfy the design requirements of 49 CFR 193, NFPA 59A-2001, 2006 International Building Code, and American Society of Civil Engineer (ASCE) 7-05. For seismic design, the facility would also be designed to satisfy the requirements of NFPA 59A-2006 and ASCE 7-05.

4.1.3.2 Seismic Ground Shaking Hazards

The proposed Project is within the seismotectonic setting known as the Texas Gulf Coastal Plains region. Tertiary and Quaternary structures in the Texas Gulf Coastal Plains are related to the tectonic environment of the Gulf of Mexico passive margin. This passive margin environment is characterized by northeast-southwest-oriented horizontal principal compressive stresses, large-scale basin inward slumping of the Gulf Coastal Plains section toward the basin, and vertical crustal motions. The vertical crustal motions are associated with flexural loading of the Gulf Coastal Plains and offshore sedimentary basins, and erosion and exhumation of the Great Plains (Fugro 2012c).

Terminal Expansion

Cameron LNG indicated that there were no reported active seismogenic faults within a 125-mile radius of the proposed Terminal Expansion (Fugro 2012a). Further, Cameron LNG's geologic fault detection study of the proposed Terminal Expansion site determined that there is no likelihood of surface fault rupture at the site (Fugro 2012a).

The proposed Terminal Expansion is in an area of low seismicity. Earthquakes have occurred in Louisiana, but their occurrence has been infrequent, with most having a magnitude too low to be felt by people or to have caused serious damage to property or structures (USGS 2001).

Western Louisiana lies within an area that USGS estimates the peak ground accelerations on a rock site to be in the range of 2 to 4 percent of the acceleration of gravity (0.02 to 0.04 g) and have a 2 percent probability of being exceeded in 50 years (USGS 2010). These peak ground accelerations can be amplified by factors of two or more on soft soil sites, which are typical of those in the vicinity of the Project.

Geotechnical investigations of the Terminal Expansion site determined that the site is classified as Site Class E (soft clay soil) in accordance with the International Building Code and standard ASCE 7-05 (Fugro 2012b). Sites with soil conditions of this type experience significant amplifications of surface earthquake ground motions.

TABLE 4.1.3-1 Probability of Seismic Hazards at the Terminal Expansion [a]			
Probability/Return Period	**Peak Ground Acceleration (g)**	**Spectral Acceleration at 0.2 Second (g)**	**Spectral Acceleration at 1 Second (g)**
10 percent in 50/475 years	0.041	0.107	0.075
2 percent in 50 /2475 years	0.121	0.292	0.230

[a] From tables 7.2-1 and 7.2-2 of Fugro (2012c) Maximum Rotated Component.

The Seismic Design of the Project's Category I items, including the new LNG tank, are to be based on site-specific Safe Shutdown Earthquake (SSE) and Operating Basis Earthquake (OBE) ground motions developed by Fugro (2012c). The site specific SSE is a ground motion which has a 2 percent probability of exceedance in 50 years while the OBE has a 10 percent probability of exceedance in 50 years. The site-specific peak ground and spectral acceleration values of the SSE and OBE are provided in table 4.1.3-1.

The facility structures and systems, other than the LNG tank, are being designed to the seismic design ground motion as specified in ASCE 7-05.

Fugro (2012c) performed a site-specific Probabilistic Seismic Hazard Analysis for the Terminal Expansion to determine the ". . . location, size, and resulting shaking intensity of future earthquakes . . ." and ". . . [a] description of the distribution of future shaking that may occur at a site" based on Baker (2008). The results of the analysis are presented in table 4.1.3-1. The predicted ground accelerations are relatively low compared to other locations in the United States.

The design of the facility is currently at the Front End Engineering Design level of completion. A feasible design has been proposed, and while Cameron LNG has committed to conducting a significant amount of detailed design work, we conclude that the timing of its filing should occur prior to the stage Cameron LNG committed (i.e., prior to construction). **Therefore, we are recommending that:**

- **Cameron LNG file the following Terminal Expansion design and construction details with the Secretary:**
  - **a. LNG tank and foundation design based on the seismic design ground motions in Cameron LNG's Resource Report 13, Appendix I dated February 2013, <u>early in the design phase</u>;**
  - **b. seismic specifications used in conjunction with the procuring equipment <u>prior to the issuing of requests for quotations</u>;**
  - **c. quality control procedures that would be used for design and construction <u>early in the design phase</u>; and**
  - **d. the results of the hydrostatic load tests on the LNG storage tanks, including settlement data, <u>prior to commissioning</u>.**

These details should be stamped and sealed by the professional engineer-of-record, registered in Louisiana, responsible for the design.

Pipeline Expansion

USGS Seismic Hazard Maps that address the areas of the pipeline expansion route and the Holbrook Compressor Station indicate that for a rock site, peak ground accelerations of 2 to 4 percent of the acceleration of gravity (0.02 to 0.04 g) have a 2 percent probability of exceedance in 50 years (USGS 2010). These peak ground accelerations increase when site amplification effects are considered. However, even with this amplification, the seismic hazard risk along the proposed route is considered to be relatively low compared to other locations in the United States.

Fugro (2012a) conducted a geologic fault hazard study of the proposed pipeline route and compressor station area and determined that there is no likelihood of surface fault rupture along the route.

4.1.3.3 Soil Liquefaction

Soil liquefaction occurs when a saturated soil loses its load bearing capability through an increase in pore water pressure that results from seismic ground shaking. Saturated sandy soils with low silt and clay content are susceptible to soil liquefaction during seismic events.

Because the potential for seismic ground shaking in the vicinity of the Project is low, the probability of soil liquefaction is also low. Additionally, Cameron LNG would address possible issues associated with potential liquefaction and associated loss of strength in the fill soils by using piles in foundation design for aboveground facilities.

4.1.3.4 Landslide Incidence and Susceptibility

Landslides are defined as the movement of rock, debris, or soil down a slope (USGS 2010).The topography of the terminal expansion site and along the pipeline route is relatively flat, with very little grade change. As a result, the Project has a low risk of landslides.

4.1.3.5 Ground Subsidence

Subsidence hazards involve either the sudden collapse of the ground to form a depression or the slow subsidence or settlement of sediments near the ground's surface. Ground subsidence in the vicinity of the Project could result from natural geologic processes or from man-made processes, such as subsurface mining and removal of groundwater from aquifer systems.

Terminal Expansion

Cameron LNG determined that subsidence (settlement due to raising the site grade) relating to underlying soil settlement after facility construction would likely occur and would be addressed during facility design and construction. As a result, Cameron LNG would construct all major facilities of the terminal expansion, such as the LNG storage tank and liquefaction trains, using pile supported foundations that would eliminate the risk of soil subsidence affecting facility stability. Pile supported foundations were successfully installed for the existing Cameron

LNG Terminal. Cameron LNG would design the piles for downdrag loads due to settlement of the soils.

However, the final grade of the site and the protective earth berms are subject to settlement. The Moffat & Nichol (2013) Revised Storm Surge Update Study indicates that subsidence along the Gulf Coast occurs at rate between 0.1 and 0.2 inch per year, while sea level rise is estimated at 0.1 inch per year. The Moffat & Nichol Study recommends that the Terminal Expansion be designed for a relative sea level rise of 0.3 inch per year or 6.0 inches over the next 20 years. Cameron LNG incorporated a design allowance of 1 foot for sea level rise and subsidence in the finished grade elevations, including protective berms. Although subsidence is anticipated, we believe the Terminal Expansion design would minimize any subsidence effects during operation.

Pipeline Expansion

Limited groundwater pumping or oil and gas production occurs in the vicinity of the proposed pipeline route, and the rate of subsidence in the vicinity of the proposed Holbrook Compressor Station is low. In addition, there is no evidence of sinkholes or other indications of subsidence along the proposed pipeline route (which is parallel and adjacent to other pipelines) or at aboveground facilities. As a result, we conclude subsidence is not expected along the proposed Pipeline Expansion. Further, we are recommending that Cameron Interstate file its geotechnical studies and engineering designs for the Holbrook Compressor Station. As Cameron Interstate would design the pipeline and aboveground facilities to withstand minor subsidence, we would not expect subsidence to have an adverse effect on the Pipeline Expansion.

4.1.4 Other Hazards

4.1.4.1 Flooding/Storm Damage

A flood occurs when the water level in a stream or river channel overflows the natural or man-made bank. Storm surge and tsunamis can also cause flooding. The 100-year flood represents a river channel water level that, based on an analysis of the historic record, is likely to be equaled or exceeded every 100 years, meaning that there is a 1 percent chance that the water level will be equaled or exceeded in any individual year during a flood event. Maximum tsunami inundation elevations at the Terminal Expansion site are judged to be less than maximum storm surge elevations. Therefore, the 100-year flood is generally used for planning purposes for buildings within the river channel and adjacent floodplain to assess the likelihood of inundation of areas within the floodplain over time. Flash floods typically result from intense rapid precipitation in upstream areas that leads to extensive short-duration runoff into the stream channel.

Storm surge is a coastal phenomenon associated with low pressure weather systems, typically intense hurricanes and winter storms. The surge of ocean water inland above the high tide mark is a result of low barometric pressure combined with high winds pushing on the ocean surface causing the water to “pile up” higher than ordinary sea level. The storm surge effect is enhanced if it occurs at high tide (U.S. Air Force Reserves 2006).

Terminal Expansion

Cameron LNG considered the potential threat of storm surge associated with hurricane winds in its facility design. The 500-year return period storm surge still water level is 11.3 feet above MSL at the Terminal Expansion site (Moffat and Nichol 2012). When global sea levels rise, subsidence, and freeboard are added, the resulting design 500-year return-period storm surge elevation increases to 12.4 feet above MSL. The 100-year return-period storm-surge still-water level is 8.1 feet above MSL at the site. When global sea level rise, subsidence, and freeboard are added, the design 100-year return-period storm-surge elevation increases to 9.4 feet above MSL. The top of support for equipment in the liquefaction and common areas would be 12.5 feet above MSL, with the maximum finished grade 12.0 feet above MSL, and the minimum finished grade 11.5 feet above MSL. In the flare area, the top of support equipment would be 10.0 feet above MSL, with a finished grade of 9.5 feet above MSL. The perimeter road surrounding this area would be 9.5 feet above MSL, which is above the design 100-year return-period storm-surge elevation. Cameron LNG would install the new full-containment LNG storage tank at an elevation consistent with the existing three LNG tanks; the elevation of the top of the foundation would be 14.0 feet above MSL and the bottom of the foundation would be 11.0 feet above MSL. Cameron LNG would also extend the existing storm surge barrier around the new LNG storage tank at an elevation of 9.0 feet above MSL.

The Terminal Expansion is subject to flooding from hurricanes, tropical storms, and other weather systems. Cameron LNG's design considers a hurricane storm surge with a 500-year return period. When subsidence and the rise in sea level are considered, the resulting design elevation to be resisted is several feet greater than the 100-year base flood map elevations provided in the FEMA Flood Risk Insurance Maps.

The elevations of the existing LNG tank at the Cameron LNG Terminal are designed such that the top of the foundation is 1.6 feet higher than the 500-year storm surge elevation. Furthermore, finished grade of the Terminal Expansion would be greater than the 500-year storm surge elevation. The finished grade elevation in the flare area and the remaining general facility areas are greater than the 100-year storm surge elevation. In addition, Cameron LNG would design its Terminal Expansion in accordance with 49 CFR 193.2067. Design factors regarding wind are discussed in section 4.12.3.

Pipeline Expansion

Extreme storm events can lead to flood hazards along the proposed pipeline expansion corridor, particularly along river floodplains and in low lying areas. However, buried pipelines are rarely affected by flooding. Cameron Interstate would construct aboveground facilities, such as the modified interconnections and metering and regulating stations, above the 100-year flood level as determined by the COE and FEMA.

Flooding resulting from hurricane surge effects was evaluated by the COE in its 1979 Flood Insurance Study. Based on the COE evaluation, these surges would not have an impact on the compressor station site. However, a portion of the compressor station site is within the FEMA 100-year flood zone. Cameron Interstate would evaluate the potential for flooding at the compressor station site during detailed engineering, and would construct all building pads at elevations that are above the 100-year flood zone level to prevent flooding of equipment. As a result, we believe that the Pipeline Expansion aboveground facilities would not be affected by flooding or storm surge.

A portion of the Holbrook Compressor site would be within the 100-year flood zone and would result in an increase in impervious surfaces. As required by Executive Order 11988 (floodplain Management), we considered the potential impacts of construction of Project-related facilities in a floodplain, as well as alternatives to siting a portion of the compressor station site in a floodplain (see section 3.6.1). Cameron Interstate committed to evaluating the potential for flooding at the compressor station site during its detailed engineering and would construct all building pads at elevations that prevent flooding of equipment. As a result, the floodplain portion of the compressor station site would not be completely filled, and we conclude that use of the floodplain portion of the site would not increase flooding.

4.1.4.2 Shoreline Erosion and Localized Scour

Shoreline erosion occurs when waves, shoreline currents, and vessel wakes disturb shoreline soils and the mobilized soil is transported from the site. Irregular or changing stream channel morphology, often related to man-made structures or stream channel debris, can lead to scouring of channel bottom materials during periods of high water flow, sometimes developing deep scour holes where water vortices develop.

Terminal Expansion

Shoreline erosion could occur along the terminal expansion site and the shoreline of the Calcasieu Ship Channel due to waves, currents, and the wake of large vessels transiting the channel. Cameron LNG would retain a 150- to 200-foot-wide vegetation buffer along the shoreline from the work dock to the northern end of the Terminal Expansion. Cameron LNG would also include erosion protection measures in the design of the work dock to minimize the potential for shoreline erosion. For example, to maintain soil stability, Cameron LNG would install a sheet pile and slope protection system consisting of articulating concrete block mats, rock filled marine mattresses, and/or graded rock riprap along the shoreline.

Pipeline Expansion

Cameron Interstate would use the HDD crossing method at all perennial waterbody crossings; therefore, the pipeline would be buried below the maximum scour depth calculated to occur during the 100-year flood event. As a result, we conclude scouring would not impact the pipeline.

4.1.5 Paleontology

While fossils in Louisiana are generally rare, there have been occasional discoveries of relatively recent fossil remains of animals such as camels and mastodons. Holocene and Pleistocene marine fossil fragments are sometimes found within sedimentary units deposited in these epochs, but these fragments have little scientific value. Project facilities would not impact any older underlying geologic formations or the fossils, if any, within them.

4.2 SOILS

4.2.1 Soil Types and Limitations

Soil types that occur within the proposed Project area, as identified by the U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS) (USDA SCS 1995), and the general limitations of these soils (USDA SCS 1988), as well as potential impacts on these soils from the proposed Project, are presented in this section.

4.2.1.1 Terminal Expansion

Soils within the proposed Terminal Expansion site are aquents, udifluvents, Creole mucky clay, and Gentilly muck. Aquents are altered or disturbed soils where the original soil material has been removed, repositioned, or fill has been added. Aquent soils result from human activities and are typically associated with urban and other types of development. Udifluvents are soils that are naturally occurring near flowing waterbodies that have deposited the soils. The Creole mucky clay and Gentilly muck consist of sandy, clayey soils that are very poorly drained and very slowly permeable. Cohesive and cohesionless soils are present in the upper 2 to 8 feet at the Terminal Expansion site, with recently deposited very soft to firm, cohesive soils below that to depths generally ranging from about 10 to 30 feet below grade. These soils were underlain by alternating strata of firm to stiff, cohesive soils and loose to medium-dense cohesionless soils to a depth of about 70 to 80 feet below grade. Soil limitations identified at the Terminal Expansion site include moderate water and wind erosion potential, hydric soils, and low to moderate revegetation potential. The erosion potential of soils is reduced by the generally level topography of the site.

Most areas on the Terminal Expansion site where aquent soils occur are former marshlands, where materials from COE maintenance dredging of the Calcasieu Channel were deposited. These soils consist of course sands to clays, sometimes with stratified layers of varying thickness. Construction of the Terminal Expansion would impact approximately 318.0 acres of udifluvent soils, 68.4 acres of aquents, 48.9 acres of Creole mucky clay, and 2.9 acres of Gentilly muck (the remaining 64.0 acres of the 502.2-acre site is open water).[26]

To minimize impacts on soils, Cameron LNG would construct and restore the Terminal Expansion in accordance with the FERC Plan, which includes erosion control and sedimentation control measures, and provisions for restoration and revegetation. We believe that adherence to the FERC Plan would minimize erosion during construction.

As a part of construction of the Terminal Expansion, Cameron would dredge about 205,000 yd^3 from the berthing area for the work dock. The dredged sediments would be disposed of under Cameron LNG's existing CUP on land located west of the Terminal Expansion site and owned and operated by Cameron LNG. Cameron LNG would pipe dredge spoil to this permitted area and convert an open water area to tidally influenced marsh as described in section 4.4.4.

[26] The area of open water stated in this section does not match that of other sections because portions of the on-site ponds are periodically dry and the soils of those dry areas are included in the areas listed for soil types. The open water area includes the berthing area for the work dock.

4.2.1.2 Pipeline Expansion

Soils within the proposed compressor station site consist of Glenmora silt loam, Guyton silt loam, and Brimstone silt loam. Soil limitations identified at the compressor station site include a moderate water and wind erosion potential, low to moderate shrink/swell potential, and slight to moderate revegetation potential. The proposed pipeline route crosses a variety of soils, as listed in Appendix E. Soil limitations along the proposed pipeline route vary widely, including areas of moderate water erosion potential; moderate to high wind erodibility potential; low, moderate, and high shrink/swell potential; and low to moderate revegetation potential (see Appendix E). To minimize impacts on soils, Cameron Interstate would construct and restore the Pipeline Expansion in accordance with the Cameron Interstate Plan, which includes provisions for erosion control, restoration, revegetation, and special construction techniques for saturated soils and agricultural areas. We believe adherence to the Cameron Interstate Plan would minimize erosion during construction.

4.2.2 Prime Farmland Soils

Prime farmland soils have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops (USDA Natural Resource Conservation Service [NRCS] 2012a). In general, prime farmland soils experience adequate and dependable precipitation, a favorable temperature and growing season, have acceptable acidity or alkalinity, and have few or no surface stones. They are permeable to water and air. Prime farmland soils are not excessively erodible or saturated with water for long periods of time.

4.2.2.1 Terminal Expansion

There are no prime farmland soils on the Terminal Expansion site. Therefore, there would be no impacts on prime farmland soils in this area.

4.2.2.2 Pipeline Expansion

Approximately 15 miles of the proposed pipeline route (72 percent) contains prime farmland soils. Construction of the pipeline would impact about 182.0 acres of prime farmland soils, and operation would impact about 31.0 acres of prime farmland. Construction and operation of the compressor station would permanently impact approximately 14.8 acres of prime farmland soil. These soils are currently in silviculture use and would be permanently removed from agricultural use.

Most impacts on prime farmland soils from construction of the pipeline would be short-term and would not affect the potential use of prime farmland for future agricultural purposes. Cameron Interstate would implement the measures in its Plan during construction and restoration, including topsoil segregation, temporary erosion controls such as silt fence, staked hay or straw bales, and sand bags, as necessary, soil decompaction, and revegetation. We believe implementation of Cameron Interstate's Plan would minimize potential impacts on prime farmland soils and restore the areas along the proposed route to preconstruction conditions. Although construction and operation of the Holbrook Compressor Station would result in permanent impacts to about 14.8 acres of prime farmland soil, we do not believe that this would be a significant impact on prime farmland soils in the area.

4.2.3 Hydric Soils

Hydric soils are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA NRCS 2012b). These soils are typically associated with wetlands. Soils that are artificially drained or protected from flooding (for example, by levees) are still considered hydric if the soil in its undisturbed state would meet the definition of a hydric soil.

4.2.3.1 Terminal Expansion

The aquent and udifluvent soils present on the Terminal Expansion site are categorized as hydric soils due to their high water content. The 68.4 acres of aquent soils that would be disturbed by construction of the Terminal Expansion were previously disturbed during dredging of the Calcasieu Ship Channel. Of the 318.0 acres of udifluvent soils that would be disturbed by construction, about 57.0 acres were previously disturbed by construction of the existing Cameron LNG Terminal. Cameron LNG would permanently affect the area of hydric soil within the Terminal Expansion site by installing the liquefaction facilities. Given the disturbed nature of these soils, we believe the conversion of 386.4 acres of hydric soils as a result of operation of the proposed liquefaction facilities would not be a significant impact.

4.2.3.2 Pipeline Expansion

The Basile and Guyton silt loams, Brimstone silt loam, Caddo-Messer silt loam, Kinder-Messer silt loam, and Mowata-Vidrine silt loams along the proposed pipeline route are classified as hydric or partially hydric soils. The proposed route extends through about 13.8 miles of hydric and partially hydric soils, resulting in an impact of about 168.0 acres of those soils during construction. If construction of the pipeline occurs when these soils are saturated, compaction and rutting could occur. Cameron Interstate would mitigate compaction impacts in residential and agricultural areas through decompaction during restoration, in accordance with its Plan. High groundwater levels that accompany hydric soils could create a buoyancy hazard for the pipeline. However, in those areas, Cameron Interstate would either coat the pipeline with concrete or use weights to provide the weight required to counteract the buoyancy. The Guyton silt loam and the Brimstone silt loam at the proposed compressor station site are classified as hydric soils (about 10.3 acres). Disturbance of these soils could also cause compaction and rutting. After construction, about 15.0 acres would be permanently disturbed for the compressor station facilities or gravel ground cover. The remaining soils at the site would be restored in accordance with Cameron Interstate's Plan. We believe implementation of Cameron Interstate's Plan during construction would minimize potential impacts on hydric soils.

4.2.4 Compaction Potential

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of the soil. The degree of soil compaction during construction is dependent on moisture content and soil texture. Fine textured soils with poor internal drainage and 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. Moist or saturated soils are more likely to compact or rut.

4.2.4.1 Terminal Expansion

Some of the soils on the proposed Terminal Expansion site are susceptible to compaction and rutting. During construction, loss of soil productivity due to compaction and damage to soil structure from heavy equipment are likely to occur. However, these areas would be developed, replaced by structures, paving, and gravel, and would not be used to support vegetation; therefore, compaction is not a concern. Cameron LNG would restore other disturbed areas in accordance with the FERC's Plan to minimize impacts from construction.

4.2.4.2 Pipeline Expansion

Due to the presence of sandy clay loam, or finer soils, with poor drainage characteristics along the proposed route, several areas have the potential to experience soil compaction. There are also several areas of silt loam soils in the proposed compressor station site that have the potential for soil compaction. As stated in Cameron Interstate's Plan, compaction would be mitigated in residential and agricultural areas crossed by the proposed pipeline and at the compressor station site. Mitigation for soil compaction would include segregating topsoil, postponing soil disturbances when soils are excessively wet, and using deep tillage operations during right-of-way restoration using a paraplow or similar implement. We believe that use of these measures during construction would minimize soil compaction resulting from construction of the proposed pipeline and compressor station.

4.2.5 Erosion

Erosion is a continuing natural process that can be accelerated by human disturbance. Factors that influence erosion potential include soil characteristics, climate, topography, vegetative cover, soil texture, surface roughness, percent slope, and length of slope. Water erosion typically occurs on loose, exposed soils with a low permeability on moderate to steep slopes. Wind erosion generally occurs in an arid climate with soils containing little vegetative growth and high wind conditions.

Clearing, grading, and equipment movement could accelerate the erosion process and, without adequate protection, result in discharge of sediment into waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility and impair revegetation rates.

4.2.5.1 Terminal Expansion

The erosion potential of soils at the liquefaction facility site is minimal due to the level nature of the site. Cameron LNG would further minimize the erosion potential of these soils by adhering to the erosion protection measures in the FERC Plan during construction and restoration of the expanded terminal. In addition, Cameron LNG would use one of the two ponds on the site as a stormwater retention pond during construction to minimize runoff and would modify its existing storm water system, as necessary, to accommodate the additional runoff from the new facilities. We believe Cameron's implementation of the FERC Plan during construction, restoration, and operation would minimize erosion.

4.2.5.2 Pipeline Expansion

Soils along the pipeline route and at the compressor station site have moderate water and erosion potentials (see Appendix E for pipeline soils). Construction would disturb soils, resulting in a temporary increase in the potential for erosion. To limit the effects of erosion, Cameron Interstate would implement the erosion control measures in its Environmental Plan (Appendix C) during construction and restoration of the pipeline right-of-way and the compressor station site. Cameron Interstate would implement and maintain these erosion and sedimentation control measures, such as silt fencing, during construction and through restoration until revegetation has occurred. Following restoration, Cameron Interstate would monitor the disturbed areas, maintain erosion control structures, and repair observed erosion. We believe implementation of these measures during construction and restoration would minimize overall soil erosion.

4.2.6 Revegetation Potential

Successful restoration and revegetation in areas that are temporarily disturbed during construction is important to maintain ecosystem productivity and to protect the underlying soils from potential damage, such as erosion.

4.2.6.1 Terminal Expansion

Although Cameron LNG would cover much of the terminal site by paving, gravel, major structures, and other Project facilities, some areas would require revegetation. Cameron LNG would implement the requirements of the FERC Plan for revegetation of disturbed areas following construction. This would include seeding disturbed areas with native vegetation as recommended by soil conservation authorities. We believe that if upland revegetation is conducted in accordance with these measures, the areas disturbed by construction would be successfully revegetated to preconstruction conditions and the impacts on soils would be minor and short-term.

4.2.6.2 Pipeline Expansion

The revegetation potential of soils along the proposed pipeline route varies from slightly poor to severely poor. Cameron Interstate would revegetate the non-cultivated portions of the construction right-of-way in accordance with its Plan and any specific landowner requests. This would include seeding disturbed areas with native vegetation as recommended by soil conservation authorities and monitoring all disturbed areas to ensure successful revegetation. We believe that if upland revegetation is conducted in accordance with these measures, areas disturbed by construction would be successfully revegetated to preconstruction conditions and impacts on soils would be minor and temporary.

Soils at the proposed Holbrook Compressor Station site have a slightly to moderately poor revegetation potential. After the facilities are installed, Cameron Interstate would final grade the site. Cameron Interstate would permanently impact about 15.3 acres of the 25.0-acre site with aboveground facilities or gravel; the remaining soils would be revegetated. We believe that implementation of Cameron Interstate's Plan would minimize impacts on soils and adequately restore these areas.

4.2.7 Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. Cameron LNG and Cameron Interstate developed spill prevention and containment procedures in their respective Environmental Plans. See Appendix C to view Cameron Interstate's Environmental Plan and access the FERC's eLibrary to view Cameron LNG's Environmental Plan[27]. These plans identify cleanup procedures to be implemented in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents. We evaluated these procedures and believe their implementation would avoid or minimize soil contamination during construction and operation of the Project.

4.2.7.1 Terminal Expansion

Cameron LNG stated that it had not encountered contaminated soil at the existing LNG Terminal and does not anticipate any contaminated soil at the proposed site of the Terminal Expansion. If unanticipated contaminated soil is discovered within the site, Cameron LNG would follow the procedures of its Unanticipated Hazardous Waste Discovery Plan included in their Environmental Plan. We have reviewed this plan and find it adequate.

4.2.7.2 Pipeline Expansion

Contaminated soil was not encountered during construction of the pipelines that are adjacent to the proposed route, and it is not likely that past activities along the proposed right-of-way would have resulted in soil contamination. If unanticipated contaminated soil is discovered during construction of the proposed pipeline, Cameron Interstate would follow the procedures of its Unanticipated Hazardous Waste Discovery Plan included in their Environmental Plan (see Appendix C), which we have reviewed and find adequate.

4.3 WATER RESOURCES

4.3.1 Groundwater

4.3.1.1 Existing Groundwater Resources

The proposed Project is in the Gulf Coastal Plain Physiographic Province and is underlain by the upper portion of the Coastal Lowlands Aquifer System, known locally as the Chicot Aquifer. The Chicot Aquifer is the principal source of groundwater in the Project area for municipal, industrial, agricultural, and domestic use (USGS 1998).

The Chicot Aquifer consists of a complex series of unconsolidated or poorly consolidated wedges of discontinuous beds of sand, silt, and clay. In southeastern Louisiana, the aquifer consists of three separate hydrologic units referred to as the 200-foot sand, the 500-foot sand, and the 700-foot sand, based on the average depths at which these units are encountered (USGS 1998). The 200-foot sand ranges from 50 to 100 feet thick and has the highest water quality of the three aquifer layers and is primarily used for domestic purposes. The 500-foot sand ranges from 170 feet to 200 feet thick and is the most heavily used layer of the Chicot Aquifer, which is used primarily as a source of industrial and public water supply. The 700-foot sand ranges from

[27] The Cameron LNG Environmental Plan can be viewed on FERC's eLibrary under Docket No. CP13-25-000 (Accession No: 20121207-5141) with Cameron LNG's Application.

85 to 150 feet thick and has been impacted by salt-water intrusion (USGS 2003). Recharge to the aquifer system occurs by direct infiltration of rainfall and is therefore susceptible to surficial contamination.

The Project area is also underlain by shallow, discontinuous, surficial aquifers, which consist mainly of alternating deposits of clays, silts, and sands. Surficial groundwater depths range from 2 to 10 feet, depending on local geologic conditions.

Public and Private Water Supply Wells and Springs

The Chicot Aquifer System has been designated by EPA as a sole-source aquifer (53 CFR 20893). EPA defines a sole- or principal-source aquifer as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas have no alternative drinking water sources that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water.

The proposed site of the Terminal Expansion is not within an "Area of Groundwater Concern" or "Critical Area of Groundwater Concern" (LDEQ 2013).

Public and private water supply wells in the vicinity of the Terminal Expansion were identified from the LDNR Strategic Online Natural Resources Information System database (LDNR 2012). A total of five wells are on or adjacent to the proposed Terminal Expansion site, three of which are on either the existing Cameron LNG Terminal property or the proposed Terminal Expansion site. Two of the wells were drilled for construction of the existing terminal. One of those wells remains active and Cameron LNG would use it during construction of the Terminal Expansion. The second well was plugged and abandoned. The third well, which is within the proposed site of the Terminal Expansion, is an inactive domestic water supply well.

The two remaining wells near the proposed Terminal Expansion site are not within 150 feet of the proposed construction area. One of these wells, owned by Cameron Parish Waterworks District 10, was issued for public water supply. On December 10, 2012 Cameron LNG met with representatives from Cameron Parish Waterworks District 10 to discuss the Terminal Expansion. The Cameron Parish Waterworks District 10 board of directors reviewed the Terminal Expansion and was satisfied with the proposed layout and proximity to the well. The board of directors also stated that they are satisfied with the proposed steps Cameron LNG would implement should groundwater contamination occur as a result of construction, including provision of an alternative water source, if needed.

Two registered water supply wells are within 150 feet of the construction area of the proposed Pipeline Expansion, but are listed as plugged and abandoned (LDNR 2012). No public water supply wells, wellhead protection areas, or springs are within 150 feet of the proposed Pipeline Expansion.

4.3.1.2 Groundwater Impacts and Mitigation

Impacts on groundwater resources could result from construction and operation of the proposed Project. These potential impacts are discussed below.

Terminal Expansion

Cameron LNG would drive pilings for any structures imposing a significant foundation load, including the LNG storage tank and the work dock, to depths ranging from 95 feet to 110 feet. Pilings could create conduits for contaminants to potentially impact surficial groundwater, but would not likely intrude into the shallowest aquifer (200-foot sand). Pilings would be confined to the surficial layers of the aquifer system. The dense surficial clays that confine the 200-foot sand layer of the aquifer would prevent movement into and contamination of the aquifer. Therefore, installation of pilings during construction would have little or no impact on groundwater.

Cameron LNG would dredge about 205,000 yd^3 of material for the proposed work dock to accommodate barges. This would increase the water depth from about 3.5 feet to about 15 feet below MSL. The proposed depth is shallower than the depth of the existing LNG carrier turning basin and berthing area. No known effects on groundwater occurred from initial and maintenance dredging of those areas, thus we do not anticipate any groundwater impacts as a result of dredging for the work dock area.

Impacts on groundwater resources could occur due to an accidental spill, leak, or other release of a hazardous substance during construction or operation of the expanded terminal. The Cameron LNG Environmental Plan includes the FERC Plan and Procedures as well as specific spill prevention and response procedures for construction activities. In addition, Cameron LNG would update its existing SPCC Plan to include the expanded terminal operations. The SPCC Plan includes actions Cameron LNG would take to avoid or minimize impacts on groundwater and other resources if a release occurs.

The soils between the Chicot Aquifer and surficial aquifers have a low permeability and if a hazardous substance is released, it may not reach the 200-foot sand portion of the aquifer. In addition, with implementation of spill prevention and mitigation measures during construction and operation, it is not likely that an accidental release of hazardous substances would result in a significant impact on groundwater resources. If contaminated groundwater is encountered during construction, Cameron LNG would discontinue activities associated with the contaminated water and investigate the source of contamination. If activities associated with construction are shown to be the source of contamination, Cameron LNG would assess the level of contamination and provide an alternative water source to any wells or water sources affected, as discussed in section 4.1.1.1.

The expanded Terminal would result in conversion of 502.2 acres to industrial land, including gravel and impervious surface, in the Project area, thereby reducing groundwater infiltration (section 4.8.1). Cameron LNG would direct stormwater from the Terminal Expansion to one of the existing manmade ponds within the Terminal Expansion boundary or through existing drainage ditches (see section 4.3.2.2 for additional details on stormwater). However, this addition of impervious material is minor compared to the surrounding area where percolation is possible.

Hydrostatic testing of the new LNG storage tank and piping of the Terminal Expansion facilities would require about 45 million gallons of water. Dust generated from vehicular and equipment traffic could increase sedimentation of the Calcasieu Ship Channel. To mitigate this effect, Cameron LNG proposes to use approximately 28 million gallons of water for dust control. If an on-site concrete batch plant is used during construction, it would require an additional 560,000 gallons of water. Water would also be required for the Terminal Expansion's fire water system.

Cameron LNG would obtain all water from an existing on-site well that is capable of drawing from both the 200-foot and 500-foot sands of the Chicot Aquifer. The well would be used intermittently, with an average flow rate of about 1,280 gpm. The flow rate and estimated volume of water that Cameron LNG would use is similar to that used during construction of the existing Cameron LNG Terminal. Although groundwater levels would be temporarily impacted by the withdrawals, the estimated overall volume is a small percentage of the total volume removed from the aquifer for domestic and industrial uses per day and the aquifer would recharge quickly. Estimated daily withdrawal from the Chicot Aquifer for public supply, industry, irrigation, and other uses is 662 million gallons per day (Sargent 2007); total withdrawals over the course of construction of the Terminal Expansion would be approximately 73.5 million gallons. In addition, there were no known groundwater impacts from hydrostatic testing of the existing LNG storage tanks and piping. Therefore, we conclude that use of the well water during construction would not result in a significant impact on groundwater resources.

During operation of the expanded terminal, the City of Hackberry would supply water through an existing connection; therefore groundwater quantities would not be affected. Cameron LNG and the City of Hackberry would agree to water usage volumes and rates.

Through use of the measures discussed above, we believe impacts on groundwater resources at the Terminal Expansion would be minimized to the extent practicable and not significant.

Pipeline Expansion

Construction of the proposed pipeline would require trenching to a depth of about 8 feet below the ground surface. In areas where surficial groundwater is near the ground surface, trench excavation could intersect the water table, requiring trench dewatering. Trench dewatering may result in localized, minor changes to the water table, which could also impact the hydrology of nearby wetland areas. Because Cameron Interstate would complete pipeline construction at a given location within a short period of time and water would be discharged to nearby areas, potential dewatering impacts would be temporary and localized, and water table elevations would reestablish soon after the trench is backfilled. Where the trench may be continually flooded and dewatering would not be feasible, Cameron Interstate would float the pipe into place and install it using the push-pull method, as described in section 2.6.3.

Some construction activities – such as trench excavation, grading, and filling of the excavated trench – could cause minor fluctuations in shallow groundwater levels or increase turbidity within shallow groundwater adjacent to the construction activity. These impacts would be limited to the area of disturbance and are not expected to have a significant impact on groundwater quality or quantity.

Near-surface soil compaction caused by heavy construction vehicles could locally reduce the soil's ability to absorb water, which would increase surface runoff and the potential for ponding. In areas where forest and portions of wetlands are removed during construction, water infiltration normally enhanced by the vegetation would reduce locally until the area is revegetated, which could temporarily affect water recharge to deeper aquifer layers. However, Cameron Interstate's Procedures provide measures to minimize impacts on groundwater during construction of the Pipeline Expansion, including returning the ground surface as closely as practical to pre-construction contours, installing trench breakers to prevent groundwater movement or loss from nearby wetlands, decompacting the ground as necessary, and revegetating the right-of-way to ensure restoration of pre-construction overland flow and recharge patterns. As a result of incorporation of these procedures, we believe impacts on groundwater due to changes in the ground surface of the right-of-way would be minor and temporary.

Spills of construction fuels, lubricants, and other potentially hazardous substances could affect shallow groundwater and unconsolidated aquifers. Potential contamination due to accidental spills or leaks of hazardous materials associated with vehicle fueling, vehicle maintenance, and storage of construction materials presents the greatest potential threat to groundwater resources during construction. The Cameron Interstate Environmental Plan prescribes spill response procedures, mitigation measures, and hazardous substance storage and disposal procedures to minimize the potential for a spill. During operation of the Holbrook Compressor Station, Cameron Interstate would install a double-walled 2,400-gallon aboveground diesel storage tank within concrete curbing to minimize the potential for a spill. Cameron Interstate provided an SRP and its Plan to avoid or minimize impacts on groundwater and other resources if a release occurs.

Low permeability sediments between the Chicot Aquifer and surficial aquifers, combined with implementation of the Cameron Interstate Plan and Procedures during construction and the SRP during operation of the Holbrook Compressor Station, would avoid or minimize impacts on groundwater due to spills of hazardous substances.

During operation of the Holbrook Compressor Station, potable water would be supplied from a local public water system. Cameron Interstate would install an underground septic system, in accordance with local and state permits, to manage sanitary and sewage wastewater. Installation of the septic system could cause minor fluctuations or increase turbidity in shallow groundwater within the construction area, similar to trenching and pipeline installation. Seepage or other leaks from the septic system could contaminate groundwater; however, proper maintenance reduces the likelihood of seepage or other leaks. Additionally, the low permeability of sediments between the Chicot Aquifer and surficial aquifers would avoid or minimize impacts on groundwater due to seepage or leaks from the septic tank. These impacts would be limited to the area immediately adjacent to the proposed tank and we believe would not significantly impact groundwater quality or quantity in the area.

Through use of the measures discussed above, we believe Cameron Interstate would minimize impacts on groundwater along the proposed pipeline route to the extent practicable.

4.3.2 Surface Water

4.3.2.1 Existing Surface Water Resources

Terminal Expansion

The proposed Terminal Expansion is within the Lower Calcasieu Watershed, which encompasses an area of about 1,080 square miles and drains to the Lower Calcasieu River that flows to the Gulf of Mexico. The channel extends from the Louisiana coastline to the Port of Lake Charles, a distance of about 36 miles, and is used for vessel transits to and from the port. The channel, which is maintained by the COE, is approximately 40 feet deep and is a Traditional Navigable Water as defined by 33 CFR 329.

Water uses of the Calcasieu Ship Channel in the vicinity of the proposed Terminal Expansion site are designated as primary contact recreation, secondary contact recreation, fish and wildlife propagation, and oyster propagation (LDEQ 2012a). Water and sediment quality within the channel have been impacted by point and non-point sources of pollutants due to direct use of the channel, upstream land use activities and physical habitat alteration, and vessel and boat traffic. The area of the channel adjacent to and downstream of the Terminal Expansion is not included on the EPA-approved 303(d) list of impaired waters (LDEQ 2012b).

Two manmade, freshwater, ponds are present on the proposed Terminal Expansion site. One is permitted by the COE and the LDNR, Office of Coastal Management for placement of dredged material from maintenance of the turning basin in the Calcasieu Ship Channel. However, the pond has not yet been used for this purpose. Neither pond is known to contain contaminated sediments**.**

During construction of Cameron LNG's existing terminal and prior to dredging, Cameron LNG conducted an evaluation of the sediment within the Calcasieu Ship Channel. That evaluation concluded that sediments in the channel were not contaminated (CH2MHILL 2003). If requested by the COE, Cameron LNG would test for contaminated sediments prior to construction within the proposed dredge area during construction of the work dock.

No potable water intakes are within 3 miles downstream of the Terminal Expansion site.

Pipeline Expansion

The proposed pipeline route crosses the West Fork Calcasieu and Upper Calcasieu Watersheds. The Pipeline Expansion would require 29 crossings of 28 waterbodies (one waterbody would be crossed twice); including 4 perennial streams, 7 intermittent streams, 16 ephemeral streams, and 1 pond (see Appendix F for stream details). Perennial streams are defined as waterbodies that hold water continually throughout the year. Intermittent streams have well defined stream banks, but lack the hydrological characteristics associated with perennial streams. These streams hold water during wet or seasonal portions of the year and do not flow continuously. Ephemeral streams are not always well defined and hold water only during and immediately after rain events.

The FERC classifies surface waters based on size: major waterbodies are greater than 100 feet wide, intermediate waterbodies are greater than 10 feet wide but less than or equal to 100 feet wide, and minor waterbodies are less than or equal to 10 feet wide. Two of the waterbodies crossed by the proposed pipeline are major waterbodies, the Houston River at MP 1.8 and Hickory Branch at MP 10.3.

The proposed route would not cross any waterbodies within 3 miles upstream of any public water intakes.

Sensitive Waterbodies

Waterbodies may be considered sensitive for a number of reasons, including the presence of significant fisheries, habitat for threatened or endangered species, high-quality recreational or visual resources, historic value, or the presence of impaired water or contaminated sediments. The proposed route crosses five waterbodies on the EPA-approved 303(d) list of impaired waterbodies (LDEQ 2012b): the Houston River at MP 1.8, Little River at MP 5.6, Beckwith Creek at MP 8.8, Hickory Branch at MP 10.3, and Indian Bayou at MP 14.8. The route also crosses two waterbodies designated as Louisiana Natural and Scenic Rivers under the Louisiana Scenic Rivers Act of 1998: Beckwith Creek at MP 8.8 and Hickory Branch at MP 10.3

4.3.2.2 Surface Water Impacts and Mitigation

Terminal Expansion

We assessed impacts associated with the export of LNG, the use of LNG carriers (including traffic, transit, and ballast water discharges), and LNG spills in our previous EIS and two EAs for the existing Cameron LNG Terminal (see section 2.1.1). Because Cameron LNG is not proposing to change the authorized frequency or size of LNG vessels, impacts associated with these activities are not addressed in this EIS. However, we note that ballast water management requirements have changed since those reviews were conducted. LNG captains would be required to comply with these more stringent requirements, found in 33 CFR 151.2025 (Ballast Water Management Requirements). As a result, our earlier assessments of potential impacts due to ballast water exchange remain appropriate.

Because very few, if any, of the barges used for construction of the proposed Project would have ballast systems, and because Cameron LNG did not request an increase in the number of LNG carriers currently authorized to use the existing terminal, the proposed Project would not have impacts associated with ballast water discharge in the Calcasieu Ship Channel or Gulf Intracoastal Waterway beyond those previously assessed.

Work Dock

Construction of the proposed work dock would require dredging approximately 205,000 yd^3 of material from the Calcasieu Ship Channel. Dredging of the work dock berth would result in impacts similar to those that occurred during construction and maintenance dredging of the adjacent existing LNG terminal's berthing area by Cameron LNG[28] and during routine maintenance dredging of the Calcasieu Ship Channel by the COE. Because the sediments within the area are anticipated to consist primarily of fine particles based on other nearby dredging

[28] Dredging impacts were previously addressed in the 2003 EIS for the existing Cameron LNG Terminal (FERC Docket No. CP02-374) and the 2006 EA for Cameron LNG Expansion Project (Docket No. CP06-422).

projects, dredging would result in the temporary and local suspension of sediments and minor increased turbidity levels that would be limited to the period of dredging and a short time after dredging ceases. To minimize turbidity increases, Cameron LNG would use a hydraulic dredge with a suction header during dredging. Cameron LNG would also use turbidity curtains, as necessary, to capture suspended sediments from dredging activities. This impact would be temporary and we believe turbidity would return to pre-dredging levels soon after dredging is completed.

Although it is possible that the sediments dredged during construction could contain contamination, the sediments would not be different from those dredged during construction of the existing LNG Terminal, which were not found to contain contaminants, as previously discussed. Cameron LNG applied for a joint Section 404 and CUP seeking authorization from both the COE and LDNR Office of Coastal Management to perform dredging and fill of coastal wetlands. Cameron LNG committed to working with the COE to identify the appropriate specifications and guidelines governing dredging activities and incorporate them into the permit. Cameron LNG would dispose of dredged sediments under its existing CUP on property owned and operated by Cameron LNG west of the existing terminal site. Cameron LNG would pipe dredged material to this permitted area and beneficially convert an open water area to tidally influenced marsh, as described in section 4.4.4.

Barges and support vessels would deliver large equipment and construction materials to the work dock, which would increase ship traffic in the Calcasieu Ship Channel and the Gulf Intracoastal Waterway. The proposed work dock is designed to accommodate two barges simultaneously without obstructing ship traffic in the channel; therefore, the impacts of increased barge and support vessel traffic would only occur during transit of those vessels to and from the work dock. Barge traffic may result in some suspension of bottom sediments and temporarily increase turbidity. The increase in turbidity could result in localized, minor, and temporary decreases in dissolved oxygen.

Barges and support vessels would take in cooling water for vessel boilers while in transit and discharge the cooling water after use. The cooling water would be circulated in a closed system and would not have chemicals added to it. Discharge of the cooling water would potentially result in highly localized and temporary increases in water temperature in the waterway and ship channel. However, based on an analysis on larger marine vessels conducted for a similar project, the temperature change would be insignificant (generally would dissipate to a change of temperature of 1°C or less warmer than ambient conditions 15 to 30 meters from the discharge source) given the total volume of water within the discharge area (FERC 2009).

Hydrostatic Testing

Cameron LNG would hydrostatically test the piping and LNG storage tank to verify the integrity of those facilities prior to placing them in service. Hydrostatic test water would be pumped from the active on-site well discussed in section 4.3.3, and no chemicals would be added to the hydrostatic test water. After completion of hydrostatic testing, Cameron LNG would discharge the hydrostatic test water to the Calcasieu Ship Channel in compliance with the FERC Procedures. In addition, Cameron LNG stated it would filter and dissipate the energy of test water before discharging it to the Calcasieu Ship Channel. Because well water would be used, no chemicals would be added to the test water, the water would only contact new pipe, and

Cameron LNG would implement the FERC Procedures, we believe that the withdrawal, use, and discharge of hydrostatic test water by Cameron LNG would not result in a significant impact on surface waters. In addition, Cameron LNG would comply with the stipulations regarding sampling and testing hydrostatic test water included in its LDEQ discharge permit, which may further reduce the potential for impacts.

Erosion and Runoff

Construction would increase the amount of impervious surfaces at the Terminal Expansion site, which would increase stormwater runoff volumes. Cameron LNG would modify its existing stormwater system, as necessary, to accommodate the additional runoff from the expanded terminal. To minimize impacts from potential erosion and sedimentation on the Calcasieu Ship Channel due to land disturbance during construction of the Terminal Expansion, construction activities would be conducted in accordance with the Cameron LNG Environmental Plan, including the FERC Plan. As mandated by these plans, Cameron LNG would install and maintain all necessary erosion and sedimentation control structures to avoid impacts on the Calcasieu Ship Channel.

Construction of the Terminal Expansion facilities would involve draining and filling of one of the two freshwater pond basins on the Terminal Expansion site. The second pond would be used as a stormwater retention basin during construction and may later be filled during operation of the Terminal Expansion. Impacts associated with filling these ponds would be permanent.

During construction of the Terminal Expansion, Cameron LNG would route stormwater through sediment removing devices, such as filter fabric, to remove sediment from the flow. One of the existing manmade ponds within the Terminal Expansion boundary would hold a portion of stormwater runoff; other runoff would flow off of the property through existing drainage ditches. Cameron LNG provided runoff calculations that indicate that the pond could hold runoff from a 10-year rain event; if necessary, to avoid overflow, Cameron LNG would pump water from the pond to the existing drainage ditch on the west side of the Terminal Expansion property. During normal operation of the proposed Terminal Expansion facilities, surface water discharges would consist of stormwater runoff. Stormwater runoff would collect in a series of trenches or discharge as sheet flow off the site. The LNG and refrigerant spill containment trenches and sumps would also collect stormwater, which would be pumped to the Calcasieu Ship Channel in accordance with the Louisiana Pollutant Discharge Elimination System (LPDES) Permit. Cameron LNG would retain an existing vegetated buffer about 150 to 200 feet wide along the shoreline from the work dock to the northern terminus of the Terminal Expansion that would act as a stormwater filter prior to discharge into the ship channel.

With implementation of the FERC's Plan and Procedures and Cameron LNG's design of the Project, we believe erosion and runoff from construction and operation would be minimized and not significant.

Inadvertent Spills

Water quality of the Calcasieu Ship Channel could be adversely affected by a spill, leak, or other release of hazardous materials during construction. Transport of released hazardous materials into the Calcasieu Ship Channel by stormwater runoff would degrade water quality and could impact aquatic organisms. To minimize the potential for a release of hazardous materials and to avoid or minimize the impacts of a release, Cameron LNG would implement the spill procedures in its Environmental Plan during construction and would implement the procedures included in its revised SPCC Plan during operation of the expanded terminal.

Through use of the measures discussed above, we believe impacts from spills on surface water resources at the Terminal Expansion would be minimized to the extent practicable.

Pipeline Expansion

Cameron Interstate would construct across waterbodies using several different methods, depending primarily on the size of the waterbody and the presence or absence of water at the time of construction. In addition, waterbody crossings would be designed and constructed in compliance with COE and state permitting requirements and the procedures presented in the Cameron Interstate Procedures included in the Cameron Interstate Environmental Plan (Appendix C). Appendix F lists the waterbodies that would be crossed by the Pipeline Expansion along with Cameron Interstate's proposed waterbody crossing methods and schematic drawings of typical crossing methods.

Cameron Interstate would cross all perennial waterbodies, including the two major waterbodies, using the HDD method. Because Cameron Interstate would use the HDD crossing method at all perennial waterbody crossings, the pipeline would be buried below the maximum scour depth calculated to occur during the 100-year flood event. As a result, we conclude scouring would not impact the pipeline.

Open-cut crossing methods, which use methods similar to conventional upland open-cut trenching, would be used to cross intermittent and ephemeral waterbodies that are not designated as scenic rivers, including waterbodies with flows that cannot be flumed or pumped around the construction zone using the dry-ditch crossing techniques (see section 2.6.3 for additional details on crossing methods). This method open-cut crossing method would typically include streams not considered significant by the state, intermittent drainage ditches and streams, and ephemeral streams and ditches. Where Cameron Interstate would use a dry-ditch crossing method (i.e., flume or dam-and-pump), it would maintain downstream flow at all times and isolate the construction zone from the stream. Cameron Interstate would use the dry-ditch crossing method for waterbodies state-designated as significant warmwater fisheries, unless the open-cut method is approved by the appropriate state agency.

The greatest potential impact on surface waters would result from the temporary suspension of sediments during open-cut crossings of flowing streams. The extent of the impact would depend on sediment load, stream velocity, turbidity, bank composition, and sediment particle size. These factors would determine the density and downstream extent of sediment migration. In-stream construction could cause the dislodging and transport of channel bed sediments and the alteration of stream contours. Changes in bottom contours could alter stream dynamics and increase downstream erosion or deposition, depending on circumstances. Turbidity resulting from resuspension of sediments from in-stream construction or erosion of cleared stream bank right-of-way areas could reduce light penetration and photosynthetic oxygen production. In-stream work could also introduce chemical and nutrient pollutants from sediments, if present. Resuspension of deposited organic material and inorganic sediments could cause an increase in biological and chemical use of oxygen, potentially resulting in a decrease of dissolved oxygen concentrations in the affected area. Lower dissolved oxygen concentrations could cause temporary displacement of motile organisms and non-motile organisms could suffer mortality within the affected area.

To reduce potential turbidity during open-cut crossings, Cameron Interstate would limit instream equipment to only the equipment necessary to complete a successful crossing. Further, Cameron Interstate would install equipment bridges for passage of all other construction equipment at flowing waterbodies, including minor crossings. Cameron Interstate would also require that waterbodies be crossed as quickly as practical and within the timing windows specified in the Cameron Interstate Procedures. Instream construction activities, including pipe installation and streambed restoration, would be completed within 24 hours for minor waterbodies and within 48 hours for intermediate waterbodies.

The clearing and grading of stream banks would expose soil to erosion and would reduce riparian vegetation along the cleared sections of the affected waterbodies. The use of heavy equipment for construction could cause compaction of near-surface soils, an effect that could result in increased runoff into surface waters. The increased runoff could transport additional sediment into the waterbodies, resulting in increased turbidity levels and sedimentation rates in the receiving waterbody. The flume and dam-and-pump waterbody crossing methods would also disturb stream banks and could result in minor, temporary increases in turbidity when flow is restored to the waterbodies; however, this impact would be minimal.

Dust generated from vehicular and equipment traffic could increase sedimentation of adjacent waterbodies. To mitigate this effect, Cameron Interstate proposes to use approximately 200,000 gallons of water from commercially available sources for dust control during construction of the Pipeline Expansion, which would minimize the movement of soil due to wind.

Cameron Interstate would follow its Procedures for waterbody crossings to ensure adequate water flow rates are maintained at all crossing locations and interruption of downstream uses are prevented. Cameron Interstate's Plan and Procedures include requirements for pre-construction planning, environmental inspection, construction methods, sediment and erosion control, restoration, decompaction, and post-construction maintenance.

Where waterbodies are an integral part of a wetland ecosystem, Cameron Interstate would ensure the hydrologic regime of the waterbody and associated wetland complex are maintained. Where installation of the pipeline has the potential to drain a waterbody and associated wetland complex, Cameron Interstate would install trench breakers or seal the trench bottom to maintain the original wetland hydrology.

Horizontal Directional Drilling Method

HDD is a trenchless crossing method that would be used to avoid direct impacts on nine waterbodies and associated wetlands, by directionally drilling well beneath them as described in section 2.6.3. Commercially available sources would truck a total of about 6,000 gallons of water to the drill sites to create drilling fluid. Drilling fluid, consisting of non-toxic bentonite (a natural clay product) and water, is used to lubricate the drill bit during drilling**.** A successful HDD would result in little or no impact on the waterbody being crossed. However, impacts on surface waters could occur if an inadvertent release of drilling fluids reaches the surface. Such releases are more likely to occur in the vicinity of the HDD entry or exit hole. If unfavorable ground conditions exist, inadvertent releases could travel along fractures in the geology and reach the sensitive resource that is intended to be avoided by the use of HDD.

Cameron Interstate prepared site-specific HDD Plans and an HDD Contingency Plan to address and plan for the possibility of an inadvertent release; these plans are included in the Cameron Interstate Environmental Plan (Appendix C). As required by the HDD Contingency Plan, containment equipment and material would be stored at each drill site to respond appropriately if an inadvertent release were to occur. In addition to impacts from an inadvertent release, placement of HDD guide wires may require minor hand clearing of woody vegetation and/or branches.

Hydrostatic Testing

Cameron Interstate would hydrostatically test the integrity of the pipeline before initiating operation in accordance with the pipeline safety regulations identified in 49 CFR Part 192. Hydrostatic testing of the pipeline would require about 8.8 million gallons of water, which Cameron Interstate would withdrawal from the Houston River Canal. Another 20,000 gallons of water would be trucked from commercial or municipal sources to test the piping at the Holbrook Compressor Station. Cameron Interstate would not add chemicals to the test water. Cameron Interstate's mitigation measures to minimize potential impacts from water withdrawal and discharge include, but are not limited to, the following:

- obtain and comply with all applicable water withdrawal permits (including LDNR's Office of Coastal Management permit) and provide proper notifications prior to construction;
- screen hydrostatic test water withdrawal intakes to minimize the potential for entrainment of fish and aquatic organisms; and
- regulate the discharge of hydrostatic test waters using energy dissipation devices to prevent erosion, scour, turbidity, or excessive streamflow.

Cameron Interstate would return hydrostatic test water to vegetated upland areas though energy dissipation devices to reduce the velocity of the discharge and minimize erosion. As result, we believe that the withdrawal, use, and discharge of hydrostatic test water would not result in a significant impact on surface waters. In addition, Cameron Interstate would comply with the stipulations regarding hydrostatic test water discharge included in its LDEQ discharge permit (including sampling and testing prior to discharge), which may further reduce the potential for impacts.

Inadvertent Spills

To avoid or minimize the potential impacts of inadvertent spills from refueling of vehicles and the storage of fuel, oil, or other hazardous materials near surface waters, Cameron Interstate would implement the measures provided in its Environmental Plan (Appendix C). These measures include restricting refueling and storage of potentially hazardous materials to upland areas at least 100 feet from waterbodies and provisions to handle stormwater that may carry spilled materials. If a spill were to occur, immediate downstream users of the water could experience degradation in water quality, and acute and chronic toxic effects on aquatic organisms could occur. However, Cameron Interstate would not store large volumes of fuel, oil, or other hazardous materials and it is not likely that significant long-term impacts would result if a spill during construction were to reach a waterbody.

Impact Summary

Through use of the measures discussed above and the proposed mitigation measures, we believe impacts on surface waters along the proposed pipeline route would be minimized to the extent practicable.

4.4 WETLANDS

Wetlands are 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 vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation (Environmental Laboratory 1987). Wetlands can be a source of substantial biodiversity and serve a variety of functions that include providing wildlife habitat, recreational opportunities, flood control, and naturally improving water quality.

Section 404 of the CWA establishes standards to evaluate and reduce total and net impacts on wetlands under the regulatory jurisdiction of the COE. These standards require avoidance of wetlands where possible and minimization of disturbance where impacts are unavoidable, to the degree practicable. Cameron must also demonstrate that it has taken appropriate and practicable steps to minimize wetland impacts in compliance with the COE's Section 404(b)1 guidelines that restrict discharges of dredged or fill material where less environmentally damaging alternatives exist.

In Louisiana, coastal wetlands are defined as wetlands less than 5 feet above MSL that occur within the designated coastal zone of the state. These wetlands are under the jurisdiction of LDNR, Office of Coastal Management.

4.4.1 Affected Wetlands

Wetlands that would be affected by Project facilities are regulated at the federal and state levels. On the federal level, the New Orleans District of the COE has authority under Section 404 of the CWA to review and issue permits for activities that would result in the discharge of dredged or fill material into waters of the United States, including wetlands. Section 401 of the CWA requires that proposed dredge and fill activities under Section 404 be reviewed and certified by the LDEQ to ensure that the proposed Project would meet state water quality standards. On the state level, the LDNR, Office of Coastal Management is responsible for the implementation of the Louisiana Coastal Resources Program, which issues CUPs and sets mitigation requirements for unavoidable losses of coastal wetland function and value due to permitted activities.

Cameron must comply with all Clean Water Act conditions of applicable permits issued by the COE, LDEQ, and LNDR, including the provisions of required compensatory wetland mitigation. Cameron reviewed available NWI maps and soil surveys, and conducted wetland field surveys within the proposed Project footprint in 2012, including the proposed Terminal Expansion facilities, the construction right-of-way, proposed access roads, ATWS, and pipeline aboveground facilities to delineate wetland boundaries in accordance with the requirements of the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987). In addition, Cameron conducted qualitative assessments for each identified wetland based on the COE's five ecological parameters that include quality of wetland vegetation, soils, hydrology, presence of plant and animal species of concern, and level of disturbance within the wetland and adjacent areas. Wetland types identified were classified into one of the following three types according to Cowardin et al. (1979):

- palustrine emergent (PEM) wetlands;
- palustrine scrub-shrub (PSS) wetlands; or
- PFO wetlands.

PEM wetlands are the most common in the vicinity of the proposed Project and are dominated by erect, rooted herbaceous hydrophytes. PSS wetlands are dominated by woody vegetation less than 6 meters tall and generally occur where land is no longer managed or where invasive species have entered marshlands. Cameron identified PSS wetlands in the vicinity of the proposed Project in abandoned fields and pastures and in marsh areas with higher elevation. PFO wetlands are dominated by tree species at least 6 meters tall and include bottomland hardwood, mixed pine/hardwood, and pine plantation. PFO wetlands occur in the floodplains of waterbodies and in depressions within pine plantations and mixed pine/hardwood forests. Details regarding impacts on individual wetlands, including wetland classification, are provided in Appendix H**.**

4.4.2 Wetland Construction Procedures and Mitigation

In general, wetland impacts need to be avoided first; if avoidance is not possible, impacts are to be minimized, rectified, reduced, and mitigated in accordance with federal and state regulations, including our Procedures and the COE's Section 404(b)1 guidelines, which restrict discharges of dredged or fill material where a less environmentally damaging and practicable alternative exists. COE jurisdictional wetlands affected by the Project would be subject to review by the COE to ensure that wetland impacts are fully identified and that appropriate wetland restoration and mitigation measures are identified. Additionally, wetlands within 5 feet of MSL would be subject to review by the LDNR. Cameron would comply with all conditions of its CUP and Section 404 permit authorizations that may be issued by the COE and state agencies.

4.4.3 Compensatory Mitigation

The COE requires all unavoidable wetland impacts be offset by the creation, restoration, enhancement, or preservation of at least equal amounts of wetlands, depending on the quality of the wetlands affected and the type of wetlands created, restored, enhanced, or preserved. There are three mechanisms for providing compensatory mitigation: permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee mitigation. Through use of the measures discussed above, collocation of the majority of the proposed Pipeline Expansion right-of way with existing rights-of-way, and the proposed mitigation measures, we believe impacts on wetlands due to construction and operation of the proposed Project would be minimized to the extent practicable.

4.4.4 Terminal Expansion

Construction and operation of the Terminal Expansion would permanently fill a total of 213.7 acres of wetlands. Of this total, approximately 119.4 acres are PEM, 69.8 acres are PSS, and 24.5 acres are PFO. Wetland vegetation includes emergent herbaceous species comprised of saltmeadow cord grass, narrowleaf cattail, common reed, Canada goldenrod, and bulrush; scrub-shrub or woody species including eastern baccharis and Jesuit's bark; and tree species, including Chinese tallow tree, wax myrtle, and yaupon.

After construction, the Terminal Expansion would be maintained in an industrial state with concrete and gravel ground cover. Cameron LNG would conduct all activities impacting wetlands in accordance with its CUP, once issued.

Cameron LNG would complete mitigation for all jurisdictional wetland impacts from construction and operation of the Terminal Expansion as required and approved by the LDNR, Office of Coastal Management and COE. Mitigation is discussed in section 4.4.2. The COE issued a jurisdictional determination for the wetland impacts associated with the Terminal Expansion stating that only 99.2 acres of wetlands are considered jurisdictional; therefore, Cameron LNG would only be required to mitigate for 99.2 acres of wetland impacts.

4.4.4.1 Wetland Construction Measures and Mitigation

Because Cameron LNG would convert the entire site of the expanded terminal to industrial use during operation, all of the wetlands on the proposed Terminal Expansion site would be permanently eliminated through either removal or filling. As a result, Cameron LNG would mitigate impacts using mitigation methods approved by the COE, and LDNR as discussed in section 4.4.3.

4.4.4.2 Compensatory Mitigation

Cameron LNG proposes permittee-responsible compensatory mitigation to create tidal fresh/intermediate marsh wetland habitat adjacent to the Project site (west of LA-27) at a ratio of 1.3 acres created for each acre of wetland impacted by the Terminal Expansion. Cameron LNG would beneficially reuse dredged material from construction of the work dock to convert about 129 acres of open water areas to marsh habitat. The mitigation area would be adjacent to the 220 acres of marsh habitat previously created during construction of the existing LNG terminal, thus contributing to a larger area of contiguous marsh habitat. Should additional dredged material be needed to achieve the elevation necessary within the mitigation area to meet the acreage requirement, dredged material from maintenance dredging at the existing Cameron LNG Terminal berthing area and the work dock would be used. Created marsh habitat would vegetate naturally and Cameron LNG would monitor it for quality and functionality for a period of 20 years.

In addition to the marsh creation area proposed as mitigation for the wetland impacts for construction of the Terminal Expansion, Cameron LNG proposes to create another marsh area for beneficial use of maintenance dredge material as part of its current CUP. Cameron LNG would implement its Mitigation Plan for the Cameron LNG Terminal Expansion, which includes post construction monitoring.

4.4.5 Pipeline Expansion

Cameron Interstate would affect about 62.1 acres of wetlands by construction of the pipeline and associated aboveground facilities. Of this total, 17.0 acres would be within the operational right-of-way. Table 4.4.5-1 provides a summary of the impacts on each type of wetland during construction and operation of the pipeline and associated facilities.

Wetland delineations were not completed between MP 2.8 to MP 4.7 due to lack of access, although wetlands are present within this portion of the route. **Therefore, we are recommending that:**

- **Prior to construction, Cameron Interstate should complete wetland surveys of the right-of-way from MP 2.8 to MP 4.7 and file the results of the surveys with the Secretary for review by the Director of the Office of Energy Projects (OEP).**

PEM wetlands are the most common wetlands along the proposed pipeline right-of-way. Most of these wetlands would remain as herbaceous because they are currently maintained along the existing utility corridors or are grazed by cattle. Common plant species representative of this vegetative community include: common rush, maidencane, horned beakrush, and needlegrass. Dominant species in PSS wetlands include: black willow, buttonbush, lamp rush, and honeysuckle. PFO wetlands occur along the proposed right-of-way in the floodplain of major tributaries associated with the Houston River, Little River, Beckwith Creek, and Hickory Branch Creek. Typical species composition in PFO wetlands and riparian areas along the proposed pipeline route include: loblolly pine, water oak, red maple, sweetgum, Chinese tallow, and black willow.

Impacts on wetlands would occur along the construction right-of-way, at the compressor station site, and at 22 ATWS areas, which Cameron Interstate would restore following construction. The effects of construction would be greatest during and immediately after construction. Generally, once the pipeline is in place, wetland vegetation communities would transition back into a community with a function similar to that of the wetland prior to construction. In PEM wetlands, the impact of construction would be relatively minor and short-term, because the herbaceous vegetation would regenerate quickly (generally within 1 to 2 years). PSS wetland impacts would also be minor and short-term, but these wetlands could take 2 to 4 years to reach functionality similar to preconstruction conditions depending on the age and complexity of the wetland system. In PFO wetlands, the impact of construction would be long-term due to the long regeneration period of these vegetative types (30 years or more).

TABLE 4.4.5-1 Wetlands Affected by the Pipeline Expansion [a]								
Wetland Classification [b]	**Acres of Wetland Type Affected**							
	PEM		**PSS**		**PFO**		**Total**	
	Temp [c]	**Perm [d]**	**Temp**	**Perm [d]**	**Temp**	**Perm [e]**	**Temp**	**Perm**
Pipeline	37.3	11.1	6.0	1.3	8. 9	1.3	**52.1**	**13.6**
Holbrook Compressor Station	0.4	0.4	0.0	0.0	3.6	2.1	**3.9**	**2.5**
FGT Interconnection	0.4	0.4	0.0	0.0	0.0	0.0	**0.4**	**0.4**
Access Roads	<0.1	<0.1	0.5	0.5	0.0	0.0	**0.6**	**0.6**
ATWS Areas	3.2	0.0	0.5	0.0	0.9	0.0	**4.6**	**0.0**
Pipeline Expansion Totals	**41.2**	**11.8**	**7.0**	**1.8**	**13.3**	**3.4**	**61.6**	**17.0**

< = Less than

[a] The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends.

[b] Wetland Classification:
PEM = Palustrine Emergent
PSS = Palustrine Scrub-Shrub
PFO = Palustrine Forested

[c] Temp = Temporary. Impact based on a 100-foot-wide construction right-of-way in wetlands.

[d] Perm = Permanent. Impact based on new 25-foot-wide maintained permanent right-of-way through PEM and PSS wetlands in collocated areas and new 50-foot-wide maintained permanent right-of-way through PEM and PSS in non-collocated areas.

[e] Perm = Permanent. Impact based on new 15-foot-wide maintained permanent right-of-way through PFO wetlands in collocated areas and new 30-foot-wide maintained permanent right-of-way through PFO wetlands.

Excavation of the pipeline trench during open-cut construction, installation of the pipe, and backfill of the trench could affect the rate and direction of water movement within wetlands. This could adversely affect wetland hydrology and revegetation by creating soil conditions that may not support wetland communities and hydrophytic vegetation at preconstruction levels. Failure to properly segregate soils during construction could result in mixed soil layers, which could alter biological components of the wetland and affect the reestablishment of native wetland vegetation. Temporary stockpiling of soil and movement of heavy machinery across wetlands could lead to inadvertent compaction and furrowing of soils, which would alter natural hydrologic patterns, inhibit seed germination, and increase seedling mortality. Heavy equipment could also introduce non-native and invasive species to the disturbed soil. Altered surface drainage patterns, storm water runoff, runoff from the trench, accidental spills, and discharge of hydrostatic test water could also negatively affect wetland regeneration.

Cameron Interstate would minimize wetland impacts by collocating and overlapping 74 percent of the proposed 21-mile pipeline route with existing pipeline rights-of-way, which would minimize impacts on previously undisturbed wetlands. Further, 100 percent of the route would follow existing corridors. Six HDDs are proposed to cross nine waterbodies and are designed to encompass wetland complexes adjacent to the waterbodies, where possible. This would reduce wetland clearing. A total of about 5.9 acres of wetland would be crossed by HDD, of which about 5.4 acres is PFO wetland.

Permanent impacts on wetlands would also occur during operation of the pipeline, compressor station, and at the FGT Interconnection. Construction of the Holbrook Compressor Station would permanently impact 2.1 acres of PFO wetland and 0.4 acre of PEM wetland; one proposed new access road to the Holbrook Compressor Station would permanently impact 0.03 acre of PEM wetland and 0.5 acre of PSS wetland. The FGT Interconnection would permanently impact 0.4 acre of PEM wetland. Permanent impacts would include the installation of permanent facilities, gravel, and paved areas.

Operation would require clearing of a 10-foot-wide corridor centered over the proposed pipeline at a frequency necessary to maintain an herbaceous state to facilitate periodic pipeline corrosion/leak surveys. Additionally, Cameron Interstate would cut and remove trees within about 15 feet of the pipeline and greater than about 15 feet in height to ensure root systems do not interfere with operation of the pipeline. This would prevent the growth of woody vegetation and forested species within 15 feet of the centerline, resulting in a permanent conversion of PFO wetland to PEM wetland. Therefore, about 1.3 acres of PFO wetland would be permanently converted to PEM wetland. The conversion of vegetation would permanently modify the function of the wetland area including wildlife habitat. While the conversion of PFO to PEM wetlands would not constitute a total wetland loss, it does represent a permanent conversion of wetland function.

4.4.5.1 Wetland Construction Measures and Mitigation

Wetland impacts would be minimized by collocating 74 percent of the proposed 21-mile pipeline route with existing pipeline rights-of-way. Section 2.6.3 provides additional details and typical drawings of right-of-way cross-sections in both collocated and non-collocated areas.

Six HDDs are proposed to cross nine waterbodies and 10 associated wetland complexes. This would avoid impacts on 5.9 acres of wetlands. No trees would be removed between the entry and exit points of the HDD; however, minor hand clearing of woody vegetation and/or branches may be required along the HDD guide wire. Section 2.6.3 describes the specialized pipeline construction that Cameron Interstate would use for construction through wetlands. Cameron Interstate would implement its Procedures to minimize impacts on wetlands, which include:

- limiting the operation of construction equipment within wetlands to equipment essential for clearing, excavation, pipe installation, backfilling, and restoration;
- limiting removal of stumps and grading in wetlands to directly over the trench, except where necessary to ensure safety;
- minimizing the length of time that topsoil is segregated and the trench is open;
- installing trench breakers at the boundaries of wetlands as needed to prevent draining of a wetland and maintain original wetland hydrology;
- prohibiting storage of hazardous materials, chemicals, fuels, and lubricating oils within a wetland or within 100 feet of a wetland boundary; and

- limiting post-construction maintenance of vegetation within herbaceous wetlands to a 10-foot-wide strip of vegetation centered over the pipeline, and in forested areas, limiting tree removal to those that are within 15 feet of the pipeline centerline.

During clearing, Cameron Interstate would install temporary erosion control measures to prevent sedimentation of wetlands.

In unsaturated wetlands, Cameron Interstate would segregate up to 12 inches of topsoil from the trench from subsoil. Topsoil would be stabilized to minimize loss due to water or wind erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary. Topsoil would not be stripped in saturated wetlands, at locations where no topsoil layer is evident, or in areas where the topsoil depth exceeds the depth of the trench. In accordance with the Cameron Interstate Procedures, Cameron would not trench within the wetland boundaries until the pipeline has been assembled and is ready for lowering-in. In saturated wetlands, Cameron Interstate would use special construction techniques, such as the use of low ground-pressure equipment or timber construction mats. Concrete-coated pipe or weights would be used during construction to ensure that the pipe does not float in saturated conditions. After construction, Cameron Interstate would remove timber mats and restore the contours as close to pre-existing conditions as possible. Non-forested wetlands within the construction right-of-way and forested wetlands outside of the permanent right-of-way that are affected by construction would be allowed to revegetate naturally, or as required by applicable permits.

4.4.5.2 Alternative Measures to FERC's Procedures

Cameron Interstate proposes alternative measures to the measures described in Section VI.A.3, VI.B.1, and VI.A.6 of our Procedures, which relate to the construction right-of-way width, the location of extra workspaces in wetlands, and locating aboveground facilities in wetlands.

Section VI.A.3 of the FERC Procedures states the width of the construction right-of-way should be 75 feet or less in wetlands. Cameron Interstate has proposed a right-of-way width of 100 feet for 66 wetland crossings due to sandy soil conditions that require a greater trench width to maintain slope stability.

Section VI.B.1 of the FERC Procedures states all extra work areas, such as staging areas and access roads, should be at least 50 feet outside of identified wetland boundaries, except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land. Cameron Interstate proposed 33 locations where ATWS areas would be within 50 feet of a wetland including ATWS for road bores and HDD pullbacks.

Additionally, Cameron Interstate has proposed an alternative measure to our Procedures relating to the location of both the Holbrook Compressor Station and the FGT Interconnection. Section VI.A.6 of our Procedures state aboveground facilities should be outside of wetlands, except where the location of such facilities outside of wetlands would prohibit compliance with DOT regulations. To achieve the required natural gas flow rate at the terminal, the compressor station would need to be between MP 3.5 and MP 9.0. Alternative locations within the 5.5-mile-long corridor were evaluated; however, wetlands comprise much of the area and could not be avoided (see section 3.7.1). The site of the Holbrook Compressor Station was chosen to avoid high quality PFO wetlands along the Little River. The FGT Interconnection would be adjacent to the existing FGT Interconnection between the FGT pipeline and the existing Cameron Interstate Pipeline. Alternative locations would increase overall wetland impacts by requiring a new interconnection facility and reducing the percent of right-of-way collocated with existing rights-of-way.

Cameron Interstate would also complete all wetland permitting and compensatory mitigation consultations with the COE, LNDR, and LDEQ before commencing construction at any extra workspaces, ATWS areas, access roads, and aboveground facilities within wetlands, as discussed above. In addition, Cameron Interstate would implement all applicable wetland protective measures included in its Procedures.

Based on our review, we determined that the proposed alternative measures to our Procedures (including those that would affect PFO wetlands), are reasonable and are adequately justified. Impacts at the specified locations would occur in PEM, PSS, and low-quality (pine plantation) PFO wetlands, with the exception of the four locations where impacts on bottomland hardwood communities would occur. In addition, the crossing of three wetlands where the wetland is not crossed at the centerline would impact bottomland hardwood communities. Additional justification and/or mitigation is warranted for Cameron Interstate's requested alternative measure to increase the right-of-way width within these seven bottomland hardwood wetlands. **Therefore, we are recommending that:**

- **Prior to the end of the draft EIS comment period, Cameron Interstate should provide an assessment of the feasibility of a reduced construction right-of-way width, expansion of nearby HDDs, or other alternative construction methods to minimize impacts on PFO wetlands containing bottomland hardwood species at MP 1.55, MP 2.25, MP 15.98, MP 18.46, MP 18.79, MP 20.11, and MP 20.36.**

4.4.5.3 Compensatory Mitigation

Cameron Interstate, as part of the wetlands permitting process, filed its Section 404 permit application with the COE, New Orleans District and is continuing consultations with the COE regarding appropriate mitigation for wetland impacts.

To mitigate the permanent loss of about 3.3 acres of wetlands along the proposed pipeline right-of-way and the conversion of about 16.6 acres of wetlands to PEM wetlands, Cameron Interstate proposed to purchase mitigation credits from a COE-approved mitigation bank servicing the area. Details regarding the number and type(s) of credits that would be purchased would be decided by the COE upon review of the Section 404 permit application. Cameron Interstate stated that the COE indicated it would not require mitigation for the permanent impacts on the PEM wetland at the FGT Interconnection. Through use of the measures discussed above, collocation of the majority of the proposed pipeline right-of way, and the proposed mitigation measures, we believe impacts on wetlands along the proposed pipeline route would be minimized to the extent practicable.

4.5 VEGETATION

4.5.1 Vegetation Resources

4.5.1.1 Terminal Expansion

The Terminal Expansion would be constructed on 424.7 acres of vegetated land, including 52.9 acres within the existing terminal boundary and 371.8 acres on property directly north of the existing terminal. Vegetation types that would be affected during construction and operation of the Terminal Expansion include 211.0 acres of upland open land and 213.7 acres of wetlands. Section 4.4.4 provides additional information on wetland types, vegetation, and impacts.

About 93 percent of the Terminal Expansion site was previously disturbed through use as a COE disposal site for dredged material from maintenance of the Calcasieu Ship Channel. About 70.0 acres were also disturbed during construction of the existing Cameron LNG Terminal. As a result, vegetative communities contain low species diversity and are not productive as agricultural land, grazing land, or high-quality wildlife habitat. Much of the property is comprised of vegetation indicative of disturbed sites, such as groundsel tree, curly dock, goldenrod, and dewberry.

All impacts on vegetation would be permanent, as Cameron LNG would convert the entire Terminal Expansion site to industrial use with concrete and gravel ground cover during operation. Cameron LNG would implement erosion control and other mitigation methods in our Plan and Procedures to minimize indirect effects on vegetative communities during construction. To offset proposed permanent wetland impacts, Cameron LNG proposes to complete compensatory wetland mitigation, as discussed in section 4.4.4.3. Due to the presence of low-quality vegetation and proposed mitigation measures, we believe impacts from construction and operation of the Terminal Expansion on vegetation communities would not be significant, although the impacts would be permanent.

4.5.1.2 Pipeline Expansion

Construction of the pipeline and associated facilities would disturb about 10.0 acres of upland forest, 41.7 acres of pine plantation, 147.0 acres of upland open land, 24.0 acres of agricultural land, and 62.1 acres of wetlands. Refer to section 4.4.5 for details on wetland types, vegetation, and impacts. Table 4.5.1-1 lists the vegetation communities affected by the proposed pipeline and associated facilities, including vegetation type and acreage affected.

TABLE 4.5.1-1
Acreages of Vegetation Cover Types Impacted by the Pipeline Expansion

Project Component	Agriculture		Pine Plantation		Wetlands [a]		Upland Forest		Upland Open Land		Total	
	Cons [b]	Oper [c]	Cons	Oper	Cons	Oper	Cons	Oper	Cons	Oper	Cons	Oper
Holbrook Compressor Station	0.0	0.0	12.4	11.6	3.9	2.5	0.0	0.0	1.0	1.0	**17.3**	**15.1**
Other Aboveground Facilities (Interconnections & Metering)	0.0	0.0	0.0	0.0	0.4	0.4	0.1	0.1	3.1	3.1	**3.6**	**3.6**
Pipeline [d]	24.0	8.1	28.6	5.7	56.7	14.0	9.8	1.4	132.6	38.4	**251.7**	**67.6**
Access Roads	0.0	0.0	0.6	0.6	1.1	0.6	0.0	0.0	0.0	0.0	**1.7**	**1.2**
Contractor Yard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	0.0	**10.3**	**0.0**
Pipeline Project Totals	**24.0**	**8.1**	**41.6**	**17.9**	**62.1**	**17.5**	**9.9**	**1.5**	**147.0**	**42.5**	**284.6**	**87.5**

[a] Includes PFO, PSS, and PEM types
[b] Cons = impacts from construction
[c] Oper = portion of construction impacts that would be permanently maintained following construction
[d] Includes vegetation cover type acreage for ATWS areas

Common canopy trees present in upland forests along the proposed pipeline route and associated facilities are: loblolly and slash pine, live and post oak, sweet gum, southern magnolia, and Chinese tallow tree. Pine plantations are typically comprised of a single species (either slash or loblolly pine) and are exclusively used for timber or paper production. Two types of critically imperiled longleaf pine savannahs, western acidic and saline, potentially occur within the proposed Pipeline Expansion area in Beauregard and Calcasieu Parishes. LNHP requested that Cameron Interstate minimize impacts on these two forest habitats as discussed in section 4.7. Typically, the understory in pine plantations is sparse and is often controlled through maintenance activities. Understory species present along the proposed pipeline include: yaupon, wax myrtle, Chinese tallow, and various species of *Smilax*. Open lands are upland areas typically vegetated with grasses, forbs, and shrubs. Common open land species include: Bermuda, Bahia, and vasey grass, goldenrod, ragweed, yaupon, American holly, groundsel tree, and wax myrtle. Un-vegetated land cover types, such as agricultural, industrial, and residential lands, are discussed in more detail in section 4.8.

Cameron Interstate would construct its pipeline within a 100-foot-wide construction right-of-way and ATWS areas. The construction right-of-way, ATWS areas, and aboveground facilities would be mechanically cleared of all vegetation and graded, with tree stumps removed as necessary. Cameron Interstate would dispose of cleared and removed timber and vegetation by one or more of the following methods as approved by landowners and/or state and local agencies: chipping/shredding and dispersing along the right-of-way; off-site disposal; or burning by permit. Construction crews would stack the timber along the disturbed right-of-way for landowner removal and use, upon landowner request and approval. Timber would be stacked where landowners can access it and would be stacked no more than 4 feet in height. A minimal gap of 30 feet would be maintained between stacks to allow for wildlife movement.

The permanent right-of-way would vary between 25 and 50 feet wide, depending on the amount of permanent right-of-way overlap with existing rights-of-way. Cameron Interstate would collocate 15.5 miles of pipeline to overlap with existing rights-of-way and the permanent right-of-way would generally be 25 feet wide. Approximately 4.1 miles of pipeline would be offset from Cameron Interstate's existing permanent right-of-way and would require a 50-foot-wide permanent easement. The remaining 1.4 miles are associated with HDD waterbody crossings where the right-of-way would not be maintained. Within upland forest, pine plantation, and forested wetland areas, the maintained easement would be 15 feet wide in collocated areas and 30 feet wide in non-collocated areas, as trees within 15 feet of the pipeline and greater than about 15 feet tall would be removed to ensure root systems do not interfere with operations of the pipeline. Routine vegetation mowing or clearing would occur not more than every 3 years across the entire permanent right-of-way. However, to facilitate periodic corrosion and leak surveys, Cameron Interstate would maintain a corridor not exceeding 10 feet in width centered over the pipeline in an herbaceous state.

The primary impacts on vegetation from construction of the pipeline and associated facilities would be the cutting, clearing, and/or removal of existing vegetation within the construction work areas. The duration and magnitude of impacts would depend on the type and amount of vegetation affected, the rate at which vegetation regenerates after construction, and the frequency of vegetation maintenance conducted on the right-of-way during pipeline operation. In addition, right-of-way revegetation would depend on factors such as local climate, soil types, right-of-way maintenance practices, and land use. There would be minor and short-term changes on agricultural, scrub-shrub and herbaceous wetland, and open upland areas because we would expect these areas to revegetate to a cover similar to pre-construction conditions within 1 to 4 years. In areas where forest regeneration would occur, re-establishment to pre-construction conditions could take 10 to 30 years, depending on the species type. In addition, blowdowns may become more frequent for a time as trees newly exposed on the edge of forested habitats would not be acclimated to windy conditions often present in edge habitats.

Of the 147.0 acres of open land that would be disturbed for all aspects of the Pipeline Expansion during construction, 42.5 acres would be permanently affected within the Holbrook Compressor Station site, the pipeline right-of-way, and the interconnections (table 4.5.1-1). Cameron Interstate would re-seed the remaining 104.5 acres after pipeline installation and re-contouring the right-of-way. Cameron Interstate would consult the local NRCS regarding seeding mixes, application rates, and times for the pipeline and associated facilities. Impacts on upland open land cover would be minor and short-term because the grass and shrub vegetation present in the majority of the Pipeline Expansion areas would revegetate to pre-construction conditions within one to two growing seasons following construction.

In forested areas, including upland forest, pine plantation, and forested wetland, the removal of trees would constitute a conversion of the forest to herbaceous cover. In areas outside the permanent right-of-way, the impact would be long-term, but those areas would be allowed to recover to pre-construction conditions over time. Within the permanent right-of-way, the conversion of wetland forest to PEM or PSS wetland would be permanent, as Cameron Interstate would preclude trees from growing within 15 feet of the pipeline. As discussed above, the permanent easement within forested wetland areas would be 30 feet wide in non-overlapping areas and 15 feet wide in areas that overlap with existing rights-of-way. Of the 13.3 acres of forested wetland that Cameron Interstate would clear during construction, 3.7 acres would be permanently maintained in an herbaceous state. Of the 51.6 acres of upland forest and pine plantation that would be cleared during construction of the Pipeline Expansion, Cameron Interstate would permanently maintain 19.5 acres in an herbaceous state. The remaining 9.6 acres of forested wetland and 32.2 acres of forested upland would be allowed to revert back to forest cover.

Cameron Interstate's use of one contractor yard would temporarily affect 10.3 acres of upland open land. ATWS areas would impact 33.5 acres of agriculture, upland forest, upland open land, wetland, and pine plantation during construction. Impacts associated with agricultural land, upland open land, and herbaceous and scrub-shrub wetlands would be short-term, while impacts on forest would be long-term. No permanent impacts on vegetation would result from the use of these sites.

To minimize direct and indirect impacts on vegetative cover types along the proposed pipeline route and associated ATWS areas, Cameron Interstate would follow the requirements of its Plan. Some of the restoration and best management practices identified in the Cameron Interstate Plan include:

- use of at least one EI who would ensure compliance with Cameron Interstate's Plan, Procedures, and other required conditions as provided in its Environmental Plan (Appendix D);

- stripping and segregating up to 12 inches of available topsoil over the ditch and working side of the right-of-way in agricultural land, residential areas, and where required by the landowner to preserve the native seed bank;
- installation of temporary and permanent erosion control measures, such as slope breakers, sediment barriers, and mulch;
- commencement of cleanup, including restoring contours, immediately after backfilling and completion of restoration within 20 days (weather permitting);
- testing and mitigation for soil compaction;
- revegetation in accordance with the recommendations of the local soil conservation authority (NRCS) or the affected landowner;
- use of barriers to control off-road vehicle activities; and
- post-construction monitoring and maintenance of revegetated areas.

Where implemented, the use of HDD methods would also avoid and/or minimize impacts on vegetated communities, riparian vegetation, and high-quality forested wetlands (see section 4.3.2). Cameron Interstate proposes to use the HDD method in six areas along the proposed pipeline route that contain mature trees. Cameron Interstate would not clear trees between the entry and exit points of the HDD; however, minor hand clearing of woody vegetation and/or branches would be required along the HDD guide wire.

Through use of the measures discussed above and collocation of the majority of the proposed right-of way to overlap with existing rights-of-way, we believe impacts on vegetation would be minimized to the extent practicable. In addition, the vegetative cover types within the Pipeline Expansion area represent a small percentage of the total available land of similar types in the surrounding area, and a large proportion of the affected area has been previously disturbed. Therefore, we do not consider construction and operation of the proposed Pipeline Expansion, including associated facilities, to be a significant impact.

4.5.2 Exotic or Invasive Plant Communities and Noxious Weeds

Exotic plant communities, invasive species, and noxious weeds can out-compete and displace native plant species, thereby negatively altering the appearance, composition, and habitat value of affected areas. Chinese tallow trees are the only noxious weed of concern present along portions of the proposed pipeline route, at the proposed compressor station site, and at the Terminal Expansion site (NRCS 2013).

Chinese tallow trees establish easily, grow quickly, and produce large quantities of seeds that are long-lived and are spread by water, birds, and mammals. This species can re-sprout quickly from crown and root buds when top growth is mechanically removed. As a result of this species already being present within the Project area, it is only possible for Cameron to manage this species rather than control its spread. No management of Chinese tallow trees would be needed at the Terminal Expansion, as the entire area would be permanently maintained as an industrial site.

Cameron Interstate would control the spread of Chinese tallow trees by managing the growth and distribution of tallow trees using the methods recommended by the NRCS: the leaf spraying and the stem spraying method. Prior to construction, Cameron Interstate would consult with the NRCS to determine acceptable application rates and spray times suitable for control of tallow trees along the pipeline route. In addition, Cameron Interstate's Plan and Procedures include procedures designed to minimize the opportunity for noxious weeds from areas outside of the Project to be introduced into the soil during construction. As stated in these documents, Cameron Interstate would develop specific procedures in coordination with NRCS to prevent the introduction or spread of noxious weeds and soil pests resulting from construction and restoration activities. Cameron Interstate's EIs would verify that the soils imported for agricultural or residential use have been certified as free of noxious weeds and soil pests. Pre-construction surveys, specifically for noxious weeds, are not proposed; however, Cameron Interstate would provide pre-construction training to construction crews for the identification and reporting of noxious weeds to EIs. Based on the proposed control measures, we conclude that impacts from noxious weeds on native plant communities would not be significant.

4.5.3 Vegetation Communities of Special Concern

No vegetative communities of special concern have been identified within the proposed Terminal Expansion site, along the proposed pipeline route, or within associated aboveground facility areas. Potential habitat for special-status plant species is discussed in section 4.7.

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife Resources

Wildlife species inhabiting the Project area are characteristic of the vegetative habitats that occur in the vicinity of the Project. We identified habitats based on interpretation of aerial photography and Cameron's field reconnaissance.

4.6.1.1 Terminal Expansion

Existing Wildlife Habitat

The wildlife habitat types at the proposed Terminal Expansion site include wetlands, open water, and open land. Fisheries are discussed in section 4.6.3. Industrial or developed lands are not included in this section.

Wetland habitats, including PEM, PSS, and PFO wetland types, provide habitat for waterfowl, wading birds, raptors, mammals, reptiles, and amphibians. Typical wildlife associated with these habitats include: wood and mottled ducks; belted kingfisher; seaside sparrow; white, great, and cattle egrets; great blue heron; Virginia and king rails; red-shouldered hawk; barred owl; red-headed woodpecker; white-tailed deer; raccoon; nutria; eastern woodrat; swamp rabbit; beaver; eastern cottonmouth; diamond-backed water snake; and southern leopard frog.

Open water habitat within the Terminal Expansion site includes two freshwater ponds. Similar to wetland habitat, open water habitat provides food and water sources, in addition to habitat for species such as wading birds, waterfowl, beavers, nutria, snakes, and other wildlife species dependent on an aquatic environment.

Open land consists primarily of grasses, forbs, and shrubs. Wildlife associated with these areas includes mammals, such as the white-tailed deer, coyote, striped skunk, cotton and white-footed mice, eastern mole, and eastern cottontail rabbit. Bird species include mourning dove, American crow, common grackle, red-winged blackbird, American kestrel, and red-tailed and red-shouldered hawks. Reptiles and amphibians include common garter snake, southern black racer, copperhead, green anole, Gulf Coast toad, and box turtle.

Much of the area proposed for the Terminal Expansion has been previously disturbed. Approximately 64.8 acres of habitat, including open water and upland open land, in the proposed Terminal Expansion area are within the existing LNG terminal footprint and were disturbed during construction of the original LNG terminal. Nearly all of the 429.9 additional acres of habitat outside the existing terminal footprint, including wetlands, open water, and upland open land, were previously disturbed from the COE's Calcasieu Ship Channel dredge material disposal. These previous activities resulted in the degradation of wildlife habitat at the proposed Terminal Expansion site, which has reduced both the number of species found on the site and habitat diversity.

Impacts and Mitigation

Construction and operation of the Terminal Expansion would result in permanent alteration of the various wildlife habitat types listed above. Construction of the Terminal Expansion facilities would permanently affect 502.2 acres, of which about 70 acres are within the existing terminal area. Approximately 213.7 acres of the Terminal Expansion site are wetlands and 211.0 acres are upland open land. Open water habitat comprises 70.1 acres, of which 9.4 acres are estuarine and 60.7 acres are freshwater man-made ponds. Land uses at the Terminal Expansion site are discussed in section 4.8 and listed in table 4.8.1-1.

Terminal Expansion construction would require vegetation clearing, grading, and fill to level the site. This would reduce cover, nesting, and foraging habitat for some species and may result in mortality of less mobile forms of wildlife, such as small rodents and reptiles. Other wildlife, such as birds and larger mammals, would leave the Terminal Expansion area as construction activities approach. These animals may relocate into similar habitats nearby; however, if a lack of adequate territorial space were to exist adjacent to the site, this could force these animals into suboptimal habitat and/or increased densities, which could lower reproductive success and survival.

Cameron LNG would permanently remove all habitats at the Terminal Expansion site and convert them to industrial land. However, these habitats have been previously disturbed and offer limited productive wildlife habitat within the Terminal Expansion site, and a large amount of similar and/or higher quality habitat exists adjacent to and near the Terminal Expansion site for wildlife use. In addition, due to current industrial activities within and around the proposed Terminal Expansion area, most wildlife species in the area are acclimated to these activities, thus impacts due to noise, light, and human activity would be negligible. Given Cameron LNG's recent successful creation of marsh habitat out of similar shallow open water areas during construction of the existing terminal, we believe the overall impact on wildlife using wetland habitat would be mitigated, as species would relocate to adjacent wetlands and the proposed marsh creation areas. These areas would provide higher quality habitat for wildlife currently using the Terminal Expansion area (refer to section 4.4.4). Therefore, we do not expect significant impacts on wildlife due to construction and operation of the Terminal Expansion.

4.6.1.2 Pipeline Expansion

Existing Wildlife Habitat

Vegetation types providing wildlife habitat within and around the Pipeline Expansion area include upland forest, agriculture, wetlands, landscaping on developed land (industrial and residential), pine plantation, and upland open land. About 74 percent of the right-of-way would overlap with existing rights-of-way; therefore, the majority of the Pipeline Expansion right-of-way would impact vegetated open land.

Open land along the proposed Pipeline Expansion route consists primarily of grasses, forbs, and shrubs. Wildlife associated with these areas include mammals, such as white-tailed deer, coyote, striped skunk, cotton mouse, white-footed mouse, eastern mole, and eastern cottontail rabbit. Bird species include mourning dove, American crow, common grackle, red-winged blackbird, American kestrel, and red-tailed and red-shouldered hawks. Reptiles and amphibians include common garter snake, southern black racer, copperhead, green anole, Gulf Coast toad, southern leopard frog, and box turtle.

The upland forest and pine plantation habitats crossed by the proposed Pipeline Expansion provide habitat for mammals, including white-tailed deer, gray fox, bobcat, coyote, eastern cottontail rabbit, cotton mouse, fox squirrel, raccoon, and opossum. Resident and migratory non-game bird species that use these habitats include barred owl, northern cardinal, wood thrush, pine warbler, and eastern towhee. Avian game species include wild turkey, bobwhite quail, and mourning dove. Small songbirds utilize the forests, thickets, and cut-over areas of the upland forests and pine plantations to rest and feed during migration and, in some cases, breed. Amphibians and reptiles found in forest habitat include box turtle, black rat snake, spotted salamander, southeastern five-lined skink, and spring peeper.

Wetland habitats provide habitat for waterfowl, wading birds, raptors, mammals, reptiles, and amphibians. Typical wildlife associated with these habitats includes wood and mottled ducks; white, great and cattle egrets; great blue heron; red-shouldered hawk; barred owl; red-headed woodpecker; white-tailed deer; nutria; eastern woodrat; swamp rabbit; raccoon; beaver; eastern cottonmouth; diamond-backed water snake; and southern leopard frog.

Riparian habitats include vegetation along banks of waterbodies, both natural and man-made. Similar to wetland habitat types, riparian habitats provide food and water sources, in addition to habitat, for species such as wading birds, waterfowl, beavers, otters, snakes, and other wildlife species dependent on aquatic environments. Waterbodies are addressed in section 4.3.2, while fisheries and other aquatic resources within these waterbodies are discussed in section 4.6.3.

Agricultural lands are frequently disturbed and provide habitat for edge-dwelling species that can either tolerate or thrive on disturbance. Edge habitats are transition zones where two ecosystems come together, such as forested and non-forested cover types. Certain species prefer these transition zones, as they provide certain types of food and cover in one area. Typical wildlife species that use agricultural lands are white-tailed deer, raccoon, striped skunk, coyote, and small mammals such as eastern harvest, cotton, and white-footed mice.

Developed lands provide limited wildlife habitats for species that utilize wooded yards and landscape shrubbery for forage and shelter. Some of these species include songbirds, squirrel, raccoon, and white-tailed deer.

Impacts and Mitigation

Construction of the proposed Pipeline Expansion would temporarily disturb about 284.6 acres of wildlife habitat during construction and permanently affect about 87.5 acres during maintenance of the pipeline right-of-way and aboveground facilities, including the Holbrook Compressor Station, interconnections, and access roads (see table 4.5.1-1). Cameron Interstate would avoid or minimize impacts on riparian habitat by use of the HDD method at all perennial waterbody crossings and use of its Procedures where wet or dry waterbody crossing techniques are proposed.

The impact of construction on wildlife species and their habitats would vary depending on the resource requirements of each species and the existing habitat present along the pipeline route and at aboveground facilities. The greatest effect to wildlife would occur during cutting, clearing, and/or removal of existing vegetation, which would reduce the amount of available habitat within the construction right-of-way and temporary workspaces. The degree of temporary impact would depend on the rate at which vegetation regenerates after construction. Herbaceous and scrub habitats generally revegetate within 4 years of disturbance, while forested areas can take up to 30 years to completely recover.

Clearing of the temporary construction right-of-way would reduce cover, nesting, and foraging habitat for some species and may result in direct mortality for less mobile forms of wildlife, such as small rodents and reptiles. Larger or more mobile wildlife, such as birds and large mammals, would vacate the right-of-way as construction activities approach. Most species would relocate into similar habitats in the vicinity of the proposed Pipeline Expansion facilities. However, if a lack of adequate territorial space exists, some individuals could be forced into suboptimal habitats. This could increase inter- and intra-specific competition and lower reproductive success and survival. That influx and increased density of species in some undisturbed areas could reduce reproductive success of animals that are not displaced by construction. These effects would cease after completion of construction and wildlife could return to the newly disturbed areas and adjacent, undisturbed habitats after right-of-way restoration is completed. Species that use early successional shrub or forest communities may benefit from the clearing and revegetation process, as additional habitat of this type would be created by construction of the proposed Pipeline Expansion. Additionally, non-woody, early successional vegetation may provide seeds and foliage as food for small mammals and birds, as well as habitat for ground-nesting birds, mammals, and reptiles.

In forested areas, construction of the Pipeline Expansion would relocate the edge habitat, as the entire route is adjacent to or near existing cleared rights-of-way, and the frequency of tree blowdowns may increase due the exposure of trees to windier conditions than they are acclimated to. These habitats are used by several wildlife species, such as white-tailed deer and various small mammals. Many species adapt well to this habitat shift and could take advantage of the edge habitats. Predatory species such as red-tailed hawk and coyote commonly use utility rights-of-way for hunting, and other species, such as eastern cottontail, northern bobwhite, mourning dove, eastern meadowlark, white-eyed vireo, white-tailed deer, and American crow, would benefit from the transition to early successional habitat for foraging. During construction, Cameron Interstate would stack cleared timber along the right-of-way at intervals at least 30 feet apart and no more than 4 feet in height to ensure wildlife movement is not impeded.

Although impacts may be advantageous for some species, construction and operation of the Pipeline Expansion would widen existing cleared rights-of-way, which may affect some interior forest species or species that prefer large tracts of unbroken forest. Species that use tree cavities for either roosting or nesting may suffer direct mortality during right-of-way clearing. Additionally, nesting success may be denied or diminished for one annual breeding cycle for adult birds that normally breed in the area but would avoid it during construction activities. The slow regeneration of forested communities within the temporary right-of-way would result in the long-term reduction in forested habitat for species that use these communities; however, abundant similar habitats are available for wildlife adjacent to the proposed Pipeline Expansion corridor. To further reduce impacts on nesting birds during pipeline operation, routine vegetation mowing or clearing would not occur along the entire width of the permanent right-of-way more frequently than every 3 years and routine vegetation mowing or clearing would not occur during the migratory bird nesting season between April 15 and August 1 unless specifically approved in writing by the responsible land management agency or the FWS, in accordance with Cameron Interstate's Plan.

Agricultural lands are areas that are regularly disturbed and would be available for replanting during the next growing season following installation of the pipeline. Therefore, we believe impacts on wildlife that use agricultural lands would be short-term and negligible.

Because Cameron Interstate would collocate the pipeline to overlap with existing rights-of-way as much as possible and would adhere to its Plan and Procedures and other measures discussed in this EIS, we believe construction and operation of the Pipeline Expansion would not substantially affect local wildlife populations. Furthermore, due to the amount of collocation, we do not expect habitat fragmentation to have a significant impact on wildlife populations. Therefore, impacts on wildlife due to construction and operation of the Pipeline Expansion would not be significant.

4.6.1.3 Unique and Sensitive Wildlife Species

Unique or sensitive wildlife species, such as colonial nesting waterbirds and migratory songbirds and waterbirds, may be present in the vicinity of the proposed Project. Federally and state listed threatened and endangered species and other species of concern are discussed in section 4.7.

Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) and Executive Order 13186, including bald and golden eagles, which are also protected under the Bald and Golden Eagle Protection Act. Bald eagles are further discussed in section 4.7. The executive order was enacted, in part, to ensure that environmental analyses of federal actions evaluate the impacts of actions and agency plans on migratory birds. It also states that emphasis should be placed on species of concern, priority habitats, and key risk factors, and it prohibits the take of any migratory bird without authorization from the FWS. The destruction or disturbance of a migratory bird nest that results in the loss of eggs or young is also a violation of the MBTA. Numerous migratory bird species, including colonial nesting waterbirds, waterfowl, and neotropical songbirds, could potentially occupy areas of the proposed Project facilities.

Migratory birds follow broad routes called flyways between breeding grounds in Canada and the United States and wintering grounds in Central and South America, and the Caribbean. Additionally, several species migrate from breeding areas in the north to winter along the Gulf Coast and remain throughout the non-breeding season. The proposed Project is at the western edge of the Mississippi Flyway and the eastern edge of the Central Flyway.

The Central and Mississippi Flyways both terminate at the Gulf Coast, making it one of the most important waterfowl areas in North America. Of the 650 species of birds known to occur in the United States, nearly 400 species occur in the Gulf Coast Migratory Bird Joint Venture area, which is discussed below. The Gulf Coast provides wintering and migration habitat for significant numbers of continental duck and goose populations that use both the Central and Mississippi Flyways. The coastal marshes of Louisiana, Alabama, and Mississippi regularly hold half of the wintering duck population of the Mississippi Flyway (Esslinger and Wilson 2001).

The proposed Project is within the Chenier Plain portion of the Gulf Coast Migratory Bird Joint Venture initiative area. The goal of the Chenier Plain Initiative is to provide wintering and migration habitat for significant numbers of dabbling ducks, diving ducks, and geese, as well as year-round habitat for mottled ducks (Esslinger and Wilson 2001). The Project is also within the Partners in Flight – North American Landbird Plan – Gulf Coastal Plain. The area in the vicinity of the proposed Project provides important breeding habitat for resident birds of conservation concern, such as reddish egret, loggerhead shrike, sandwich tern, and dickcissel, as well as important wintering and stop-over habitat for migratory priority species, such as red knot and prothonotary and Swainson's warblers (FWS 2008). No critical habitat for bald eagles is present in the vicinity of the proposed Project according to FWS element occurrence records, and it is unlikely that a transient bald eagle would use habitat within that area.

The Terminal Expansion site contains marginal habitat for migratory birds, as much of the vegetation has been previously disturbed. The primary migratory birds using the wetland and open water habitats within the proposed Terminal Expansion site are various species of waterfowl and water birds; species are predominantly gadwall, mallard, blue-winged teal, American coot, and various species of egrets and herons. Although wetland habitats in the Terminal Expansion area provide habitat for migratory waterfowl and waterbirds, use of this site is likely limited due to the proximity to and activity associated with LA-27, the Calcasieu Ship Channel, and the existing LNG Terminal. To mitigate this loss, Cameron LNG proposes to create tidal freshwater/intermediate marsh west of the Terminal Expansion site, which would provide additional habitat for migratory waterfowl and various wading/water bird species nearby. Impacts on migratory birds and their habitat within the Terminal Expansion site due to construction and operation would be similar to impacts on general wildlife resources, discussed in section 4.6.1. Therefore, impacts on the abundance of migratory waterfowl and other water birds due to the permanent conversion of these habitats would not be significant.

A variety of migratory bird species, including songbirds and raptors, use the vegetation communities in the vicinity of the Pipeline Expansion route. Representative species are similar to the species that inhabit the area in the vicinity of the Terminal Expansion site. Impacts on migratory birds and their habitat would be similar to impacts on general wildlife resources due to construction and operation of the Pipeline Expansion, as previously discussed. To further reduce impacts on nesting birds during pipeline operation, Cameron Interstate would not conduct routine vegetation mowing or clearing more frequently than every 3 years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline would be cleared at a frequency necessary to maintain an herbaceous state. Cameron Interstate would not conduct routine vegetation mowing or clearing during the nesting season between April 15 and August 1, in accordance with its Procedures.

FWS stated Cameron LNG would not be required to perform migratory bird surveys prior to construction of the Terminal Expansion due to the marginal nature of the habitat (correspondence with FWS dated February 11, 2013). However, Cameron LNG stated it would continue to consult with the FWS regarding potential impacts on migratory birds within the Terminal Expansion site during construction. Prior to construction, Cameron Interstate proposes to perform surveys throughout the Pipeline Expansion right-of-way and other facility workspaces during the nesting season to identify unavoidable migratory bird habitat, such as rookeries and/or nesting colonies. Surveys were conducted by Cameron Interstate in 2012, and no potential or existing rookery sites were identified. Cameron Interstate agreed to file a Migratory Bird Conservation Plan with FWS prior to the commencement of construction. This plan would describe mitigation measures and calculations regarding any compensatory mitigation for unavoidable impacts on migratory birds or their habitat. If unavoidable impacts are discovered during pre-construction surveys, Cameron Interstate would take appropriate measures to avoid impacts in the form of altering construction time windows to ensure active rookeries and nesting sites are not affected and conducting nesting surveys prior to clearing, should clearing be necessary during the nesting season. Because Cameron Interstate has not committed to filing this conservation plan with the Commission, **we are recommending that,**

- **<u>Prior to construction</u>, Cameron Interstate should file with the Secretary for review and written approval by the Director of OEP:**
  - **a. the completed surveys to identify unavoidable bird of conservation concern impacts, such as impacts on rookeries and/or nesting colonies; and**
  - **b. the results of consultation with the FWS, including measures to avoid or minimize impacts on birds of conservation concern and their habitat.**

Because Cameron Interstate agreed to conduct surveys and implement mitigation measures (such as timing of activities) to avoid impacts on migratory birds, we believe impacts on migratory birds would not be significant.

Managed and Sensitive Wildlife Areas

No national wildlife refuges or state wildlife management areas are within or adjacent to the proposed Project. The Sabine National Wildlife Refuge (NWR) and Cameron Prairie NWR are about 6 and 12 miles, respectively, from the Terminal Expansion and no impacts would occur on either of these two refuges. Section 4.8.5 provides further information on these refuges.

The pipeline route would cross private property managed for hunting from MP 10.45 to MP 12.12. This property is owned by Goldsmith Farms and is managed in cooperation with the LDWF for a number of wild game species, including white-tailed deer, feral hogs, wild turkey, and pheasant. Hunting is designated by season for each species and limits are based on surveys conducted by LDWF personnel. In addition to hunting, the property is actively managed for pulp wood production. Given the current management practices, we do not believe construction or operation of the proposed pipeline would adversely affect hunting activities.

4.6.2 Aquatic Resources

4.6.2.1 Terminal Expansion

Existing Aquatic Resources

Surface waters that would be affected by construction of the proposed Terminal Expansion facilities include intertidal estuarine environments that support an estuarine fishery and freshwater ponds that support warm, freshwater fish. Typical recreational fish species that may exist on or near the proposed Terminal Expansion site are listed in table 4.6.3-1. No known commercial fisheries occur within the proposed Terminal Expansion site. Impacts on sensitive fisheries, such as penaeid shrimp and red drum, and EFH are described in section 4.6.4. Impacts on surface waters due to construction and operation of the Terminal Expansion are discussed in section 4.3.2.3.

The aquatic habitat near the proposed work dock is comprised mainly of shallow estuarine bottom, such as unconsolidated subtidal sediment and unconsolidated intertidal flats. Subtidal soft sediments provide feeding habitat for demersal fish, worms, and mollusks living on and in the sediments. Unconsolidated subtidal habitat has been designated as EFH for penaeid shrimp and the snapper/grouper complex of species, which is described in section 4.6.4. All unconsolidated sediments, including subtidal and intertidal areas, in the Calcasieu Ship Channel are considered early successional due to the constant disturbance from maintenance dredging, propeller wash, vessel traffic, and natural sedimentation.

The depth of water near the bank of the ship channel where Cameron LNG would dredge for the work dock is approximately 3.5 feet below MSL. During and after construction, Cameron LNG would maintain the depth between 15 and 16 feet below MSL to facilitate the loading and unloading of barges. Cameron LNG would impact approximately 60.7 acres of open water (two freshwater man-made ponds); one pond would be drained and filled during construction and the other would be used as a stormwater retention basin and may be filled in the future.

TABLE 4.6.3-1 Fish Species Occurring in Waterbodies Affected by the Project [a]		
Common Name	**Project Occurrence**	**Classification**
Alligator gar	Pipeline	Freshwater/Recreational
Red shiner	Pipeline	Freshwater
Blue catfish	Pipeline	Freshwater/Recreational
Channel catfish	Pipeline	Freshwater/Recreational
Flathead catfish	Pipeline	Freshwater/Recreational
Spotted bass	Pipeline	Freshwater/Recreational
Largemouth bass	Pipeline	Freshwater/Recreational
Yellow bass	Pipeline	Freshwater/Recreational
White crappie	Pipeline	Freshwater/Recreational
Black crappie	Pipeline	Freshwater/Recreational
Bowfin	Pipeline and Terminal	Freshwater/Recreational
Western mosquitofish	Pipeline and Terminal	Freshwater
Bluegill	Pipeline and Terminal	Freshwater/Recreational
Blue crab	Terminal	Estuarine/Recreational
Spotted seatrout	Terminal	Estuarine/Recreational
White shrimp	Terminal	Estuarine/Recreational
Brown shrimp	Terminal	Estuarine/Recreational
Red drum	Terminal	Estuarine/Recreational

[a] All waterbodies and fisheries classified as warmwater.

Impacts and Mitigation

We assessed impacts associated with the export of LNG, the use of LNG carriers (including traffic, transit, and ballast water discharges), and LNG spills in our previous EIS and two EAs for the existing Cameron LNG Terminal (see section 2.1.1). Cameron LNG is not proposing to increase its authorized number or size of LNG carriers, and the associated impacts would not change; therefore, these activities are not addressed in this EIS. However, we note that ballast water management requirements have changed since those reviews were conducted. LNG captains would be required to comply with 33 CFR 151.2025 (Ballast Water Management Requirements), which offer more options than previous requirements and are more stringent than previous requirements. As a result, our earlier assessments of potential impacts due to ballast water exchange remain appropriate.

Work Dock

Construction of the proposed Terminal Expansion requires dredging of approximately 205,000 cubic yards of material from a 9.4-acre area and sheet piling/pile driving activities to construct a work dock near the existing LNG terminal berthing area. Cameron LNG would construct the work dock approximately 375 feet from the edge of the maintained portion of the Calcasieu Ship Channel.

Cameron LNG would use a vibratory hammer to install sheet piling and dock piles on land near the bank of the Calcasieu Ship Channel. Once the dock sheet piling and piles are installed, the berthing area would be dredged to attain the desired water depth of 15 to 16 feet below MSL. Therefore, no sheet piling or pile driving activities would be conducted within the water column. However, the occurrence of these activities near the water could generate underwater sound pressure waves that can adversely affect nearby marine organisms, including fish. Dredging and the installation of the pilings for the dock could cause rapid concussive noise underwater. Depending on the sound frequency and intensity associated with this activity, it could cause a change in aquatic species behavior in proximity to the work dock area or could cause species to avoid the area. Underwater noise levels are commonly referred to as a ratio of the underwater sound pressure to a common reference pressure of 1 micropascal (µPa) root mean-square pressure, which is expressed in decibels (dB) of sound intensity as dB re: 1 µPa. There are insufficient peer reviewed reliable data available for the onset of behavior disturbance in fish; however, as a conservative measure, NMFS generally uses 150 dB re: 1 µPa as the threshold for behavior effects to fish species of particular concern, citing that noise levels in excess of 150 dB re: 1 µPa can cause temporary behavior changes (startle and stress) that could decrease a fish's ability to avoid predators. The current interim thresholds protective of injury to fish are 206 dB re: 1 µPa (peak) and 187 dB re: 1 µPa (cumulative) sound exposure levels (SELs) for fish 2 grams or greater, and 183 dB re: 1 µPa (cumulative) SEL for fish of less than 2 grams (ICF 2009).

Construction noise levels underwater would be greatest during dredging activities which are estimated to be between 172 and 185 underwater dB re: 1 µPa at 1 meter and would attenuate rapidly with distance (Central Dredging Association [CEDA] 2011). Although noise levels would be above the threshold for changes in fish behavior, these levels would not exceed the threshold for injury or mortality on species. Additionally, installing the pilings on land would reduce noise impacts because the ground would dissipate the sound generated from the hammer to noise levels well below 150 dB re: 1 µPa. Based on Cameron LNG's proposed construction methods, aquatic species behavior may be impacted, but these species would likely move out of the area temporarily during dredging and return once construction activities have ceased. Therefore, we believe that impacts on aquatic species from noise would be temporary, localized, and not significant.

During construction of the work dock, additional lighting and noise would be present at the construction site. However, aquatic species in the area are likely acclimated to the current ambient noise and light, due to the industrial nature of the Calcasieu Ship Channel. Therefore, impacts on aquatic species due to nighttime lighting and industrial noise during construction and operation would be negligible when taking into account the proximity of the existing LNG terminal to the work dock and the existing environment of the area. Furthermore, Cameron LNG would direct any nighttime lighting on the activity being conducted to ensure the safety of workers and minimize impacts on aquatic species.

Cameron LNG proposes to use a hydraulic suction dredge during construction of the work dock facilities. The construction activities related to these facilities could result in siltation at the water's edge and temporarily increase turbidity and suspension of solids within the water column. Increases in turbidity can affect fish physiology and behavior. Potential physiological effects include mechanical abrasion of surface membranes, delayed larval and embryonic development, reduced bivalve pumping rates, and interference with respiratory functions. Possible behavioral effects from increased turbidity include interference with feeding for sight-foraging fish and area avoidance. Alternately, the reduced visibility of predatory fish could lower vulnerability to predation for prey species. Turbidity also interferes with light penetration and thus reduces photosynthetic activity by phytoplankton. Such reductions in primary production would be localized around the immediate area of the work dock and would be limited to the duration of the sedimentation plume at the dock. Because the Calcasieu Ship Channel has a naturally high suspended sediment load, we believe the increase in suspended sediments typically created by a hydraulic suction dredge would not be significant. Because Cameron LNG would be using a type of suction dredge, the amount of suspended sediment would be less than that resulting from use of a traditional clam shell dredge. Therefore, the potential effects of increased suspended sediments to aquatic species would be minor due to the condition of the existing environment and the methods used for dredging. Further, construction of the work dock would require only 4 weeks of active dredging. Therefore, we conclude that the impacts on aquatic species would be temporary, and species could return to the area following construction.

Excessive nutrient loading from sediment resuspension could have an adverse impact on the Calcasieu Ship Channel because it could cause dramatic increases in the productivity of planktonic algal populations. The particles that would resuspend as a result of dredging are fine silt and clay. Cameron LNG would comply with all requirements of its joint CWA 404 permit and CUP to minimize the suspension of sediments. In addition, Cameron LNG proposes to implement the BMPs in its Environmental Plan to mitigate increases in turbidity, such as using containment and diversion dikes and turbidity curtains. Cameron LNG would also conduct water sampling before and throughout dredging operations to ensure that standards specified in the previous COE permit would not be exceeded for total suspended solids or dissolved oxygen. In general, the impacts of dredging on turbidity are expected to be localized, temporary, and minor. Furthermore, impacts would be similar to those that result from the current maintenance dredging conducted by the COE in the Calcasieu Ship Channel. Based on previous dredging activities conducted during the construction of the berthing slip for the existing LNG terminal, the temporary increase in turbidity and total suspended solids would have limited adverse impacts on aquatic species near the work dock construction area.

Dredging activities would affect the shallow estuarine bottom, in addition to the water column. Benthic organisms, such as mollusks and crustaceans, may experience direct mortality during these activities, while other more mobile species, such as blue crab, may experience temporary displacement. While the construction-related impacts would be greatest on the benthic community within the dredging area, impacts on saltwater fish species, such as red drum and spotted seatrout, would also occur, but would be localized and temporary. Due to the relatively small area of direct impact (9.4 acres) and the short duration of dredging, these species and other similar species would be temporarily displaced and could return upon completion of construction of the work dock. Although the benthic community would be directly affected, these communities generally re-populate within 1 year (Minerals Management Service [MMS] 2004); therefore, the impacts from dredging for construction of the work dock on the benthic community would be short-term and minor.

Potential impacts from introduction of invasive species due to barges and support vessels using the work dock could affect aquatic species in the area. However, vessels calling on the work dock during construction and operation would be barges and tugs that would not discharge ballast water. In addition, mostly local vessels would be used during construction of the Terminal Expansion and the potential for invasive species introduction via hull attachment on these vessels would be negligible. Therefore, we do not anticipate impacts associated with the introduction of invasive species during construction of the Terminal Expansion. During operation, barges would only deliver supplies when necessary or to facilitate maintenance dredging in the berthing and work dock areas and perform maintenance activities associated with the expanded terminal.

Barge movements and the movements of support vessels and other supply vessels during construction and operation of the Terminal Expansion are not expected to substantially increase shoreline erosion, benthic sediment disturbance, or prop scarring in the immediate area. These occurrences are not expected primarily because the vessels are slow moving and do not create substantial wakes. Some benthic sediment disturbance could occur when the barges are offloading at the work dock; however, the major increase in barge traffic would be short-term, lasting for about the first 14 months of construction. In addition, vessel groundings are not likely due to the slow movement of the barges. We conclude that impacts associated with increased barge traffic on aquatic species would not be significant.

Operational impacts would occur during maintenance dredging of the work dock. These impacts would be similar to those discussed for construction dredging of the work dock, such as increased turbidity and decreased water quality during dredging. Cameron LNG would comply with all state and federal requirements to minimize the suspension of sediments according to its CUP. In addition, Cameron LNG would perform maintenance dredging at the same time the COE performs maintenance dredging in the Calcasieu Ship Channel. This would reduce the number of times that aquatic species would be affected by increased suspended sediment loads. Because turbidity that would occur during maintenance dredging for the work dock would be localized and temporary, we believe impacts on fisheries in or near the work dock area would not be significant.

Freshwater Pond Fill

Construction of the Terminal Expansion facilities would involve draining and filling of one of the freshwater pond basins and use of the second pond as a stormwater retention basin that may be filled in the future. The impacts associated with filling these ponds during construction or operation of the proposed Terminal Expansion would be permanent. The freshwater ponds are man-made and were stocked with warmwater fish species for recreational purposes by the former landowner. Fish within these ponds would suffer mortality. However, because these freshwater ponds are not naturally occurring and the fish present are not endemic to the basins, we do not believe these impacts would be significant.

Hydrostatic Testing

Cameron LNG would hydrostatically test the facility piping and the new LNG storage tank, which would require water from an on-site well and discharge into the Calcasieu Ship Channel upon completion. Hydrostatic testing is discussed in more detail in section 4.3.2.3. The discharge of hydrostatic test water could cause localized turbidity at the end of the discharge hose or pipe. However, to minimize the potential impacts related to this activity, Cameron LNG would sample, test, and discharge all hydrostatic test water in accordance with its discharge permit and the Cameron LNG Environmental Procedures. In addition, Cameron LNG would not add chemicals to the water, and energy dissipation devices would be used. We conclude that impacts on aquatic resources from hydrostatic testing would be temporary and negligible with the use of these preventative measures.

Inadvertent Spills

To minimize the potential for petroleum or hazardous materials spills from land equipment or vessels berthed at the work dock during construction and operation, Cameron LNG would implement its spill procedures, which include spill prevention and response guidelines, in accordance with its Environmental Plan. Cameron LNG would revise its existing Terminal SPPC plan to include the expanded terminal facilities and would implement the procedures in the revised plan during operation. Both the Environmental Plan and the Terminal SPCC plans include guidelines to reduce response time in the event of a release and expedite an efficient cleanup. Based on the implementation of these procedures by Cameron LNG, we believe impacts on aquatic species due to inadvertent releases would be minimized.

4.6.2.2 Pipeline Expansion

Existing Aquatic Resources

The Pipeline Expansion would cross 27 waterbodies (with one waterbody crossed twice) and one pond, for a total of 29 waterbody crossings. Appendix F provides a list of the waterbodies crossed, the proposed crossing method, and the fishery classification for each. All the waterbodies crossed by the proposed route may support warm, freshwater fisheries. The representative fish species present in the waterbodies that would be crossed by the pipeline route are presented in table 4.6.3-1.

No known commercial fisheries occur within the vicinity of the pipeline route. The majority of recreational fishing along the proposed route occurs in the Houston and Little Rivers, Beckwith Creek, and Hickory Branch. The smaller intermittent and ephemeral streams along the pipeline route do not support warmwater fisheries. Some of the larger intermittent waterbodies could support fish during the periodic inundation that occurs seasonally or after large precipitation events. However, due to the sporadic periods of inundation, the intermittent and ephemeral waterbodies crossed by the proposed pipeline are unlikely to sustain fishery resources. No sensitive fish species, fisheries of concern, or EFH have been identified within the waterbodies crossed by the route.

Impacts and Mitigation

Waterbody Crossings

Impacts on fisheries resulting from pipeline construction activities at waterbody crossings could include sedimentation and turbidity, alteration or removal of instream and stream bank cover, introduction of water pollutants, or entrainment of small organisms during withdrawal of hydrostatic test water. Studies generally indicate 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).

Cameron Interstate proposes to cross 14 waterbodies using the open-cut method, five using the dry-ditch method (dam-and-pump or flume crossing), one by a conventional bore in conjunction with a road crossing, and nine waterbodies using the HDD method (see section 2.6.3 and Appendix F). Cameron LNG proposes to cross all perennial waterbodies by the HDD method, thereby minimizing construction impacts on fisheries. Using the HDD method would minimize vegetation clearing adjacent to the waterbody, as well as eliminate trenching directly in the stream or river bed. The use of the HDD method would avoid impacts on fisheries during construction unless an instream inadvertent return occurred. An instream inadvertent return would impact water quality and could impede fish movement due to the release of drilling fluid into the waterbody, potentially increasing the rates of stress, injury, and/or direct mortality experienced by fish. If an inadvertent return occurs, Cameron Interstate would implement the cleanup and mitigation measures outlined in its HDD Contingency Plan (Appendix C), such as the use of hay bales, silt fencing, and other containment materials to prevent the fluid from reaching a waterbody, and the construction of pits and berms around the borehole entry to contain any inadvertent releases.

An open-cut crossing would result in short-term increases in turbidity and siltation downstream of the pipeline crossing sites. The concentration of suspended solids would decrease rapidly after the completion of instream work, but the increased siltation may cause degradation of benthic and spawning habitat and decreased flow of oxygenated water to benthic organisms and fish eggs. Direct loss of spawning habitat, benthic invertebrates, and protective cover may occur at the pipeline crossing location due to trenching and backfilling within the stream or river bed. However, any sedimentation and turbidity resulting from construction would be temporary. Where feasible, waterbody crossings would occur during periods of low or no flow. Cameron Interstate would construct all waterbody crossings in accordance with the construction and mitigation measures in its Procedures, which requires completion of most instream work within 24 hours for waterbodies 10 feet wide or less, and within 48 hours for streams between 10 and 100 feet in width (Appendix C).

Cameron Interstate's open-cut construction would require clearing of streamside vegetation, which may result in reduced shading and possible increased water temperatures in localized areas of the stream. However, stream bank clearing would be adjacent to existing rights-of-way, which would minimize changes in water temperature because much of the vegetation adjacent to the waterbodies is already being maintained in a low-growing, herbaceous state and is not providing shade over the waterbodies. Cameron Interstate would adhere to its Plan and Procedures to restore vegetation post-construction to minimize potential stream bank erosion and siltation of the waterbody. To provide greater protection for warmwater fisheries, the Cameron Interstate Procedures also require that construction activities within waterbodies take place between June 1 and November 30 unless expressly permitted by the appropriate state agencies in writing on a site-specific basis.

Using the dry-ditch method (either flume or dam-and-pump) rather than an open-cut crossing reduces turbidity and downstream sedimentation during construction; however, minor aquatic habitat alteration could occur. Temporary impediments to flow, such as the dam structures or flume pipes, as well as loss of habitat, water temperature increases from removal of riparian vegetation, and/or the alteration of water quality could increase the rates of stress, injury, and/or mortality experienced by fish.

Use of the Cameron Interstate Procedures would reduce impacts on fisheries from construction-related sedimentation and turbidity (Appendix C). For all crossing methods, excavated material would be stored within the right-of-way on or above the stream banks at least 10 feet from the water's edge. Cameron Interstate would install temporary erosion control devices around piles of excavated material to minimize the potential for sediment-laden water to enter the stream. Additionally, all staging and temporary workspace areas would be at least 50 feet from the water's edge where topographic conditions permit (unless otherwise permitted), thus minimizing the potential for erosion and sedimentation along the stream banks. Impacts on water quality from open-cut and dry-ditch crossings would be temporary and suspended sediment concentrations would return to pre-construction levels soon after crossings are completed. With implementation of the Cameron Interstate Procedures, we believe these temporary and localized impacts on fish and other freshwater aquatic organisms would be minimal.

Hydrostatic Testing

Hydrostatic testing of the pipeline would be conducted to ensure the integrity of the installed pipe. All hydrostatic test water for the pipeline would be withdrawn from the Houston River. The water withdrawal process could entrain fish eggs and juvenile fish. To minimize the potential for this impact, Cameron Interstate would cover the intake hose with an adequately-sized mesh screen. During withdrawal, Cameron Interstate would maintain flow rates in the river that are adequate to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users. Cameron Interstate would also sample, test, and discharge all hydrostatic test water in accordance with its state discharge permit and its Procedures. Therefore, impacts on fish species due to hydrostatic testing would be temporary and negligible. Hydrostatic testing is discussed in further detail in section 4.3.2.3.

Inadvertent Spills

Water quality could be adversely affected by an accidental spill of hazardous material into or near a waterbody. Adherence to the spill prevention measures in the Cameron Interstate Environmental Plan, such as prohibiting refueling or storage of hazardous materials within 100 feet of waterbodies, would minimize the potential for releases to occur. Should a spill occur, implementation of the response measures in the Cameron Interstate Environmental Plan would reduce response time and ensure appropriate cleanup, therefore minimizing impacts on aquatic species.

4.6.3 Essential Fish Habitat

The MSFCMA, as amended in 1996, was established, along with other goals, to promote the protection of EFH in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined in the MSFCMA as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. All estuaries and estuarine habitats in the northern Gulf of Mexico are considered EFH (GMFMC 1998).

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

- Notification – The action agency should clearly state the process being used for EFH consultations (e.g., incorporating EFH consultation into the EIS).
- 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 should include: a description of the proposed action; an analysis of the effects (including cumulative effects) of the proposed action on EFH, the managed fish species, and major prey species; the Federal agency's views regarding the effects of the action on EFH; and proposed mitigation, if applicable.
- EFH Conservation Recommendations – After reviewing the EFH Assessment, NMFS would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.
- Agency Response – The action agency must respond to NMFS within 30 days of receiving recommendations from NMFS. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH.

The FERC proposes to incorporate EFH consultations for the Terminal Expansion facilities with the interagency coordination procedures required under NEPA. As such, we are requesting that NMFS consider the EIS as initiation of EFH consultation.

Only impacts associated with the proposed construction and operation of the Terminal Expansion are discussed in this section. The FERC previously prepared an EIS and two EAs to assess construct and operation impacts from the existing Cameron LNG Terminal on EFH and EFH species (see section 2.1.1). As a part of those environmental assessments, in 2003 the FERC consulted with NMFS regarding EFH for construction of the original LNG Terminal on dredging the berthing area, loss of estuarine emergent wetlands within the terminal footprint, filling of tidal creeks and marsh ponds, accidental releases of LNG, and the number of LNG carriers and transit routes. We determined and NMFS agreed that based on the implementation of conservation measures and the compensatory mitigation plan developed by Cameron LNG, no substantial adverse impacts on EFH or EFH species would occur due to the construction and operation of the Cameron LNG Terminal. The FERC then consulted with NMFS on the 2006 expansion of the existing terminal which included additional dredging, additional LNG carrier traffic, loss of estuarine emergent wetland, and accidental releases of LNG. We determined and NMFS agreed that based on the compensatory mitigation proposed by Cameron LNG, no net uncompensated impacts would occur on EFH and, therefore, no significant long-term impacts would occur. In 2010, the FERC consulted with NMFS regarding EFH for approval to export LNG from the existing terminal, which included ballast water discharges from LNG carriers while loading. We determined and NMFS agreed that no impacts on EFH would occur due to ballast water discharge, as all LNG carriers would adhere to Coast Guard regulations requiring an open ocean ballast water exchange. The impacts of LNG spills are not addressed in this EIS for the following reasons: (1) LNG spills were fully assessed in our previous consultations, assessments, authorizations for export of LNG, and (2) Cameron LNG is not requesting to increase its authorized number or size of LNG carriers (including traffic, transit, and ballast water discharges).

4.6.3.1 EFH Characterization

NMFS and the GMFMC have identified the Calcasieu Ship Channel and adjacent coastal marsh as EFH for multiple recreational and commercial marine species. The EFH that may be affected by the proposed Terminal Expansion includes estuarine water bottoms (soft bottom sediment) and estuarine water column. The estuarine water bottom habitat in and near the work dock area is comprised of sub-tidal unconsolidated sediments. This EFH type serves as important nursery and feeding areas for many fish and invertebrates, including demersal fish that eat worms and mollusks living on and in the sediments. The community composition of the estuarine water bottom and column habitat within the Calcasieu Ship Channel remains in an early successional stage due to regular disturbance from the COE's 2-year maintenance dredging program, Cameron LNG's maintenance dredging at the berthing facilities of its existing terminal, propeller wash from passing vessels, and natural sedimentation. Estuarine water column habitat serves as EFH for several species and their prey at various life stages by providing habitat for spawning, breeding, and foraging. Fish communities within the water column are determined by factors such as salinity, temperature, dissolved oxygen, and are acclimated to the level of disturbance activity within the Calcasieu Ship Channel.

EFH species listed for the Project area include brown shrimp, white shrimp, red drum, the snapper/grouper complex, coastal migratory species, and highly migratory species. Although certain life stages for each of these species inhabit estuaries and some of the prey species are estuarine dependent, there are many other estuaries in the area to provide alternative habitat that contain appropriate prey species. In addition, the species are all mobile and could avoid most direct impacts during construction and operation and use other habitat nearby. Based on review of available literature and previous and on-going projects conducted in and near the Terminal Expansion area, we believe the proposed Terminal Expansion would have no adverse impacts on species within the snapper/grouper species complex, the coastal migratory species in the area, such as cobia and mackerel, or the highly migratory species in the area. All highly migratory species (which include 5 species of tuna, 5 species of billfish, and 25 species of shark) are considered pelagic and would not be present within or near the project area with the exception of the bull shark. Although the bull shark could be present in the area because the species uses estuarine habitat as a nursery for juveniles, bull sharks are very mobile and would likely avoid the area during construction. Therefore, their presence in the vicinity of the Project during construction is not likely, and we believe there would be no adverse effects to these species. These species/complexes are not addressed further in this EIS.

Species and life-stages which may be present within the Terminal Expansion area during construction and/or operation due to their use of EFH in the area are listed in table 4.6.4-1.

TABLE 4.6.4-1 EFH Species In Waterbodies Affected by the Terminal Expansion			
Common Name	**Scientific Name**	**Life Stages in Estuarine Habitat**	**Comment**
Brown shrimp	*Penaeus aztecus*	Post-larval, juvenile	EFH present within project vicinity
White shrimp	*Penaeus setiferus*	Post-larval, juvenile	EFH present within project vicinity
Red drum	*Sciaenops ocellatus*	Larval, juvenile, sub-adult	EFH present within project vicinity

4.6.3.2 EFH Species Descriptions

Brown Shrimp

Brown shrimp eggs and larvae inhabit offshore marine environments where spawning takes place. The eggs are demersal and the larvae are planktonic. Brown shrimp begin to migrate to estuarine habitats as post-larvae, migrating on flood tides at night from February through April. The juvenile stage occurs within estuarine habitats and post-larval and juvenile brown shrimp are common to highly abundant in all Gulf of Mexico estuaries from Apalachicola Bay in Florida to the Mexican border, although they are generally not present between December and February. They are typically associated with shallow vegetated habitats, silty sand, and non-vegetated mud bottom where salinities range from 0 to 70 parts per thousand. The densities of post-larval and juvenile brown shrimp are highest in marsh edge habitat and submerged vegetation. At maturity, the juveniles migrate back to ocean waters. Larval brown shrimp feed on phytoplankton and zooplankton; post-larvae feed on epiphytes, phytoplankton, and detritus; and juveniles and adults prey on polychaetes, amphipods, chironomid larvae, algae, and detritus (Gulf of Mexico Fisheries Management Council [GMFMC] 1998).

White Shrimp

White shrimp eggs and larvae inhabit nearshore marine waters. The eggs are demersal and the larvae are planktonic. Post-larvae migrate into estuarine habitats from May through November, with peaks occurring June through September. After entering the estuaries, post-larval white shrimp become benthic and typically inhabit shallow water estuarine habitats on muddy-sandy substrates with high organic detritus content or estuarine marsh habitats and they are generally present year-round. Densities of post-larval and juvenile white shrimp are usually highest in marsh edge and submerged aquatic vegetation habitats. Juveniles are common to highly abundant in all Gulf of Mexico estuaries from Texas to the Suwannee River in Florida. When they reach maturity, they migrate from estuarine habitats back to marine habitats in late August and September. Larval white shrimp feed on phytoplankton and zooplankton; post-larvae feed on epiphytes, phytoplankton, and detritus; and juveniles and adults prey on polychaetes, amphipods, chironomid larvae, algae, and detritus (GMFMC 1998).

Red Drum

In the Gulf of Mexico, red drum occur in a variety of habitats, ranging from water depths of about 130 feet (40 meters) offshore to very shallow estuarine waters. Red drum can tolerate salinities ranging from freshwater to highly saline. They commonly occur in nearly all estuaries of the Gulf of Mexico year-round where they are present over a variety of substrates, including sand, mud, and oyster reefs. Estuarine wetlands are especially important as nursery habitat for larval, juvenile, and sub-adult red drum, and are also important habitat for the prey species of all life stages. Larval red drum prey on mysids, amphipods, and shrimp, whereas larger juveniles feed on crabs and fish. Crustaceans, including shrimp and crabs, and fish are the most important prey items in the adult red drum diet (GMFMC 1998).

4.6.3.3 Project Activities Potentially Affecting EFH

The Pipeline Expansion would not impact EFH. Cameron LNG would conduct the majority of the construction activities for the Terminal Expansion on land as discussed in section 2.3. With implementation of Cameron LNG's Plan and revised SPCC Plan, we believe the potential for land-based activities to affect EFH or EFH species would be negligible; therefore, this EFH assessment focuses on activities associated with the work dock and vessels calling on the dock.

During construction of the work dock, Cameron LNG would drive sheet piling and dock piles on land prior to dredging the work dock area up to the location of the sheet pilings. No sheet pilings or dock piles would be driven directly into the water. After installation of the piles, Cameron LNG would dredge and maintain the area underneath and around the work dock to a depth of 15 to 16 feet below MSL. Approximately 205,000 yd^3 of sediment would be removed from a 9.4-acre area during construction (figure 2.2-1). Up to about 275 barges per month (about 9 or 10 per day) would use the work dock during the first 7 months of construction of the Terminal Expansion, decreasing to about 125 per month (about 4 per day) in months 10 through 14 of construction, and further decreasing after that to about 1 barge every 3 days through the end of construction of the Terminal Expansion in July 2018. During operation of the expanded terminal, barge deliveries would be made at the work dock for various maintenance activities.

Other Project-related activities with the potential to affect EFH include: runoff from the expanded terminal (see section 4.3.2.2); discharge of hydrostatic test water into the channel (see sections 4.3.2.2 and 4.6.3); an accidental release of petroleum products during construction (see sections 4.3.2.2 and 4.6.3); exacerbation of shoreline erosion due to vessel wakes (see section 4.1.3.6); and increased sound levels and lighting at the work dock area (addressed below). The potential effects of these activities on EFH or EFH species are discussed below.

4.6.3.4 Impact and Mitigation

As shown in table 4.6.4-1, life stages were identified for the three EFH species that could potentially be affected by aspects of construction and operation of the proposed Terminal Expansion. No spawning occurrences or habitat, egg stage, or habitat for adults for any of the three species would be affected by the Terminal Expansion, as those life stages take place farther offshore than the construction or operation area.

All phases of construction and operation of the work dock could affect EFH or EFH species, but dredging would present the greatest potential impact. Dredging would cause sediment suspension and turbidity temporarily, lowering the water quality within a localized area surrounding dredging activities. As discussed in section 4.6.3, increases in turbidity can adversely affect fish physiology and behavior, resulting in less healthy individuals, reductions in fecundity, and reduced foraging. However, Cameron LNG would minimize sedimentation through the use of a cutterhead dredge, as discussed in section 4.6.2. Furthermore, the Calcasieu Ship Channel has naturally high suspended sediment loads and active dredging at the work dock would take approximately 4 weeks. Therefore, the increase in turbidity due to dredging of the work dock area would be minor compared to the existing environment. Increased turbidity would also be temporary during active dredging and localized to the immediate area surrounding the work dock. Habitat would revert back to normal conditions after construction. All three managed EFH species could be present during the 4 weeks of active dredging; however, based on the mitigation measures proposed (i.e., use of a cutterhead dredge and limited duration of dredging), the existing environment, and the timing of construction of the work dock, the impacts of dredging on EFH or EFH species in the water column would be temporary and minor. In addition, Cameron LNG would place dredge material in its mitigation site at an elevation sufficient to create tidal freshwater/intermediate marsh, providing additional habitat for EFH species.

Another aspect of dredging activities that could affect EFH or EFH species is disturbance of the estuarine water bottom habitat within the proposed work dock area. Within the first few days after completion of dredging operations, the benthic community would be reduced in species richness, species abundance, and biomass through direct mortality. This would reduce the amount of prey available for all three EFH species within the proposed work dock area; however, polychaetes, oligochaetes, and other similar species would quickly re-colonize disturbed areas following dredging. Through natural processes and rapid population growth, these species take advantage of unoccupied space in newly exposed sediments (MMS 2004). We anticipate that, based on published data, dredging would result in a negligible temporary impact on the benthic community. Therefore, impacts on EFH species would also be negligible, as the species could forage in other nearby EFH areas and return to the work dock area after repopulation of the prey base.

Dredging and the installation of the pilings for the dock could cause rapid concussive noise underwater. Depending on the sound frequency and intensity associated with this activity, it could cause a change in aquatic species behavior in proximity to the work dock area or could cause species to avoid the area. Underwater noise levels are commonly referred to as a ratio of the underwater sound pressure to a common reference dB re: 1 μPa as discussed in section 4.6.3. Construction noise levels underwater would be greatest during dredging activities which are estimated to be between 172 underwater dB and 185 underwater dB re: 1 μPa at 1 meter and would attenuate rapidly with distance (CEDA 2011). Although noise levels would be above the threshold for changes in fish behavior, these levels would not exceed the threshold for injury or mortality on species. Additionally, installing the pilings on land would reduce noise impacts because the ground would dissipate the sound generated from the hammer to noise levels well below 150 dB re: 1 μPa. Based on Cameron LNG's proposed construction methods, EFH species behavior may be impacted, but these species would likely move out of the area temporarily during dredging and return once construction activities have ceased. Therefore, we believe that impacts on EFH species from noise would be temporary, localized, and not significant.

During construction of the work dock, additional lighting would be installed and used at the construction site. However, aquatic species in the area are likely acclimated to the current ambient light from the existing Cameron LNG Terminal and the industrial nature of the Calcasieu Ship Channel. Therefore, impacts on EFH species due to nighttime lighting during construction would be minor when taking into account the proximity of the existing LNG terminal to the work dock, and the existing environment. Certain EFH species may be drawn to light that bleeds outside the immediate construction area and may be subject to increased predation. However, we do not believe impacts at the population level would occur. Furthermore, Cameron LNG would direct any nighttime lighting on the activity being conducted to ensure the safety of workers and minimize impacts on FEH species.

The increase in barge traffic at and near the work dock during construction would result in a short-term increase in vessel traffic and noise in the area. During operation, barges would only deliver supplies when necessary or to facilitate maintenance dredging in the berthing and work dock areas. Barge movements and the movements of support vessels and other supply vessels are not expected to substantially increase shoreline erosion, benthic sediment disturbance, or prop scarring in the immediate area, primarily because the vessels are slow moving and do not create substantial wakes. Some benthic sediment disturbance could occur when the barges are offloading at the work dock; however, the major increase in barge traffic would be short-term, lasting for about the first 14 months of construction. Underwater noise generated by large vessels calling on the work dock is estimated to be between 180 and 190 dB re: 1 μPa at 1 meter and would attenuate rapidly with distance (CEDA 2011). Noise would be greatest during vessel transport to the work dock. However, noise would attenuate at a faster rate during vessel movement, and species would be subjected to the noise for a short period of time as the vessels pass. Vessels moored at the dock would produce noise during engine start up and if idling. Idling noise would be lower as the propeller would not be in use. Noise levels of vessels calling on the work dock would be similar to the noise currently generated by vessels transiting the Calcasieu Ship Channel. Based on these considerations, we conclude that impacts associated with increased barge traffic and noise on EFH and EFH species would be consistent with current vessel traffic noise occurring in proximity to the Terminal Expansion and would not be significant.

Hydrostatic testing of the Terminal Expansion piping and the storage tank would require water to be withdrawn from an on-site well and not directly from the channel; therefore, no impacts on EFH would result from water intake for this purpose. Discharge of the freshwater hydrostatic test water could cause localized turbidity and minor changes of the salinity and temperature. Cameron LNG would not add any chemicals to the test water. Cameron LNG would conduct discharges in accordance with its discharge permit and the FERC Procedures through the use of energy dissipation devices onto land prior to entering the ship channel. Use of these measures would result in temporary and negligible impacts on EFH and EFH species in the form of minimal water and sediment disturbance during discharge, and the impact would dissipate shortly after completion of hydrostatic discharge activities. Section 4.3.2 provides additional information on hydrostatic testing for the proposed Terminal Expansion.

During and after construction, the conversion of land to impervious surface areas at the Terminal Expansion site would result in an increased volume of stormwater runoff, which could create changes in salinity, temperature, and/or dissolved oxygen in the area surrounding discharges. Cameron LNG would modify the existing stormwater management system to accommodate runoff from the expanded terminal, and update its existing LPDES Industrial

Discharge Permit. All stormwater leaving the expanded site would be directed to and discharged through permitted outfalls or leave the site as sheetflow. Cameron LNG would also maintain a 150- to 200-foot-wide vegetation buffer between the work dock and the northern boundary of the Terminal Expansion along the Calcasieu Ship Channel during construction and operation, which would dissipate and filter stormwater runoff. Impacts from increased stormwater runoff are expected to occur only during storm events and have a negligible impact on water quality.

To minimize the potential for petroleum product spills during construction and operation, Cameron LNG would implement spill prevention procedures and clean-up measures in its Environmental Plan, which includes spill prevention and response guidelines. The implementation of these procedures would minimize response time and ensure appropriate cleanup actions are taken in the event of a spill. Therefore, we believe impacts from a spill would be minimized.

4.6.3.5 EFH Conclusions

Although construction of the work dock would involve permanent conversion of estuarine sub-tidal bottom habitat to deep water habitat and direct mortality to benthic organisms, the deepened area would recolonize with soft-bottom benthic organisms soon after completion of dredging, providing a prey base for EFH species (MMS 2004). This temporary impact would re-occur with regular maintenance dredging along with elevated turbidity events associated with maintenance dredging scheduled to occur every 2 years in conjunction with the COE dredging schedule. These events represent a minor increase in the already periodic nature of elevated turbidity due to ongoing maintenance dredging throughout the Calcasieu Ship Channel. The area temporarily affected for construction and operation of the work dock would be negligible in terms of the two types of EFH in the area when taking into account the amount of similar sub-tidal and deep water habitat available in the immediate vicinity.

To minimize impacts from dredging on EFH and EFH species, Cameron LNG would use a cutterhead dredge for initial and maintenance dredging. Dredged materials would be beneficially used at existing disposal sites and in Cameron LNG’s marsh mitigation area, rather than placed back into the estuary in the vicinity of the Terminal Expansion site. Cameron LNG would also adhere to its Environmental Plan, which includes spill prevention and response procedures to reduce response and clean-up time in the event of an accidental release.

Impacts on brown shrimp and white shrimp would be limited to the post-larval and juvenile stages, as both stages occur in estuaries similar to the habitat present at the work dock site. Brown shrimp are present year-round, while white shrimp are present in the estuary between March and November. Direct mortality could occur during active dredging; however, individuals are mobile and many could avoid the construction area. After dredging, and until conditions are conducive for repopulation, individuals would use areas with suitable EFH. Impacts from each of the construction activities discussed above are expected to be temporary. Impacts on the prey species of white and brown shrimp and EFH would also be temporary and localized due to Cameron LNG’s construction methods and mitigation measures. We do not anticipate any substantial adverse effects on white or brown shrimp.

Red drum, at any life stage, occur year-round in estuaries associated with the Gulf of Mexico. Larval, juvenile, and sub-adult red drum are likely to be present in the Calcasieu Ship

Channel throughout construction and operation of the Terminal Expansion. Direct mortality could occur during active dredging; although individuals would likely avoid the area during construction of the work dock and use other EFH areas nearby. Operation of the Terminal Expansion would not likely impede population growth of red drum in the area. As discussed above, prey species for red drum would re-colonize quickly after construction and dredging are completed. In addition, impacts from each of the construction activities discussed above and potential operational impacts are expected to be temporary. Therefore, we do not anticipate any substantial adverse effects to the red drum.

Based on this information, we believe effects on EFH and EFH species in and near the construction area of the Terminal Expansion would be localized and temporary especially when compared to the everyday industrial use of the Calcasieu Ship Channel. Therefore, the Project would not have a substantial adverse impact on EFH or EFH species in the area.

4.7 THREATENED, ENDANGERED AND OTHER SPECIAL STATUS SPECIES

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species that are protected under the ESA, as amended, or are considered as candidates for such listing by the FWS or NMFS, and those species that are state-listed as threatened, endangered, or other special status.

Federal agencies, in consultation with the FWS, are required by Section 7(a)(2) of the ESA to ensure that any action authorized, funded, or carried out by the agency would not jeopardize the continued existence of a federally listed threatened or endangered species or species proposed for listing, or result in the destruction or adverse modification of the designated critical habitat of a federally listed species. As the lead federal agency, the FERC is responsible for the Section 7 consultation process with the FWS. The lead agency is required to consult with the FWS and/or NMFS to determine whether any federally listed endangered or threatened species or any of their designated critical habitats are in the vicinity of the Project, and to determine the proposed action’s potential effects on those species or critical habitats.

For actions involving major construction activities with the potential to affect listed species or critical habitats, the federal agency must prepare a BA for those species that may be affected. As lead, the FERC must submit its BA to the FWS and/or NMFS and, if it is determined that the action may adversely affect a federally listed species, the FERC must submit a request for formal consultation to comply with Section 7 of the ESA. In response, the FWS and NMFS would issue a Biological Opinion as to whether or not the federal action would likely adversely affect or jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat. To comply with Section 7 of the ESA, we request the FWS consider this draft EIS and the various survey reports prepared by Cameron (submitted separately), as our BA for the proposed Project. As Cameron LNG does not propose to change the authorized number or size of LNG carriers, and no ballast water would be needed for construction barges, these items are not discussed further in this EIS.

To assist in compliance with Section 7 of the ESA, Cameron, acting as the FERC’s non-federal representative, initiated informal consultation with the FWS-Louisiana Field Office and NMFS-Baton Rouge Field Office on September 12, 2012, regarding federally listed and other special status species. Cameron also consulted with the Louisiana Natural Heritage Program (LNHP) regarding state-listed or other special status species or habitat with the potential to be affected by construction and operation of the Project.

Cameron reviewed the FWS database, the LDWF Species by Parish List, and conducted surveys in May, June, and July 2012, and January 2013, for federal and state-listed threatened or endangered species and their critical habitats in the Project area. Agency consultations, together with previous studies and a review of updated lists of threatened and endangered species, initially identified 12 federally listed or candidate species that potentially occur within or near the proposed Project (tables 4.7-1 and 4.7-2). Cameron also requested a data review from LNHP within 1 mile of the proposed Project to determine the presence of state-listed threatened or endangered species and other special status species and habitats of special status species in the vicinity of the Project. Sixteen species were identified that potentially occur within or near the proposed Project, of which seven are also federally listed (tables 4.7-1 and 4.7-2). No federal or state-listed threatened, endangered, candidate, or special status species were observed during surveys. In addition, no known critical habitats for federally listed species or potential habitats for other special status species were observed. Cameron submitted the results of its field surveys to the FWS and NMFS.

We have reviewed the information submitted by Cameron, performed our own research, and consulted directly with the FWS and NMFS. Based on our review, we believe that the proposed Project would have *no effect* on 10 federally listed, candidate, and state-listed species in Beauregard, Calcasieu, and Cameron Parishes because the Project would not be within the known range of the species or because the Project would not affect habitat for the species (table 4.7-1). Therefore, these 10 species are not addressed further in this EIS, of which four are under the jurisdiction of NMFS, four are under the jurisdiction of the FWS, and two are under the jurisdiction of LDWF. The remaining 11 species are listed in table 4.7-2 and discussed in this section.

4.7.1 Federally Listed Threatened and Endangered Species

A total of 10 species listed as federally threatened or endangered occur in Beauregard, Calcasieu, and Cameron Parishes. However, only four would be within the area of the proposed Project. Three are under the jurisdiction of the FWS (piping plover, red-cockaded woodpecker, and West Indian manatee) and one is under the jurisdiction of NMFS (Kemp’s ridley sea turtle). These species are evaluated below.

TABLE 4.7-1 Federal, Candidate, and State-Listed Species Eliminated From Further Review						
Common Name	**Scientific Name**	**Listing Parish**	**Project Component**	**Federal Status [a]**	**State Status [a]**	**Determination and Comments**
Sprague's pipit [b]	*Anthus spragueii*	Cameron, Calcasieu	Terminal, Pipeline	C	–	Would not cause a trend toward federal listing. Suitable habitat is not present within the Project area
Gulf sturgeon [b]	*Acipenser oxyrinchus desotoi*	Cameron	Terminal	T	–	*No effect*. Suitable foraging habitat is present near the work dock site, but the species is not known to inhabit the area.
Louisiana black bear [b, c]	*Ursus americanus luteolus*	Cameron, Calcasieu, Beauregard	Terminal, Pipeline	T	–	*No effect*. Suitable habitat is not present within the Project area
Green sea turtle	*Chelonia mydas*	Cameron	Terminal	T	T	*No effect*. Suitable habitat is not present within the Project area
Hawksbill sea turtle	*Eretmochelys imbricata*	Cameron	Terminal	E	E	*No effect*. Suitable habitat is not present within the Project area
Leatherback sea turtle	*Dermochelys coriacea*	Cameron	Terminal	E	E	*No effect*. Suitable habitat is not present within the Project area
Louisiana pine snake [d]	*Pituophis ruthveni*	Beauregard	Pipeline	C	–	Would not cause a trend toward federal listing. Suitable habitat is not present within the Project area
American chaffseed [d]	*Schwalbea americanus*	Beauregard	Pipeline	E	–	*No effect*. Suitable habitat is not present within the Project area
Diamondback terrapin	*Malaclemys terrapin*	Cameron	Terminal	–	RH	*No effect*. Suitable habitat is not present within the Project area
Ornate box turtle	*Terrapene ornata*	Cameron	Terminal	–	RH	*No effect*. Suitable habitat is not present within the Project area

Species lists from FWS Species List by County and LDWF Species List by County.

[a] E: endangered, T: threatened, C: candidate, RH: restricted harvest

[b] Species listed by the FWS for Cameron Parish, but not shown by LDWF as federally listed for Cameron Parish.

[c] Species listed by the FWS for Beauregard and Calcasieu Parishes, but not shown by LDWF as federally listed for either Beauregard or Calcasieu Parishes.

[d] Species shown by LDWF as federally listed for Beauregard Parish, but not listed by the FWS in Beauregard Parish.

TABLE 4.7-2
Federal, State, and Special Status Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Listing Parish	Project Component	Federal Status [a]	State Status [a]	Determination and Comments
Piping plover	*Charadrius melodus*	Cameron	Terminal	T	T	*Not likely to adversely affect*. Suitable habitat may be present within the Project area
Red-cockaded woodpecker [b]	*Picoides borealis*	Beauregard, Calcasieu	Pipeline	E	E	*Not likely to adversely affect*. Suitable habitat may be present within the Project area
West Indian manatee	*Trichechus manatus*	Cameron	Terminal	E	E	*Not likely to adversely affect*. Suitable foraging habitat is present near the work dock site
Kemp's ridley sea turtle	*Lepidochelys kempii*	Cameron	Terminal	E	E	*Not likely to adversely affect*. Suitable foraging habitat is present near the work dock site
Bald eagle	*Haliaeetus leucocephalus*	Beauregard, Calcasieu, Cameron	Terminal, Pipeline	–	E	*Impacts would not be significant*. Suitable habitat is present within the Project area
Brown pelican	*Pelicanus occidentalis*	Cameron	Terminal	–	E	*Impacts would not be significant*. Suitable habitat is present within the Project area
Alligator snapping turtle	*Macrochelys temminckii*	Beauregard	Pipeline	–	RH	*Impacts would not be significant*. Suitable habitat is present within the Project area
Old prairie crawfish	*Fallicambarus macneesei*	Cameron	Terminal	–	I	*Impacts would not be significant*. Suitable habitat is present within the Project area
Dotted gay-feather	*Liatris punctata*	Beauregard, Calcasieu	Pipeline	–	CI	*Impacts would not be significant*. Suitable habitat may be present within the Project area
Long-sepaled false dragon head	*Physostegia longisepala*	Cameron	Terminal	–	I	*Impacts would not be significant*. Suitable habitat is present within the Project area
Silveus dropseed	*Sporobolous silveanus*	Beauregard, Calcasieu	Pipeline	–	I	*Impacts would not be significant*. Suitable habitat may be present within the Project area

[a] E: endangered, T: threatened, RH: restricted harvest, I: imperiled in state of Louisiana; CI: critically imperiled in state of Louisiana

[b] Red-cockaded woodpecker is listed by the FWS for both Beauregard and Calcasieu Parishes, but LDWF only shows this species as federally listed under Beauregard Parish.

4.7.1.1 Piping Plover

The piping plover is federally listed as threatened in the state of Louisiana, although in the Great Lakes region it is listed as endangered (FWS 2012b). It is a migratory species that winters in Atlantic and Gulf coastal regions of the United States and several Caribbean islands, and breeds in the northern United States and Canada (FWS 2012c). This species mainly uses wide, flat, open, sandy beaches to forage. Nesting territories occur on open beaches near small creeks or wetlands. Piping plovers eat mostly insects, spiders, and crustaceans that occur on open beaches or mudflats (FWS 2012c; LDWF 2012a). In Louisiana, the piping plover has been observed in the Calcasieu River Basin (LDWF 2012a). Threats to this species include habitat loss and degradation, particularly of coastal beaches, and nest disturbance and predation (FWS 2012c).

During winter, this species could be present along the shoreline near the Terminal Expansion, should open mudflats or beaches exist. However, based on Cameron LNG's survey information and aerial imagery interpretation, those preferred shoreline types are not currently present in the vicinity of the Terminal Expansion. Further, the industrialized nature near the Terminal Expansion would limit the likelihood that the species would use the small amount of existing shoreline. Piping plover could transit through the area during construction of the Terminal Expansion; however, it is likely they would avoid the area due to the high level of activity. As such, we believe the proposed Terminal Expansion is *not likely to adversely affect* the piping plover.

4.7.1.2 Red-cockaded Woodpecker

The red-cockaded woodpecker is federally listed as endangered and is known to occur in both Beauregard and Calcasieu Parishes. It is generally a non-migratory species that inhabits mature pine forests. The species has been known to inhabit longleaf, loblolly, shortleaf, slash, and pond pine stands, but seems to prefer longleaf pine stands over other tree species. Red-cockaded woodpeckers forage, nest, and roost in tree cavities and prefer mature stands between 60 and 150 years old, depending on the species (NatureServe 2012a). They are not tolerant of dense understories. Red-cockaded woodpeckers eat mostly insects from tree cavities and beneath bark, but also eat fruit from shrubs and vines. Primary threats to this species include loss and fragmentation of habitat due to development, use of shorter rotations in pine plantations and forests, and fire suppression, which results in thicker understories (LDWF 2012b).

This species requires mature pine forests, which are not present within or around the Terminal Expansion site, Pipeline Expansion route, or within associated aboveground facility sites with the exception of a small portion of the pipeline right-of-way between MP 13.9 and MP 14.5. The FWS identified this area as potential habitat for the red-cockaded woodpecker and requested Cameron Interstate perform additional surveys within a 0.5-mile radius of the potential habitat. Cameron Interstate, with FWS personnel, conducted an additional survey in accordance with the 2003 Red-cockaded Woodpecker Recovery Plan survey protocols on January 24, 2013. No red-cockaded woodpeckers or nest clusters were identified within the proposed Pipeline Expansion right-of-way. Therefore, due to the small amount of available habitat and the lack of observations of individuals or nest cavities, we believe the proposed Pipeline Expansion is *not likely to adversely affect* the red-cockaded woodpecker. On March 11, 2013, the FWS provided concurrence with this determination and indicated no further consultation would be required for the Pipeline Expansion. However, because pipeline construction would not commence within a year of this survey, **we are recommending that:**

- **<u>Prior to construction</u> Cameron Interstate should complete and file the results of an updated survey for the red-cockaded woodpecker between MP 13.9 and 14.5 where this species and its habitat potentially exist. Specifically, Cameron Interstate should ensure that the FERC staff receives the updated survey report for the red-cockaded woodpecker completed <u>within 1 year</u> of the construction start date, as well as any comments received from the FWS regarding impacts on this species.**

4.7.1.3 West Indian Manatee

The West Indian manatee is federally listed as endangered and can be found in marine, estuarine, and freshwater environments. Manatees generally seek out natural warm water sites to forage, drink, and rest, including areas where industrial facilities discharge warm water. Most of their time is spent in freshwater and estuarine environments, but manatees will venture into salt water to travel to different locations. Manatees are herbivores that feed on a large variety of plants, including submerged, emergent, and floating vegetation. Mating can occur at any time of year and, while calving peaks in the spring months, calves may be present in any area at any time of the year and usually remain with the mother for 2 years. Major threats to this species include boat collisions, habitat loss, and forage species loss (FWS 2012d).

Manatees are present in the Calcasieu River Basin; however, given the level of industrial activity, their presence near the Terminal Expansion site is unlikely (LDWF 2012c). The LNHP database shows a historical sighting near the Terminal Expansion site in 1929, but none since then. Although their presence is unlikely, manatees may be present in the Calcasieu Ship Channel and increased vessel strikes may potentially occur with an increase in vessel traffic during Cameron LNG's construction and use of the work dock. As the manatee has not been observed in the vicinity of the Terminal Expansion site in over 80 years and appropriate habitat for foraging is minimal, we believe the Project is *not likely to adversely affect* the West Indian manatee.

4.7.1.4 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle is the smallest of the sea turtles found in the Gulf of Mexico and is federally listed as endangered. It occurs mainly in the coastal areas of the Gulf of Mexico and the U.S. Atlantic seaboard. Nesting occurs mainly in Mexico from May to July, but Kemp's ridley sea turtles also nest in small numbers along the Gulf coast, mostly in southern Texas (NMFS 2011). Kemp's ridley sea turtles have not been known to nest on the Louisiana coast (LDWF 2012d). Juveniles and sub-adults occupy shallow, coastal regions and are commonly associated with crab-laden, sandy or muddy water bottoms; young turtles often float on mats of *Sargassum* seaweed. Kemp's ridley sea turtles feed mostly on swimming crabs, but their diet also includes fish, jellyfish, and mollusks. The primary threat to this species is capture and entanglement in fishing gear, such as shrimp trawls, gill nets, and longlines. Egg collection has also historically been a threat to the population (NMFS 2011).

Nesting areas for the Kemp's ridley sea turtle are not present in or near the Terminal Expansion site and no Kemp's ridley sea turtles have been known to nest in Louisiana. Foraging and transit habitat, as described above, for the Kemp's ridley sea turtle exist near the site of the proposed construction dock; however, given the level of industrial activity in the Calcasieu Ship Channel, it is highly unlikely that the Kemp's ridley sea turtle would use any habitat near the proposed Terminal Expansion. If, however, sea turtles were present on occasion, they could avoid any sheet piling or pile driving activities and sedimentation from dredging activities.

Sheet piling and pile driving activities for the proposed work would not occur in the water; all piling and piles would be driven on land prior to dredging. These activities would generate noise because it would occur close to the water's edge. It is anticipated that in-water construction of the work dock would take 3 months. In addition, dredging activity would generate noise because it occurs within the water column. However, dredging is a common activity in the vicinity of the Terminal Expansion, and it is likely that most aquatic species are accustomed to the level of noise generated by dredging. Therefore, impacts due to noise would be minor due to the size of the work dock, the short duration of construction, and the current frequency of dredging in the area. During construction of the work dock, Cameron LNG would conduct all in-water work during daylight hours with lighting only minimally used for safety and security reasons after dark (1 to 5 foot candles). Minimal lighting (1 to 5 foot candles) would also be required during operation of the work dock for safety and security reasons after dark. Therefore, impacts from lighting during construction and operation of the work dock would be temporary and minor. Dredging activities within the Calcasieu Ship Channel occur every 2 years according to the COE schedule, and dredging also occurs for maintenance of the berthing area of the existing terminal. Dredging activities associated with the proposed work dock would be minimal in comparison to the regular maintenance dredging within the channel. Due to the lack of available habitat and avoidance of the area due to current industrial activities, including dredging, sea turtles would likely continue to avoid the area. To minimize dredging impacts, Cameron LNG proposes to use a hydraulic cutterhead dredge which NMFS has confirmed would pose no risk to sea turtles.

During site surveys, Cameron LNG did not observe any suitable sea turtle habitat or individuals. In addition, foraging and transit habitat for the Kemp's ridley sea turtle is limited near the Terminal Expansion site. Therefore, based on the limited foraging and transit habitat and Cameron's measures to minimize impacts from dredging, lighting, and pile driving, we conclude the proposed Project is *not likely to adversely affect* the Kemp's ridley sea turtle.

4.7.1.5 Federally Listed Species Conclusion

Because ESA consultation with the FWS and NMFS is ongoing and to ensure that Cameron LNG and Cameron Interstate do not begin construction until Section 7 of the ESA consultation is complete, **we are recommending that:**

- **Cameron LNG and Cameron Interstate not begin construction of Project facilities <u>until</u>:**
  - **a. all outstanding biological surveys have been completed;**
  - **b. the FERC staff completes any necessary consultations with FWS and NMFS; and**

c. **each has received written notification from the Director of OEP that construction and/or use of mitigation (including implementation of conservation measures) may begin.**

Should any listed species be identified in the vicinity of the Project or any additional species be listed, we would re-open consultation at that time.

4.7.2 State-Listed and Special Status Species

Cameron conducted consultations with LNHP and determined that, in addition to the federally listed species above, two state endangered species, three state imperiled species, one critically imperiled species, and one restricted harvest species could be affected by the proposed Project. The life histories and potential impacts on these seven species are discussed in this section.

4.7.2.1 State-Listed and Special Status Species

Bald Eagle

The bald eagle is state-listed in Louisiana as endangered. It was federally listed as endangered in 1967 primarily because the use of dichlorodiphenyltrichloroethane (DDT) caused thinning of eggshells and a decrease in survivorship of the eggs. A recovery plan was put in place and the use of DDT was curtailed, which allowed the bald eagle population to increase significantly. It was subsequently delisted in 2007, but is still federally protected by the Bald and Golden Eagle Protection Act, which prohibits the "taking" of bald eagles, including their parts, nests, or eggs. In addition, "taking" includes disturbance, which means to bother or agitate a bald eagle to the point of injury, decrease in productivity, or nest abandonment (FWS 2010; FWS 2012e). It winters and breeds throughout the United States along river systems, next to large lakes, and along coastal areas. In Louisiana, bald eagles winter along the coast and near some lakes in the northern part of the state, and nest in winter and early spring. Bald eagles tend to use the same nest year after year and, in southern Louisiana, nests are usually constructed in large cypress trees. Bald eagles generally feed on fish, but their diet also includes waterfowl, carrion, muskrats, and nutria. Current threats to this species include loss of nesting habitat and disturbance to nesting pairs from humans during the nesting season (LDWF 2012e).

The bald eagle could winter or breed in areas near the Terminal Expansion site and Pipeline Expansion route; however, little suitable habitat is available and the area has a high level of industrial activity, which could cause eagles to avoid the area. Potential foraging habitat does exist near the Terminal Expansion site; however, it is unlikely that many eagles use this area due to the level of industrial activity. In the vicinity of the Pipeline Expansion route, the majority of the forest cover is managed pine plantation, which is not preferred bald eagle habitat. Additionally, Cameron Interstate would HDD all perennial waterbodies, where bald eagles are most likely to occur. This would further minimize the likelihood of pipeline construction related impacts on the bald eagle. Further, Cameron conducted surveys in May, June, and July 2012 and no nesting sites were found within 0.5 mile of the proposed Terminal Expansion site or the proposed Pipeline Expansion route.

Because no nesting sites were observed during surveys and little suitable habitat for either nesting or foraging can be found nearby, we believe the Project would not significantly impact the bald eagle. Should a bald eagle be observed, Cameron LNG would stop all work and would immediately notify the FWS and LDWF to determine appropriate protection actions.

Brown Pelican

The brown pelican is state-listed as endangered. It was federally listed as endangered in 1970 for the same reason as the bald eagle: the use of DDT thinned eggshells of the brown pelican to the point that survivorship of eggs was severely decreased. Pelicans usually occur in small flocks in bays, estuaries, and along the coast. The brown pelican generally nests in small thickets in the dune line of barrier islands between November and July. Often if a pair is unsuccessful with the first nest, the pair will re-nest within the same season. They feed mainly on fish and some marine invertebrates in deep and shallow coastal waters. Current threats to this species include a decrease in nesting habitat due to erosion of barrier islands, illegal take of the eggs by humans, and coastal land loss throughout its range (FWS 2012f; LDWF 2012f).

No potential brown pelican habitat exists near the Pipeline Expansion site. Potential foraging areas for the brown pelican exist near the Terminal Expansion site, but no high quality nesting habitat exists in the vicinity. Although foraging habitat exists near the Terminal Expansion site, it is unlikely that brown pelicans would use the area often due to the level of industrial activity. As no nesting sites and little suitable habitat are found nearby, we believe the Project would have minimal impact on the brown pelican.

Alligator Snapping Turtle

The alligator snapping turtle is under restricted harvest in Beauregard Parish. Alligator snapping turtles can become very large animals and are usually found in slow moving rivers, lakes, or oxbows, but can also be found in freshwater marsh areas with rivers close by (LDWF 2012g). Because the proposed Pipeline Expansion route contains several large waterbodies, construction could affect the alligator snapping turtle. However, Cameron Interstate proposes to use the HDD method to cross all perennial waterbodies, which would most likely contain alligator snapping turtles. The use of the HDD method would minimize or avoid direct impacts on this species. If an inadvertent release occurs, drilling mud could enter the waterbody, which would cause localized turbidity. The alligator snapping turtles would likely leave or avoid the area if this occurs. Furthermore, Cameron Interstate would perform drilling under the guidance of their HDD Contingency Plan (Appendix C). The use of this plan and associated mitigation measures would minimize impacts on the alligator snapping turtle. Therefore, we believe the impact on the alligator snapping turtle would be minimized.

Old Prairie Crawfish and Long-Sepaled False Dragon-Head

The old prairie crawfish and long-sepaled false-dragon head are designated as imperiled in Louisiana. All historical observations were made between 1966 and 1988; no observations have been made since. The long-sepaled false dragon-head prefers bottomland hardwood forests and slightly disturbed wet areas, such as roadside ditches (LDWF 2012h). Although habitat exists for the long-sepaled false dragon-head in the vicinity of the Terminal Expansion site, no individuals or populations have been observed and recorded near the area since 1988. Therefore, the presence of the species is not expected within the area and we conclude the proposed expansion would have no impact on the long-sepaled false dragon-head.

The old prairie crawfish, also known as the old prairie digger, lives in burrows in areas where the water table is close to the ground surface and that experience frequent flooding. They mainly inhabit herbaceous areas and can be found in roadside ditches (NatureServe 2012b). The species was last recorded in the area in 1966. Although habitat exists for the old prairie crawfish in the vicinity of the Terminal Expansion site, no individuals or populations have been observed or recorded near the area since 1966. Therefore, the presence of the species is not expected within the area and we conclude the Project would have no impact on the old prairie crawfish.

Dotted Gay-Feather and Silveus Dropseed

LNHP provided information that indicates the dotted gay-feather and silveus dropseed occur within longleaf pine savannahs; therefore, they could be present in the vicinity of the Pipeline Expansion right-of-way. The dotted gay-feather is critically imperiled in Louisiana and the silveus dropseed is imperiled in Louisiana. These species, as described by LNHP, are associated with two types of critically imperiled longleaf pine savannahs, western acidic and saline, that potentially occur in the vicinity of the proposed Pipeline Expansion right-of-way in Beauregard and Calcasieu Parishes. LNHP requested that Cameron Interstate minimize impacts on these two forest habitats. LNHP also requested in an October 24, 2012 letter that caution be used when working in or near these areas to avoid impacts on these two species and the two longleaf pine savannah habitats. During wetland delineations conducted in July 2012, no longleaf pine savannahs were documented by Cameron Interstate. However, a field visit was conducted with LNHP on February 13, 2013 and a portion of the proposed Pipeline Expansion route was found to include saline longleaf pine savannah. Cameron Interstate indicated it would work with LNHP to develop a site-specific construction management plan for this area prior to construction, which would include best management practices and restoration methods. If either the dotted gay-feather or silveus dropseed are observed during construction, Cameron Interstate has committed to ceasing construction activities in the immediate area and notifying the LNHP to determine the appropriate protection actions. However, in an effort to reduce impacts on western acidic and western saline longleaf pine savannahs, **we are recommending that:**

- **<u>Prior to construction</u>, Cameron Interstate file with the Secretary, for review and written approval by the Director of OEP, the Site-Specific Construction Management Plan developed for areas where the pipeline would cross western acidic and western saline longleaf pine savannahs.**

Based on the intention to develop and implement a site-specific management plan to minimize impacts on the saline longleaf pine savannah, we conclude that no significant impacts would occur on longleaf pine savannah habitat or on the dotted gay-feather and silveus dropseed species.

4.7.2.2 Threatened, Endangered, and other Special Status Species Conclusion

Based on review of available literature, results of field surveys, and coordination with agency personnel, it is not likely that any of the state-listed or special status species for Beauregard, Calcasieu, or Cameron Parishes would frequently inhabit the Terminal Expansion site or the Pipeline Expansion right-of-way or in the immediate vicinity of those areas. Based on the limited amount of available habitat in the area for listed or other special status species, the temporary nature of the impacts for the Pipeline Expansion, alignment along and overlap with existing rights-of-way, and mitigation measures proposed, we believe the Project would either have no impact on special status species or the impact would be adequately minimized.

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

4.8.1 Land Use

Cameron would construct its Project in Cameron, Calcasieu, and Beauregard Parishes. Land use in the vicinity of the Project is generally classified into the following categories: forested, planted pine, open space, open water, agricultural, residential, and industrial/commercial lands. Installation of facilities for the Terminal Expansion and Pipeline Expansion would require temporary disturbance of about 824.9 acres of land. After construction, the permanent rights-of-way would encompass about 590.3 acres. The remaining 234.6 acres would return to pre-construction conditions and uses. Table 4.8.1-1 summarizes the acreages of each land use type that Cameron would affect during construction and operation of the Project. The definitions of each land use type are as follows:

- forested – includes upland and wetland forests;
- pine plantation – includes planted pine land used for silviculture;
- open space – includes non-forested open lands, such as: existing utility rights-of-way; grassland/rangeland; emergent and scrub-shrub[30] wetlands and uplands; and grazing land;
- open water – includes water crossings greater than 100 feet;
- agricultural – includes active cropland or hay fields;
- residential – includes residential yards, subdivisions, and planned new residential developments; and
- industrial/commercial – includes all developed areas, such as roads railroads, and industrial areas.

4.8.1.1 Terminal Expansion

The proposed Terminal Expansion site is on the west side of the Calcasieu Ship Channel. Most of the site was previously disturbed by the placement of dredged material from maintenance of the Calcasieu Ship Channel and construction of the existing LNG Terminal. Land uses surrounding and within the proposed expansion site are primarily industrial, forested and non-forested wetlands, roads, open space, and open water. Cameron LNG would construct the Terminal Expansion within and adjacent to its existing LNG Terminal, which abuts the southern end of the Terminal Expansion site. Construction of the facilities would require approximately 502.2 acres, including 400.2 acres of open land (which includes emergent and scrub-shrub wetlands), 24.5 acres of forested land, 7.5 acres of industrial land, and 70.1 acres of open water. Approximately 70.0 acres of these impacts are within the existing terminal boundaries. Cameron LNG would convert all lands used for construction of the Terminal Expansion to industrial use.

[30] Scrub-shrub lands are dominated by woody vegetation less than 20 feet tall, such as sage brush, young trees, and small or stunted trees or shrubs.

4.8.1.2 Pipeline Expansion

Pipeline

During construction, Cameron Interstate would use a 100-foot-wide right-of-way in uplands and wetlands (see figure 2.3.1). Cameron Interstate would require about 290.7 acres for construction of its pipeline (which includes area for the ATWSs and access roads). Of this amount, approximately 140.0 acres (48 percent) was previously disturbed during construction of the Cameron Interstate and LA Storage Pipelines. Cameron Interstate would construct the entire 20.9 miles of pipeline parallel to existing rights-of-way. Cameron Interstate would collocate about 15.5 miles with its existing pipeline right-of-way. In these areas, the construction right-of-way would overlap the existing rights-of-way, with the width of the overlap dependent upon the configuration of the existing rights-of-way (see table 4.8.1-1). During operation, Cameron Interstate would maintain an additional 25-foot-wide permanent easement adjacent to its existing 50-foot-wide permanent rights-of-way. Cameron Interstate would extend its pipeline about 4.1 miles northeast from its existing permanent rights-of-way (see table 4.8.1-1), and would acquire and maintain an additional 50 feet of permanent easement in this area. The remaining 1.3 miles of the pipeline would be installed using the HDD method. Cameron Interstate would maintain about 67.8 acres during operation of the pipeline.

Aboveground Facilities

The Pipeline Expansion would include one new compressor station, a new interconnection with Trunkline, metering stations and modifications at four existing interconnections, and installation of a metering station at the existing Cameron LNG Terminal. Cameron Interstate would construct the new Holbrook Compressor Station on about 25 acres of land in Calcasieu Parish at MP 8.4. Of that area, about 5 acres would be within the construction right-of-way of the pipeline and are addressed with the pipeline impacts discussed above. For the remaining 20 acres, about 17.6 acres would be cleared and graded during construction, while 2.4 acres would not be impacted. Cameron Interstate would maintain about 15.3 acres for operation of the station. Cameron Interstate would seed and maintain as grass the remaining 2.3 acres.

The new Trunkline interconnection would impact about 0.2 acre of land in Beauregard Parish near MP 20.8. The new interconnection and metering facilities at Trunkline would use portions of the existing LA Storage interconnection site. Additionally, Cameron Interstate would use all of the 0.2 acre during operation.

Cameron Interstate would install new metering facilities at its four existing interconnections: FGT, TGP, TETCO, and Transco. Cameron Interstate would expand and relocate the existing fence lines at these interconnections to accommodate the new facilities. The FGT interconnection would require 1.5 acres during construction and operation. The TETCO and Transco interconnections would be at one site and would require 0.7 acre of land during both construction and operation. The TGP interconnection would require 1.4 acres for construction and operation.

TABLE 4.8.1-1 Land Uses Affected by the Liquefaction Project [a]																
Parish	**Forest [b]**		**Pine Plantation**		**Open Space [c]**		**Open Water**		**Agriculture**		**Residential**		**Industrial/ Commercial**		**Total**	
	Cons	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**
Terminal Expansion																
Calcasieu	18.5	18.5	0.0	0.0	170.1	170.1	< 0.1 [d]	< 0.1 [d]	0.0	0.0	0.0	0.0	0.0	0.0	188.6	188.6
Cameron	6.1	6.1	0.0	0.0	230.1	230.1	70.0	70.0	0.0	0.0	0.0	0.0	7.5	7.5	313.6	313.6
Terminal Expansion Project Total	*24.5*	*24.5*	*0.0*	*0.0*	*400.2*	*400.2*	*70.1*	*70.1*	*0.0*	*0.0*	*0.0*	*0.0*	*7.5*	*7.5*	*502.2*	*502.2*
Pipeline Expansion																
Calcasieu	11.7	3.0	26.1	5.7	85.8	24.7	0.0	0.0	0.0	0. 0	0.0	0.0	0.9	0.2	124.5	33.6
Beauregard	3.8	0.0	0.3	0.0	72.1	26.0	0.0	0.0	18.5	8.1	0.0	0. 0	0.3	0.1	95.1	34.2
Pipeline Expansion Total	*15.5*	*3.0*	*26.4*	*5.7*	*157.9*	*50.7*	*0. 0*	*0.0*	*18.5*	*8.1*	*0.0*	*0.0*	*1.2*	*0.3*	*219.6*	*67.8*
Holbrook Compressor Station																
Calcasieu	0.0	0.0	16.0	13.7	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	17. 6	15.3
ATWS																
Calcasieu	1.1	0.0	0.0	0.0	10.4	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.1	0.0	17.3	0.0
Beauregard	3.0	0.0	2.2	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	16.5	0.0
ATWS Total	*4.1*	*0.0*	*2.2*	*0. 0*	*21.6*	*0.0*	*0.0*	*0.0*	*5.6*	*0.0*	*0.0*	*0.0*	*0.2*	*0.0*	*33.7*	*0.0*
FGT Interconnection																
Calcasieu	0.0	0.0	0.0	0.0	1.5	1.45	0.0	0.0	0.0	0.0	0. 0	0.0	0.1	0.1	1.5	1.5
TGP Interconnection																
Calcasieu	0.1	0.1	0.0	0.0	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.17	1.4	1.4

TABLE 4.8.1-1 Land Uses Affected by the Liquefaction Project – Continued [a]																
Parish	**Forest [b]**		**Pine Plantation**		**Open Space [c]**		**Open Water**		**Agriculture**		**Residential**		**Industrial/ Commercial**		**Total**	
	Cons	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**	**Cons**	**Oper**
TETCO and Transco Interconnections [d]																
Beauregard	0.0	0.0	0.0	0.0	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7
Trunkline Interconnection																
Beauregard	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	< 0.1	<0.1	0.2	0.2
Contractor Yard																
Calcasieu	0.0	0.0	0.0	0.0	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	10.6	0.0
Access Roads																
Calcasieu	0.0	0.0	1.2	1.2	0.6	< 0.1	0.0	0.0	0.0	0.0	0.0	0.0	22.9	0.0	24.7	1.2
Beauregard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	0.0	12.8	0.0
Access Roads Total	*0.0*	*0.0*	*1.2*	*1.2*	*0.6*	*< 0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*35.7*	*0.0*	*37.4*	*1.2*
Pipeline Expansion Project Total	*19.7*	*3.1*	*45.8*	*20.6*	*195.2*	*55.6*	*0.0*	*0.0*	*24.0*	*8.1*	*0.0*	*0.0*	*37.9*	*0.7*	*322.7*	*88.1*
Liquefaction Project Total	**44.2**	**27.7**	**45.8**	**20.6**	**595.4**	**455.8**	**70.1**	**70.1**	**24.0**	**8.1**	**0.0**	**0.0**	**45.4**	**8.2**	**824.9**	**590.3**

< = Less than
Cons = Construction
Oper = Operation
[a] The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends.
[b] Forested acreages include upland forests and forested wetlands.
[c] Open Space acreages include emergent and scrub-shrub wetlands.
[d] The TETCO and Transco Interconnections would occupy the same workspace.

Contractor and Storage Yard

The Pipeline Expansion would require temporary use of one warehouse/storage yard to store pipe and equipment for the Pipeline Expansion, as well as for contractor office space, on about 10.6 acres adjacent to the Ragley Compressor Station in Calcasieu Parish (see figure 2.0-3). This area was previously used as a storage yard during construction of the existing Cameron Interstate Pipeline.

Additional Temporary Work Space/Staging Areas

Cameron Interstate would need 33.7 acres of ATWSs adjacent to the construction right-of-way. The majority of ATWSs would be within open land and agricultural land. In the event that Cameron Interstate requires new ATWSs in some areas and for reasons approved by its Plan (i.e., non-wetland areas to accommodate full right-of-way topsoil segregation or for truck turn-arounds where no reasonable alternative exists), they would be identified and approved by the EI prior to use by the construction workforce and identified in the construction status reports.

Access Roads

Cameron Interstate would use 28 public and private roads that intersect or parallel the proposed pipeline route to access the right-of-way during construction (the access roads are depicted on the alignment sheets in Appendices B; Appendix H provides a table that lists the access roads along with their lengths and locations by milepost). Cameron Interstate would also construct a new 1,500-foot-long access road to the Holbrook Compressor Station, which would impact about 1.2 acres. No other new access roads to the pipeline right-of-way are proposed and the existing roadways would not require major modifications, such as widening. Additionally, Cameron Interstate does not propose any new permanent access roads (other than to provide access to the Holbrook Compressor Station). However, Cameron Interstate may require minor modifications to some of the existing access roads, such as grading and replacement of gravel. Access roads and anticipated improvements are discussed in section 2.3.2.

4.8.1.3 Land Use Impacts and Mitigation

Impacts and mitigation on forest and open space are described in sections 4.4 (wetlands) and 4.5 (vegetation) of this EIS. The sections below focus on land uses not discussed in detail elsewhere in this EIS.

Planted Pine

Cameron LNG would not impact any pine plantation. Cameron Interstate would clear about 45.8 acres of pine plantation during construction of the Pipeline Expansion. After construction, 25.2 acres would be available for planting and use in timber production. This would be a long-term impact due to the relatively long growth period required for marketable timber. Cameron Interstate would prohibit timber production within the permanent right-of-way, resulting in permanent removal of 20.6 acres of timber production. However, Cameron Interstate would compensate the landowner for the loss of timber production in accordance with the terms of individual easement negotiations.

Existing Rights-Of-Way

Terminal Expansion

About 70.0 acres of the expansion would be within the existing Cameron LNG Terminal.

Pipeline Expansion

About 15.5 miles of the proposed pipeline right-of-way would overlap existing rights-of-way, limiting the amount of newly disturbed right-of-way. This would result in impacts on 140.0 acres of land that was previously disturbed during construction of the Cameron Interstate and LA Storage pipelines. The proposed route crosses eight paved public roads, 21 unpaved and/or private roads, and one railroad. Cameron Interstate would bore the railroad and paved road crossings to avoid impacts on rail traffic, adverse effects to the roadways, and traffic on the roadways. Cameron Interstate would cross non-paved roads using the open-cut method. Where open-cut construction is proposed on roads that provide access to private residences or businesses with no alternate entrance, Cameron Interstate would maintain passage during construction. In addition, Cameron Interstate would attempt to avoid peak traffic times during construction of roadway crossings that could temporarily close roads, use signage to minimize impacts, and follow local regulations regarding maintaining the flow of traffic.

Cameron Interstate would keep roads free of mud left by its construction equipment. Track-driven equipment would cross paved roads on tires or equipment pads to minimize damage to the road surface. To further minimize road damage, Cameron Interstate would enforce local weight limitations and restrictions. Cameron Interstate would repair roadways damaged by its construction to pre-construction conditions. We believe that use of these construction methods would not have a significant impact on roadways or railroads.

Open Water

Terminal Expansion

Open water is considered to be perennial waterbodies greater than 100 feet wide. Construction of the Terminal Expansion would include filling about 70.1 acres of open water. Two manmade freshwater ponds are present on the Terminal Expansion site. One seasonally dry pond that Cameron LNG would fill was created as a result of the onsite disposal of dredged material from COE maintenance dredging in the Calcasieu Ship Channel. Cameron LNG would use the second pond as a temporary construction stormwater basin and may fill it later. The smaller pond is deeper, does not dry up seasonally, and supports some of the typical species for fresh water ponds in the area. It was previously used for recreational fishing, but after Cameron LNG purchased the land for the Terminal Expansion, including the fish camp, access to that area has been limited to Cameron LNG employees. This pond could be filled during construction, resulting in converting all open water within the facility to industrial land.

As part of the Terminal Expansion, Cameron LNG would construct and use a work dock along the western bank of the Calcasieu Ship Channel. The work dock would require dredging of about 9.4 acres and would result in a permanent impact on open water at the terminal.

We believe impacts from construction and operation of the Terminal Expansion would not be significant for several reasons. The existing ponds were manmade, with the larger pond used for industrial purposes that would not be necessary for continued operation of the existing Cameron LNG Terminal. The smaller pond is no longer used for recreational fishing because that area is limited to employee use. Open water adjacent to the work dock would remain as open water although public use of the water would be prohibited. In addition, there is a large amount of open water in all directions from the Terminal Expansion site.

Pipeline Expansion

Cameron Interstate would use the HDD method to cross all perennial and sensitive waterways (six HDD crossings along the approximately 21-mile-long route), with the result that those waterbodies would not be impacted by construction. Operation of the pipeline would result in no permanent impacts on open water. Waterbody crossings are discussed further in section 4.3

Agricultural

Terminal Expansion

The Terminal Expansion would not impact any agricultural lands during construction or operation.

Pipeline Expansion

Cameron Interstate would impact about 18.5 acres of agricultural lands within the 100-foot-wide pipeline construction right-of-way and 5.6 acres within the ATWS areas. To minimize impacts on agricultural lands, Cameron Interstate would implement the measures provided in its Plan, including topsoil segregation, erosion control, and soil compaction mitigation.

The pipeline would also extend through about 15.2 miles of lands with soils classified as prime farmland. Cameron Interstate would implement its Plan, which includes mitigation measures to limit impacts, such as topsoil segregation and soil compaction mitigation in annually cultivated prime farmland. In addition, construction of the Holbrook Compressor Station would affect approximately 5.2 acres of prime farmland, currently used for silviculture and classified as pine plantation.

The Pipeline Expansion would impact about 24 acres of agricultural lands, with a loss of production during and shortly after construction is completed. After construction, Cameron Interstate would allow all cultivated agricultural land impacted by the Project to return to preconstruction conditions. There would be no permanent impacts on cultivated land by the Project. As a result, we believe the impact on cultivated agricultural land would be temporary to short-term and would not be significant.

Residential Lands

No active businesses occur within 50 feet of the Project.

Terminal Expansion

Cameron LNG purchased the one residence that was within 50 feet of the boundary of the proposed site of the Terminal Expansion, and the next closest residence is about 1.2 miles northwest of the property boundary. The nearest residence may observe an increase in traffic along LA-27 during construction as well as a change in the viewshed from the residence. Visual impacts on residential areas are discussed in section 4.8.6, transportation impacts are discussed in section 4.9.7.2, and noise and dust impacts on nearby residences are discussed in section 4.11.

Pipeline Expansion

There is one residence within 50 feet of the proposed construction right-of-way and one unoccupied trailer and one shed within 20 feet of the right-of-way. The nearest residence to the proposed Holbrook Compressor Station is about 0.6 mile from the site. In residential areas, the two most significant impacts associated with construction and operation of natural gas facilities are disturbance during construction and hindrance of property future uses due to the presence of Project facilities. 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 the right-of-way; potential damage to septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from the right-of-way. Additionally, during typical overland pipeline construction, the trench is sometimes excavated before the pipe is strung and welded. This could result in open trenches for extended periods of time, which could pose a safety hazard to nearby residents.

To minimize residential impacts of the construction right-of-way, Cameron Interstate would implement the following mitigation measures:

- notify the residents of the approximate time that construction would take place on their property;
- minimize noise within 1 mile of residences;
- employ water trucks or sprinklers as necessary to reduce dust;
- place curtains of suitable material, as necessary, to prevent windblown sand blasting particles from reaching residences;
- repair or replace any damaged septic tanks or drain fields;
- only remove mature trees if necessary for safe operation of construction vehicles;
- restore all lawn areas and landscaping immediately after construction or as specified in landowner agreements;
- reduce the width of the construction right-of-way near the residences to maintain at least 15 feet of undisturbed land between the right-of-way and the residence;
- fence the edge of the construction work area for 100 feet on either side of the residence; and
- maintain safety fencing throughout construction.

After construction, landowners may use the right-of-way, provided they do not interfere with the rights granted to Cameron Interstate. No trees would be permitted on the permanent right-of-way, as they may impair access to the pipeline, and roots could damage the pipeline coating. No structures, including houses, tool sheds, garages, poles, swimming pools, or other objects not easily removed would be permitted on the permanent right-of-way.

Three other residences are within 135 feet of the proposed construction right-of-way (table 4.8.1-2). Cameron Interstate developed site-specific construction plans for each of these residences (Appendix D). We reviewed these site-specific plans, and believe Cameron Interstate's proposed mitigation measures would lessen impacts on the affected residences.

Construction would not affect the residence nearest the compressor station site, but compressor station noise during operation would result in a minor impact at that residence (see section 4.11). In addition to the residence closest to the compressor station, there is one other residence within 1 mile of the Holbrook Compressor Station (about 0.9 mile from the site). Due to the distance from the compressor station site, we would not expect any impacts at that residence.

The proposed route is adjacent to existing rights-of-way. Overall, we believe construction of the Project would have a moderate, temporary impact on residential land use. There would be a permanent and minor noise impact on residential land use in the vicinity of the Holbrook Compressor Station during operation of the Project due to an increase in sound levels (see section 4.11).

TABLE 4.8.1-2
Residences and Structures Within 135 feet of the Pipeline Expansion Construction Right-of-Way

Facility	Parish	Milepost	Distance to Construction Work Area (feet)
House	Calcasieu	0.3	15
House	Calcasieu	1.3	93
House	Calcasieu	1.4	67
Unoccupied Trailer	Calcasieu	1.5	20
House	Beauregard	20.9	135
Shed	Beauregard	20.9	19

4.8.2 Landowner and Easement Requirements

4.8.2.1 Terminal Expansion

The 502.2 acres required for construction of the Terminal Expansion are all under the ownership of Cameron LNG, with approximately 70.1 acres within the existing Cameron LNG

Terminal property. As a result, Cameron LNG would not acquire additional land or easements for the Terminal Expansion.

4.8.2.2 Pipeline Expansion

Except for the compressor station, Cameron Interstate would install all facilities associated with the Pipeline Expansion on private lands. Cameron Interstate is the landowner of the proposed site of the Holbrook Compressor Station.

For privately owned land along the proposed pipeline route, Cameron Interstate would secure an easement to convey both temporary and permanent rights-of-way prior to construction. The easement acquisition process is designed to provide fair compensation to the landowners for the right of Cameron Interstate to use the property during construction and operation of the pipeline.

If an easement cannot be negotiated with a landowner and the Project has been Certificated by the FERC, Cameron Interstate could use the right to eminent domain granted to it under Section 7(h) of the NGA and the procedure set forth under the Federal Rules of Civil Procedure (Rule 71A) to obtain the right-of-way and ATWS areas. Cameron Interstate must compensate the landowner for the right-of-way and any damages incurred during construction. However, a court would determine the level of compensation. In either case, Cameron Interstate would compensate the landowner for the use of the land.

4.8.3 Planned Developments

4.8.3.1 Terminal Expansion

There are no existing or known planned developments at or near the proposed site of the Terminal Expansion.

4.8.3.2 Pipeline Expansion

The proposed pipeline route does not cross and is not near any area recorded planned development. The previous landowner of the compressor station site indicated he may develop parcels along Holbrook Park Road, approximately 1,500 feet from the proposed compressor station. However, no development plans have been submitted to the parish.

4.8.4 Recreation and Special Interest Areas

4.8.4.1 Terminal Expansion

Cameron LNG's Terminal Expansion would not directly affect designated recreational or special interest areas by construction or operation.

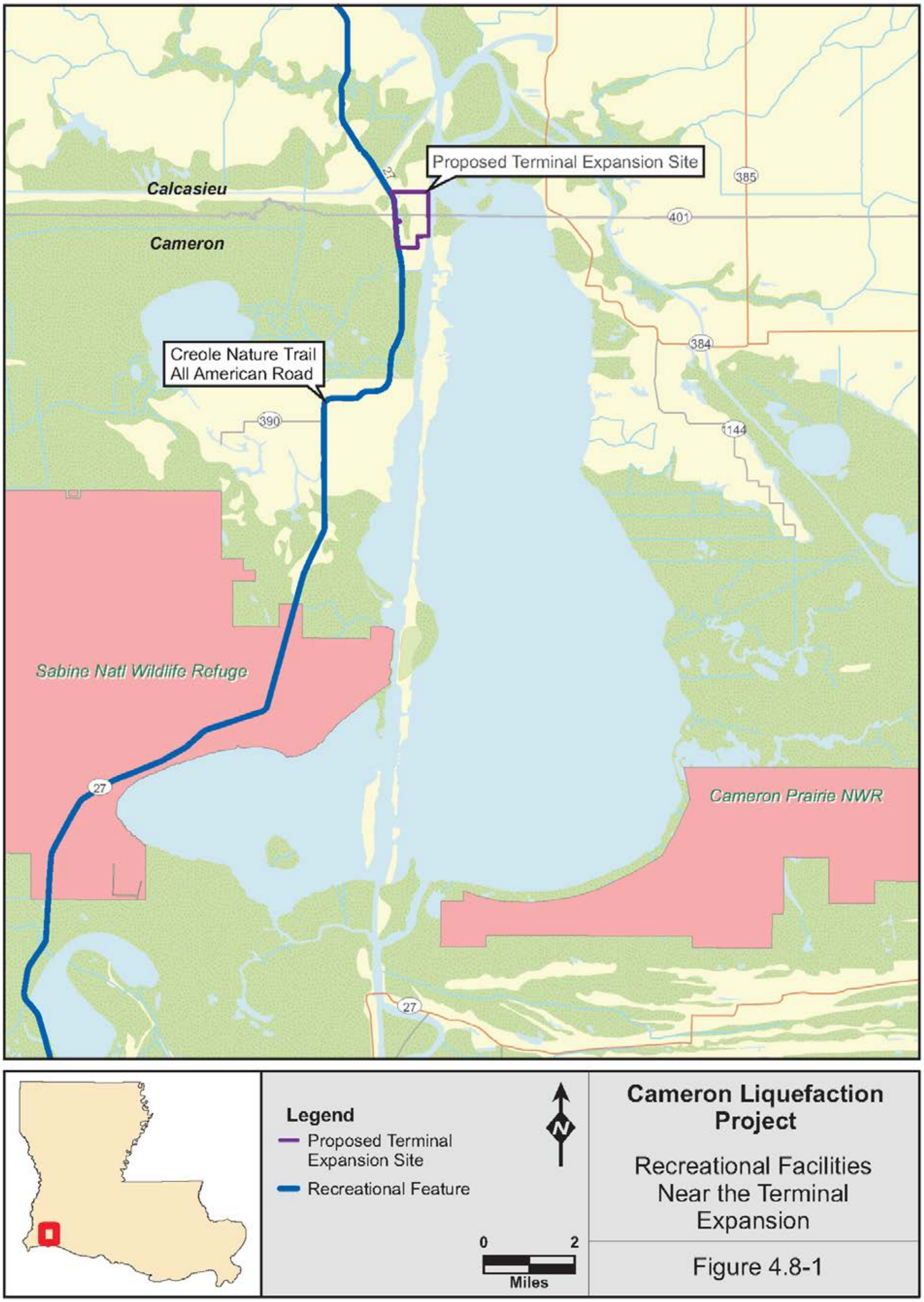
There are two wildlife refuges in the vicinity of the Terminal Expansion site (figure 4.8-1) and 36 miles of accessible coastal beaches in Cameron Parish. In addition, the Creole Nature Trail All American Road (Creole Nature Trail) is a roadway system approximately 180 miles long that extends through Calcasieu and Cameron Parishes. It includes the portion of LA-27 that extends from Sulphur to the Gulf Coast, including the highway in the vicinity of the Terminal Expansion. During the approximately 4.5-year construction period for the terminal expansion, there would be a substantial increase in traffic on LA-27 between Sulphur and the Terminal Expansion site. Our recommendations for mitigating the impact of the additional traffic are discussed in section 4.9.7. In addition, the majority of the traffic would be from construction workers commuting to and from the site during early morning or evening hours, times when many tourists and recreational users of the roadway would not be affected. Impacts on this portion of the Creole Nature Trail could also include visual impacts (see section 4.8.6) and noise and dust impacts (see section 4.11). We believe that the impacts of construction and operation of the Project on the Creole Nature Trail would be minor to moderate with incorporation of the mitigation measures identified in section 4.9.7.

Portions of two NWRs are in the vicinity of the Calcasieu Ship Channel and offer a variety of recreational activities. The Sabine NWR is 8 miles south of Hackberry, Louisiana, and the refuge extends to the ship channel between river miles 9 and 12. Users of the Sabine NWR adjacent to the channel may observe an increase in barge traffic during construction, and may also observe LNG carrier traffic through the channel (see section 4.8.6). The East Cove Unit of the Cameron Prairie NWR extends along a portion of the southeastern shore of Calcasieu Lake. The Cameron Prairie NWR is distant from the Calcasieu Ship Channel, and there is a strip of land on the eastern side of the channel that blocks views from the refuge. As a result, we believe East Cove Unit users would not likely be affected by traffic in the channel due to construction and operation of the Project. In addition, Cameron LNG has not requested an increase in the number of LNG carriers currently authorized to call on the terminal, and the impacts to the NWRs would not increase beyond those assessed on our previous EIS and EAs.[31] As a result, the Terminal Expansion would not impact land uses of the NWRs.

The closest marina to the Terminal Expansion is near Hackberry, more than 2 miles south of the terminal site. The marina is on a tributary to the channel and would not be directly affected by the increase in barge traffic during construction or operation of the Terminal Expansion.

Construction of the Terminal Expansion would require dredging in the waters of the Calcasieu Ship Channel adjacent to land and would increase barge and support vessel traffic in the channel (also see section 4.9.7.1). However, Cameron LNG would not construct in the channel, and there would be at least 300 feet between vessels berthed at the work dock and the edge of the maintained ship channel.

[31] Hackberry EIS (docket no. CP02-374), Cameron LNG Terminal Expansion EA (docket no. CP06-422), and Environmental Assessment, Cameron LNG Export Project (docket no. CP10-496).



Proposed Terminal Expansion Site
Calcasieu
Cameron
Creole Nature Trail
All American Road
Sabine Natl Wildlife Refuge
Cameron Prairie NWR
27
385
401
384
390
1144
Legend
Proposed Terminal Expansion Site
Recreational Feature
N
0
2
Miles
Cameron Liquefaction Project
Recreational Facilities Near the Terminal Expansion
Figure 4.8-1

During construction of the Terminal Expansion, barge traffic in both the Gulf Intracoastal Waterway and in the Calcasieu Ship Channel would increase. In each of the first 7 months of Terminal Expansion construction there would be about 275 barges per month, or about 9 barges per day. Barge deliveries would decrease to 150 per month (about 5 per day) during months 8 through 10, and 125 barges per month (about 4 per day) from months 11 through 14. After that there would be about 10 barges per month (about 1 barge every 3 days) for the duration of construction. Although recreational boat traffic uses the Calcasieu Ship Channel in transit to Calcasieu Lake, we believe the impacts on that traffic during construction would be minor. Similarly, the impacts of barge traffic on fishing in the channel would be minor. Barge traffic would also increase in the Gulf Intrastate Waterway during construction, although the impacts would be similar to those of barge traffic in the channel. Overall, construction of the Terminal Expansion would result in minor, short-term impacts on recreational boating and fishing in the channel and the waterway, with most of the impacts occurring during the first 10 months of construction.

As described above, Cameron has not requested an increase in LNG carrier traffic or a change in the size or quantity of ships that are currently authorized at the existing LNG Terminal. During operation, the potential impacts on recreational boating and fishing would not increase above the impacts addressed in our previous EIS and EAs for the existing Cameron LNG Terminal.

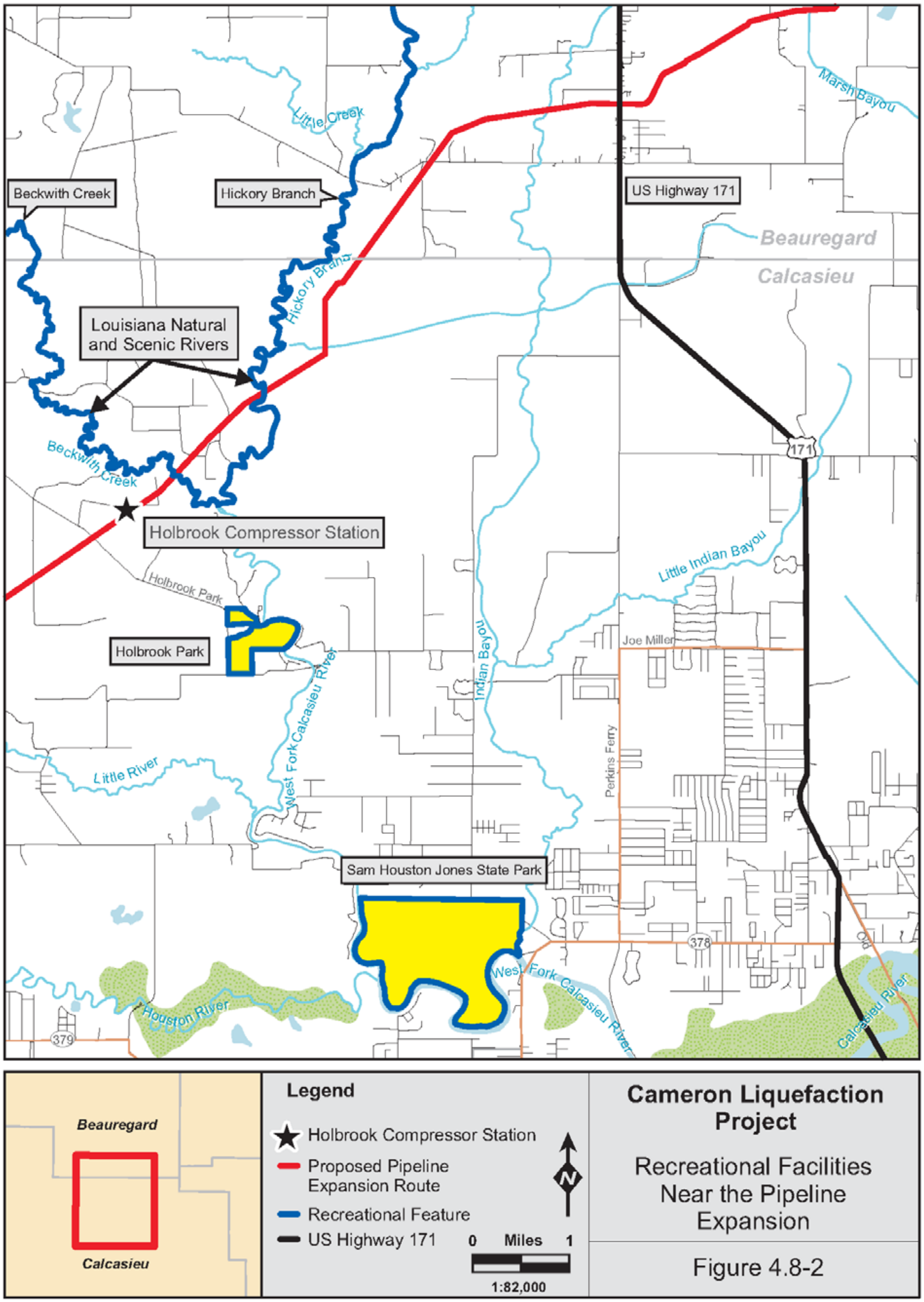
4.8.4.2 Pipeline Expansion

Cameron Interstate would construct its Pipeline Expansion near several recreation areas, including U.S. Highway 171 (a scenic highway), two Louisiana Natural and Scenic Rivers, Sam Houston Jones State Park, Holbrook Park, and private hunting areas (figure 4.8-2). Potential visual impacts on these areas are discussed in section 4.8.6.

U.S. Highway 171 is a scenic highway that follows the western border of Louisiana from north to south. The pipeline would cross U.S. Highway 171 in Beauregard Parish at MP 15.5. Cameron Interstate would cross the highway using the conventional bore construction method to avoid direct impacts on the highway and transportation.

The pipeline route would cross two Louisiana Natural and Scenic Rivers in Calcasieu Parish (Beckwith Creek at MP 9.0 and Hickory Branch at MP 10.3). Cameron Interstate would cross both waterbodies by the HDD construction method to avoid impacts on the bed and banks of the waterbodies.

Sam Houston Jones State Park is approximately 5 miles southeast of the proposed pipeline in Calcasieu Parish. Recreational activities at this park include boating, fishing, birding, hiking, and camping. Holbrook Park is in Sulphur, Louisiana, approximately 1.5 miles southeast of MP 8.4. Holbrook Park has a public boat ramp, tent and RV camp sites, playground, picnic area, and a pavilion. Because of the distance between the construction right-of-way and these parks, we believe Cameron Interstate would avoid direct park impacts.



Beckwith Creek
Hickory Branch
Little Creek
Marsh Bayou
US Highway 171
Beauregard
Calcasieu
Hickory Branch
Louisiana Natural and Scenic Rivers
Beckwith Creek
Holbrook Compressor Station
Holbrook Park
Little Indian Bayou
Holbrook Park
Joe Miller
Indian Bayou
West Fork Calcasieu River
Perkins Ferry
Little River
Sam Houston Jones State Park
378
Houston River
West Fork Calcasieu River
Calcasieu River
379
171
Beauregard
Calcasieu
Legend
Holbrook Compressor Station
Proposed Pipeline Expansion Route
Recreational Feature
US Highway 171
N
0 Miles 1
1:82,000
Cameron Liquefaction Project
Recreational Facilities Near the Pipeline Expansion

Figure 4.8-2

There are hunting lands managed in cooperation with the LDWF for deer, goose, turkey and pheasant near the proposed compressor station site, and the proposed pipeline route extends through private hunting lands between MP 10.4 and MP 12.1. To limit impacts on hunters, Cameron Interstate would schedule pipeline construction through these areas to avoid the hunting season where practicable.

4.8.4.3 Indirect Project Impacts on Public Parks

During construction of the pipeline and the Terminal Expansion, most non-local workers, and in some cases their families, would reside primarily in Calcasieu and Beauregard Parishes (see section 4.9.5). Cameron LNG anticipates that that up to 130 permanent employees would be hired to operate the Terminal Expansion facilities, and the Pipeline Expansion would require 5 new permanent employees. It is likely that some workers and/or their families would visit nearby parks in those parishes, or visit parks in Cameron Parish, resulting in indirect impacts. However, there is a large inventory of recreation areas in the three parishes spread over a large geographic area, and although some facilities may be stressed due to use by workers and/or their families, we believe that the overall impact on these facilities would not be significant.

4.8.5 Visual Resources

4.8.5.1 Terminal Expansion

The primary existing structures in the viewshed of the proposed terminal site include the existing Cameron LNG Terminal, oil and gas production facilities, electric transmission line towers, and storage tanks. The viewshed also includes the Calcasieu Ship Channel east of the proposed site; open land and wetlands to the north, west, and south; and LA-27, which is part of the Creole Nature Trail.

Construction of the Terminal Expansion would increase traffic on LA-27, which would affect the views of those using the highway. These changes to the visual character of the area during construction that highway users could observe include increased equipment, vehicles, workers, and structures on the Terminal Expansion site. The portion of the Creole Nature Trail that borders the proposed Terminal Expansion site represents only a small portion of the 180 miles of the Creole Nature Trail, and those traveling along the highway would have a short time to view the site during construction. In addition, Cameron LNG would construct its expansion adjacent to the existing Cameron LNG Terminal, and views would be consistent with the existing industrial area. The impact on visual resources during construction would be short term due to the presence of workers and equipment for the approximately 4.5-year construction period, but the impacts of the facilities would be permanent as discussed below.

The expanded terminal would include many aboveground structures that could result in a visual resource impact. These include three liquefaction trains, a new LNG storage tank, an NGL storage and truck loading area, a work dock, power generation units with exhaust stacks, a vapor fence, and flare structures. In addition, most of these structures would require lighting. Cameron LNG would site about 13 percent of the Terminal Expansion within the existing Cameron LNG Terminal site, while constructing the remaining portions north of and adjacent to the existing terminal. Table 4.8.6-1 lists the primary equipment and structure of the Terminal Expansion along with the heights above ground level.

TABLE 4.8.6-1 Major Structures of the Terminal Expansion				
Structure	**Number**	**Length (feet)**	**Width (feet)**	**Height (feet)**
Storage Tanks				
LNG Tank	1	260.0 (dia)	-	170.0
Condensate Storage Tank	1	90.0 (dia)	-	55.0
Piperacks				
Main Piperack w/ air coolers	1/train	700.0	100.0	80.0
Turbines				
Frame 7 Turbine Enclosure	2/train	60.0	40.0	60.0
Frame 7 Exhaust Stacks	2/train	15.0 (dia)	-	250.0
Flares				
Flare Derrick Structure	1	45.0	45.0	420.0
Flare (Operational)	1	2.0	-	200.0
Other				
Amine Absorber	1/train	17.0 (dia)	-	95.0
Amine Regenerator	1/train	15.0 (dia)	-	110.0
Main Cryogenic Heat Exchanger	1/train	17.0 (dia)		150.0

Abbreviations:
Dia = diameter

The proposed Terminal Expansion site is surrounded primarily by open land, wetlands, and industrial lands. Gresham et al. (2002) conducted an *Aesthetic Viewshed Study* prior to Cameron LNG's construction of the existing LNG Terminal. The study assessed potential visual impacts from three viewpoints: a residence 0.5 mile north of the LNG Terminal, a residence approximately 1.5 miles south of the terminal, and a residential area 4.0 miles to the east, on the opposite side of Lake Calcasieu. The residence 0.5 mile from the existing Cameron LNG Terminal was acquired by Cameron and is within the proposed Terminal Expansion boundary. Therefore, we did not consider the reported potential impacts from that viewpoint in our assessment.

Gresham et al. (2002) noted that the LNG Terminal facilities would be visible from the residential viewpoints 1.5 miles away and 4.0 miles away, which suggests that the proposed facilities would also be visible from those viewpoints. The existing LNG storage tanks range in height from 168 feet to 192 feet. Cameron LNG would construct the new LNG storage tank within the existing terminal and adjacent to existing LNG storage tanks. The new tank would have a height of 170 feet, which is within the range of the existing tanks and would limit the observable overall change to the viewshed. All other facilities would result in enlarging the industrial viewshed of an area that is currently forest, wetlands, open land, and open water. The proposed facilities range in height from 18 feet to a maximum of 420 feet for a flare structure (table 4.8.6-1). However, we believe the proximity of the proposed structures to the existing industrialized area would lessen the overall impact, as would the existing oil and gas production facilities, electric transmission line towers, and storage tanks. In the previous viewshed analysis, Graham et al. (2002) stated that the viewers at the residence across the ship channel, 4.0 miles away, could see the LNG storage tanks, but that the gray color of the tanks would lessen their visual impact, and soil piles along the ship channel would partially screen the tanks and project facilities as would passing ships. Those conditions would also lessen the visual impact of the proposed Terminal Expansion on viewers in that area.

Cameron LNG would install a 20-foot-high vapor fence along the Terminal Expansion property boundary adjacent to LA-27. Although the vapor fence would be shorter than other structures at the site, it would extend along the entire length of the Terminal Expansion property boundary resulting in a substantial change in the viewshed to viewers traveling along LA-27. **Therefore, we are recommending that:**

- **<u>Prior to the end of the draft EIS comment period,</u> Cameron LNG should file with the Secretary a plan to install and maintain vegetative screening between LA-27 and the vapor fence to disrupt views of the vapor fence and limit the visual impacts on users of LA-27 in the vicinity of the Terminal Expansion site.**

Operation of the Terminal Expansion would also result in visual impacts on those traveling along LA-27, which is the Creole Nature Trial. As for construction, those traveling along the highway would have a short time to view the site, and views of the expanded terminal would be consistent with views of the existing adjacent Cameron LNG Terminal.

Overall, we believe the expanded terminal would result in minor impacts on the viewshed during construction and operation. LA-27 travelers would have the greatest visual impacts. However, those viewers would only be impacted for the brief time they are driving in the vicinity of the site and the views would be similar to those of the existing Cameron LNG Terminal. With incorporation of our recommended mitigation for the vapor fence, we believe that operation of the Terminal Expansion would not result in a significant impact on visual resources.

The existing Cameron LNG Terminal includes outdoor lighting that consists primarily of downlighting for safety and lights on tall structures for aircraft warnings. Cameron LNG would operate similar lighting on the expanded terminal during operation. In addition, viewers of the existing terminal are occasionally able to see flares at night, and that would also be the case for the expanded terminal. The viewshed for the expanded terminal extends as far as 4.0 miles from the site. Most of the viewers of night lights in that area would consist of motorists along LA-27 and other roadways, boaters in the channel, residents at their homes, and viewers from a variety of locations in the viewshed. However, the lighting of the expanded terminal would appear similar to the existing terminal, although across a greater area. Viewers familiar with the nighttime appearance of the existing terminal may notice a larger lit area. Although the lighting would be obvious throughout the viewshed and slightly different in size than the currently lit area, it would be similar to the lighting of oil and gas facilities throughout the area. We believe the impact of night lighting on visual resources would not be significant.

4.8.5.2 Pipeline Expansion

Cameron Interstate's right-of-way vegetation clearing would cause the primary impact on visual resources during construction and operation of the pipeline and associated facilities. To minimize visual impacts, the entire proposed right-of-way would parallel existing permanent rights-of-way, which avoids development of a new corridor. This would limit the extent of changes in the viewshed. However, clearing of forested lands within the construction right-of-way, and maintaining the permanent right-of-way as herbaceous and scrub/shrub vegetation types would change the viewscape for viewers in the area. We believe the impact would not be significant because the increase in width of the right-of-way would be difficult to discern, and there would be few observers of the change. Cameron Interstate would allow all other forested lands to revert to pre-construction conditions, although it could require 20 to 40 years to reach that stage, resulting in long-term visual impacts in those areas.

In addition to clearing of vegetation, construction of the pipeline and associated facilities would require the presence of personnel, large construction equipment, and vehicles, all of which could be visible in areas accessible to the public, such as at roadways crossed by the route and near residences. Cameron Interstate identified one residence and one unoccupied trailer within 50 feet of the construction right-of-way. In addition, three other residences are within 135 feet of the construction right-of-way. Visual impacts in these areas due to the presence of construction equipment and personnel would be temporary. Therefore, we believe those visual impacts would not be significant.

U.S. Highway 171 is a scenic highway that Cameron Interstate would cross using a conventional bore to avoid impacts on the highway and traffic. The land use in this area is open land, and the construction equipment and personnel would be visible to motorists on the highway in the vicinity of the right-of-way. These impacts would be temporary and minor due to the brief period of potential observation by motorists.

The pipeline route would cross two Louisiana Natural and Scenic Rivers in Calcasieu Parish. Cameron Interstate would cross both waterbodies by the HDD method to avoid impacts on the bed or banks. Additionally, Cameron Interstate would set the HDD entry and exit workspaces back at least 400 feet from each waterbody. Although most viewers would not see the right-of-way from the waterbodies or the construction equipment on the right-of-way, it is possible that portions of the drilling equipment would be visible from some locations. We believe this temporary visual impact would not be significant due to the small change in viewscape.

The proposed Holbrook Compressor Station is on an undeveloped pine plantation parcel of land. The major structure at the compressor station would be the compressor buildings, which would be about 40 feet tall. The area surrounding the proposed compressor station site is mainly forested and currently being used for silviculture. The closest roadway to the proposed compressor station is Holbrook Park Road, approximately 1,500 feet from the site. The area surrounding the proposed compressor station is largely forested and would provide visual screening of the compressor station from the roadway. We believe the visual impacts from construction would be temporary and minor.

Cameron Interstate would limit outdoor lighting for the compressor station to downlighting for safety during normal operation. The area surrounding the compressor station is largely forested and the closest residence is 0.6 mile from the site and only one other residence is within 1 mile of the site. Therefore visual receptors would be limited. In addition, the low level of light produced by downlighting would not be visible from long distances. As a result, the nighttime appearance of the compressor station would not have a significant impact on visual resources. Although the visual impacts during operation would be permanent, we believe they would not be significant due to the rural nature of the compressor station's location, distance from the roadway, downlighting, and forested screening.

4.8.6 Coastal Zone Management

The Louisiana CZMP is administered by the LDNR. The inland extent of the coastal zone boundary is defined by the Gulf Intracoastal Waterway. Within the coastal zone, areas are divided into Environmental Management Units by the LDNR. The LDNR evaluates activities or development affecting land within Louisiana's coastal zone for compliance with the CZMA through a process called "federal consistency." Almost half of the proposed Terminal Expansion site is within the designated coastal zone. Because Cameron LNG has not yet obtained its authorization, **we are recommending that:**

- **Prior to construction, Cameron LNG file documentation of concurrence from the LDNR that the Terminal Expansion is consistent with the Louisiana CZMP.**

The dredging for and building of a work dock for the existing terminal was approved by the Commission as part of a previously proposed expansion of the Cameron LNG Terminal.[32] Although the dock was not constructed, the Coastal Use Permit and consistency determination was approved for this portion of the Project and the dock could be constructed under the current consistency determination. For the remainder of the Terminal Expansion within the coastal zone, LDNR is conducting a consistency determination concurrent with Cameron LNG's filling of an application for a conditional use permit. The FERC would not approve construction until all federal authorizations, including CZMA authorization, has been granted. The proposed Pipeline Expansion is not within the jurisdiction of the CZMP.

The Project would not impact either wetland reserve program or conservation reserve program lands.

4.9 SOCIOECONOMICS

Construction of the Project could impact socioeconomic conditions, either adversely or positively, in the general vicinity of the Project. These potential impacts include alteration of population levels or local demographics, increased employment opportunities, increased demand for housing and public services, transportation impacts, and an increase in government revenue associated with sales and payroll taxes. The potential socioeconomic impacts of Project operation include employment opportunities, ongoing local expenditures by the operator, an increased tax base, and an increase in the demand for public services.

[32] Cameron LNG Terminal Expansion EA (docket no. CP06-422)

The Project would include facilities in three parishes: the Terminal Expansion in Cameron and Calcasieu Parishes; and the Pipeline Expansion in Calcasieu, and Beauregard Parishes. For the purposes of our socioeconomic analysis, these three parishes are defined as the “Project area.”

In accordance with Executive Order 12898 on Environmental Justice, all public documents, notices, and meetings were made readily available to the public throughout the Cameron Liquefaction Project area during our review of the Project. The mailing list for the Project has been continuously updated during the EIS process. The public has been notified of all official proceedings regarding the Project with the issuance of the NOI and the scoping meeting we held in the Project area. Section 1.3 of this EIS further describes the public participation and notification process.

Cameron Interstate would collocate the majority of the Pipeline Expansion with existing linear and facility infrastructure, with the remaining portion of the pipeline route parallel and close to other existing linear facilities. Therefore, routing was not selected to disproportionately impact low income or minority populations. Further, the Project would not significantly impact urban or residential areas nor would there be disproportionately high and adverse human health or environmental effects on minority, low-income communities, or Native American tribes because none have been identified.

4.9.1 Population

Table 4.9.1-1 provides a summary of selected population and demographic information for the Project area.

4.9.1.1 Terminal Expansion

The U.S. Census Bureau (2010a) reported that in 2010, the population of Cameron Parish was 6,839, with a population density of 5.3 persons per square mile. Calcasieu Parish was considerably more populated, with a 2010 population of 192,768 and a population density of 181.2 persons per square mile. The average population density for Louisiana in 2010 was 104.9 persons per square mile.

Cameron LNG anticipates full construction of the Terminal Expansion to begin in 2014, and be completed in 2018. Cameron LNG estimates a peak construction workforce of about 3,500 workers over a time span of about 6 months, with an average workforce of about 2,300 workers per month. Cameron LNG anticipates hiring many of these workers locally; non-local personnel are expected to be highly skilled tradesmen. However, to present a worst-case assessment for this EIS, we have assumed all workers would be non-local.

The peak construction workforce could represent a sizeable increase to the local population if all 3,500 workers were housed within Cameron Parish. However, non-local workers would likely find housing in Cameron and Calcasieu Parishes. As discussed in section 4.9.5, the majority of available transient housing is in Calcasieu Parish, with most of the housing within 15 to 25 miles of the proposed Terminal Expansion site.

TABLE 4.9.1-1
Existing Socioeconomic Conditions in the Project Area

State/ Parish	Population		Population Density (per square mile)		Per Capita Income	Civilian Labor Force	Unemployment Rate (percent)	Top Two Major Industries [a]
	2000[b]	2010[c]	2000[b]	2010[c]	2010[c]	July 2013[d]	July 2013[d]	2010[e]
Cameron	9,991	6,839	7.6	5.3	$24,634	3,214	6.2	1. Management, Business, and Science 2. Retail Trade
Calcasieu	183,577	192,768	171.4	181.2	$23,591	95,953	6.4	1. Entertainment[f] 2. Retail Trade
Beauregard	32,986	35,654	28.4	30.8	$21,543	14,632	8.4	1. Manufacturing 2. Retail Trade
Louisiana	4,468,976	4,533,372	102.6	104.9	$23,094	2,123,336	7.1	1. Retail Trade 2. Entertainment[f]

[a] Excludes Education and Health Service industry.
[b] From U.S. Census Bureau (2000)
[c] From U.S. Census Bureau (2010a)
[d] From Louisiana Workforce Commission (2013)
[e] From U.S. Census Bureau (2010b)
[f] Entertainment refers to the Entertainment Accommodation and Food Services industry.

The 2010 Census data for Louisiana indicate that the average family size in the state is 2.6 persons (U.S. Census Bureau 2010a). If all non-local workers move to the Terminal Expansion area with their families, up to 9,135 people may relocate to Cameron and Calcasieu Parishes during construction of the Terminal Expansion. Although it is not likely that all workers would be non-local, and it is unlikely that all workers would bring families, an increase of 9,135 people would result in a 4.7 percent increase in the population of Calcasieu Parish for the peak 6 months of construction. For the remainder of the construction period, the population could increase by about 6,000 people if all workers were non-local and brought families.

Cameron LNG anticipates hiring up to 130 permanent employees to operate the expanded terminal. This workforce and their families would represent a minor but permanent increase in the population in the vicinity of the Terminal Expansion.

4.9.1.2 Pipeline Expansion

The proposed pipeline route traverses two Parishes: Calcasieu and Beauregard. Calcasieu Parish is described above. Beauregard Parish is more populated than Cameron, but less developed than Calcasieu, with a population of 32,986 and a population density of 30.8 persons per square mile (U.S. Census Bureau 2010a).

Cameron Interstate anticipates construction activities for the Pipeline Expansion to begin in 2015 and finish in 2016. The construction workforce would consist of approximately 270 workers for the compressor station and 200 workers for the pipeline. Cameron Interstate estimates a local workforce of 20 to 40 percent who would commute to the work sites daily. However, if all workers are non-local and if each worker brings 2.6 family members, the temporary population would increase by about 1,230 individuals. As described in section 4.9.5, those workers would likely reside in Calcasieu and Beauregard Parishes, a 0.5 percent increase in the combined population of the parishes. That would represent a minor population increase in the vicinity of the Pipeline Expansion.

Cameron Interstate anticipates hiring five new permanent employees to operate the Pipeline Expansion. This would represent a negligible increase in the local population in the vicinity of the Pipeline Expansion.

4.9.1.3 Combined Terminal and Pipeline Expansion Impacts

Construction of the Terminal Expansion and Pipeline Expansion would coincide for a period of 12 to 18 months. For this period, the combined construction workforces would range from 2,700 to 3,900 workers, depending on when the workforce for the Terminal Expansion peaks. The total population for the three parishes in the Project area is approximately 235,000. Assuming all workers are non-local and would be accompanied by 2.6 family members, the population increase could be between 7,047 and 10,179 for a 6-month period. This would represent a potential 3.0 to 4.3 percent increase in the population of the Project area, which is a minor increase.

Operation of the Project would require a permanent workforce of 135 new employees. This would represent a minor permanent impact on the local population.

4.9.2 Economy and Employment

Table 4.9.2-1 provides selected employment and income statistics for the Project area. The main employment sectors in Cameron Parish are management, business, scientific, administrative, and retail trade. In Calcasieu Parish the main employment sectors are entertainment and retail trade (U.S. Census Bureau 2010b).

TABLE 4.9.2-1
Employment and Income Characteristics of the Project Area

	Louisiana	Cameron Parish	Calcasieu Parish	Beauregard Parish
Major Industry (2010) [a, b]	**Retail Trade**	**Management, Business, Scientific, and Administrative**	**Entertainment, Accommodation and Food services**	**Manufacturing**
2006-2010 Civilian Labor Force [c]	2,116,794	3,632	92,007	15,123
2006-2010 Per Capita Income (dollars) [a]	23,094	24,634	23,591	21,543
2006 - 2010 Population below poverty level (percent) [a]	18.1	11.6	16.2	13.2
July 2013 Unemployment Rate (percent) [c]	7.1	6.2	6.4	8.4

[a] From U.S. Census Bureau (2010a)
[b] Excludes Education and Health Service industry.
[c] Louisiana Workforce Commission (2013)

4.9.2.1 Terminal Expansion

The civilian labor force is defined as the sum of employed persons and those searching for work. As of July 2013, the civilian labor force numbered 3,214 persons in Cameron Parish and 95,953 in Calcasieu Parish. Per capita income is roughly the same for both parishes ($24,634 in Cameron Parish - and $23,591 in Calcasieu Parish), and both are above the state's average per capita income of $23,094.

Cameron Parish has an unemployment rate of 6.2 percent, with 11.6 percent of the population below the poverty line. Calcasieu Parish has an unemployment rate of 6.4 percent, and 16.2 percent of the population is below the poverty line. Both parishes have lower unemployment rates than the state of Louisiana, which has an unemployment rate of 7.1 percent. In addition, both parishes have a smaller percentage of the population that is below the poverty level compared to Louisiana's 18.1 percent.

During the proposed construction, Cameron estimates a total payroll for the Terminal Expansion of about $657 million. Construction of the Terminal Expansion would increase economic activity within the area in several ways:

- a direct effect – hiring of local construction workers and purchases of goods and services from local businesses;
- an indirect effect – the additional demand for goods and services, such as replacing inventory from the firms that sell goods and services directly to the project or to workers and their families; and
- an induced effect – the spending of disposable income by the construction workers at local businesses, which in turn order new inventory from their suppliers.

The increase in economic activity resulting from the sum of these three effects would result in a temporary positive economic impact in the Terminal Expansion area.

Anticipated operational expenditures include $10.4 million per year in salaries, or approximately $80,000 per worker per year. As this is well above the average income for the area, we conclude that the permanent workforce associated with the Terminal Expansion would result in a minor, but positive permanent impact on the local economy.

4.9.2.2 Pipeline Expansion

The manufacturing and retail trade sectors are the major employers in Beauregard Parish (U.S. Census Bureau 2010b). Employment and income information for Calcasieu Parish is described above.

As of July 2013, the civilian labor force was 14,632 persons in Beauregard Parish (Louisiana Workforce Commission 2013). Beauregard Parish has a per capita income of $21,543, which is lower than the other parishes in the Project area (U.S. Census Bureau 2010a).

Beauregard Parish had an unemployment rate of 8.4 percent in of July 2013, with 13.2 percent of the population below the poverty line. All three parishes have a smaller percentage of their population below the poverty line than Louisiana, but only Cameron and Calcasieu have a lower unemployment rate as well.

As with the Terminal Expansion, in addition to the direct employment and payroll impacts generated by the Pipeline Expansion, dollars spent on goods and services would have minor, positive direct, indirect, and induced economic impacts on the Project area during the construction period.

Operation of the pipeline would require five new permanent employees. These permanent positions would result in a negligible positive impact on the local economy.

4.9.3 Local Taxes and Government Revenue

4.9.3.1 Terminal Expansion

Cameron LNG estimates spending $637 million on construction goods and services in the Terminal Expansion area during construction of the Terminal Expansion. This would generate increased local, state, and federal sales tax revenue in Cameron, Calcasieu, and Beauregard Parishes. The expenditures on goods and services by the construction workforce and the families of the workers would also generate increased tax revenues. In addition, local, state, and federal governments would tax the $657 million in total workforce payroll. This increase in tax revenue would be a minor, temporary, positive impact on the tax revenue in the Terminal Expansion area.

After construction, Cameron LNG would pay parish property taxes on its Terminal Expansion facilities and equipment. There also would be long-term increases in sales tax revenue from expenditures on materials, goods, and services by Cameron LNG and the operational workforce.

Based on the present tax laws and Cameron LNG's assumed Terminal Expansion life of 20 years, Cameron LNG estimated that the total property tax paid to Cameron and Calcasieu Parishes would be $1.5 billion.

4.9.3.2 Pipeline Expansion

As for the Terminal Expansion, expenditures by Cameron Interstate, workers, and the families of workers during construction would increase tax revenues in the Pipeline Expansion area. This would be a minor, temporary, positive impact on the tax revenue in the Pipeline Expansion area.

Operation of the pipeline would also have a positive effect on local property tax revenue based on Cameron's tax projections of about $86.5 million over the life of the pipeline.

4.9.4 Housing

Table 4.9.5-1 provides data on the local rental and other temporary housing options in the Project area. According to the U.S. Census Bureau (2010c), vacant housing units in Cameron Parish totaled 1,018 units; of these, 62 units were rentals and 779 were for seasonal, recreational, or occasional use. In Calcasieu Parish, vacant housing units totaled 8,062 units; of these, 3,015 units were rentals and 726 were for seasonal, recreational, or occasional use. There are also 85 hotels/motels in Calcasieu Parish that could be used by any of the short-term workforce (HotelMotels 2013). In 2010, there were approximately 9,080 total vacant housing units in the Terminal Expansion area. In Beauregard Parish, vacant housing units totaled 1,881 units. Of these, 250 were rentals and 514 were for seasonal, recreational, or occasional use (U.S. Census Bureau 2010c). There are about 8 recreational vehicle (RV) parks in Calcasieu Parish, which contain over 470 RV spaces. There are no RV parks in Beauregard Parish, and there are two RV parks located in Cameron Parish, which contain over 19 spaces (Louisiana RV Parks 2013; Hidden Ponds RV Park 2013).

4.9.4.1 Terminal Expansion

As stated previously, Cameron LNG anticipates local residents would comprise a portion of the workers hired for construction of the Terminal Expansion. However, for the purpose of this analysis, we have assumed all 3,500 workers in the peak construction workforce would be non-local. The proposed Terminal Expansion site extends into southern Calcasieu Parish and much of the parish would be easily accessible to workers. Calcasieu Parish has the most vacant transient housing units that would be available to the workforce, including vacant units for rent and those for seasonal, recreational, and occasional use (about 3,700 units) as well as rooms at 85 hotels and motels (table 4.9.5-1), and it is likely that the majority of the workforce would be housed there. In addition, a portion of the 3,187 "other vacant" units in Calcasieu Parish may also be available for use by the workforce. Overall the three parishes have 3,328 vacant units for rent, along with 2,016 "seasonal" units, 4,209 "other vacant" units, and 102 hotels and motels. The currently available transient housing in Cameron, Calcasieu, and Beauregard Parishes is sufficient to accommodate the maximum peak workforce for the terminal along with families of the workers who chose to bring their families. Housing of those workers and family members would result in a moderate, temporary impact on housing availability in the Project area that would last about 6 months. Outside of the time when the workforce peaks, the impact on transient housing would be minor, even assuming all 2,300 workers bring their families. Overall, we believe construction of the proposed Terminal Expansion would not result in significant impacts on transient housing availability in the area.

We believe the addition of 130 permanent staff required to operate the expanded terminal would have, at most, a minor permanent impact on local housing markets.

TABLE 4.9.4-1
2010 Housing Characteristics of the Project Area

State/Parish	Total Housing Units [a]	Vacant Housing Units [a,b]	Vacant Housing Units for Rent [a,b,c]	Other Vacant Units [a,c]	For Seasonal, Recreational, or Occasional Use [a,b]	Hotels/ Motels [c]	Rental Vacancy Rate (percent) [a]
Cameron	3,593	1,018	62	139	779	7	16.3
Calcasieu	82,058	8,062	3,015	3,187	724	85	11.8
Beauregard	15,040	1,881	251	883	513	10	8.0
Louisiana	1,964,981	236,621	66,857	95,464	42,253	1,875	10.5

[a] U.S. Census Bureau (2010c)

[b] Housing Definitions (US Census Bureau 2010c)

Vacant Housing Unit – A housing unit is vacant if no one is living in it at the time of enumeration

Vacant Units for Rent – Vacant units offered "for rent" and vacant units offered either "for rent or for sale"

For Seasonal, Recreational, or Occasional Use – Vacant units used or intended for use only in certain seasons or for weekends or other occasional use throughout the year.

Other Vacant Units – If a vacant unit does not fall into any of the classified categories, it is classified as "other vacant". For example, this category includes units held for occupancy by a caretaker or janitor, for migrant workers, and for personal reasons of the owner.

[c] HotelsMotels 2013

4.9.4.2 Pipeline Expansion

Cameron Interstate anticipates local hires would comprise 20 to 40 percent of the peak of 470 workers for the Pipeline Expansion. Those workers would commute daily from their homes to the construction right-of-way or the compressor station site. However, for the purposes of this assessment, we considered the worst-case scenario, with all 470 workers being non-local and requiring temporary housing. Based on the number of available rental housing units and hotels/motels in Calcasieu and Beauregard Parishes as discussed above, adequate housing exists to accommodate those workers and their families. Use of 470 housing units in Calcasieu and Beauregard Parishes would result in a minor, temporary impact on transient housing in those parishes. Overall, construction of the proposed Pipeline Expansion would not result in significant impacts on transient housing in the area.

Operation of the pipeline would require five new permanent employees who would relocate to the Pipeline Expansion area. These new employees would represent a negligible decrease in available permanent housing.

4.9.4.3 Combined Terminal and Pipeline Expansion Impacts

Construction of the Terminal Expansion and Pipeline Expansion may coincide for a period of 12 to 18 months. For this period, the combined construction workforces would range from 2,700 to 3,900 workers, depending on when the workforce for the Terminal Expansion peaks. As noted above, there is sufficient vacant transient housing in Cameron, Calcasieu, and Beauregard Parishes (about 9,500 units, including all categories, plus rooms in 102 hotels and motels) to accommodate the construction workforce peak, assuming some workers would be housed in the vacant “seasonal” and “other” units (as defined in table 4.9.5-1) and in the rooms available in the 102 hotels and motels in the parishes. The impact on transient housing availability would last no more than 6 months and would not be significant.

Operation of the Project would require 135 permanent employees who would relocate to the area. These new employees would represent at most a minor impact on housing.

4.9.5 Public Services

Table 4.9.5-1 summarizes local community public services in the Project area.

4.9.5.1 Terminal Expansion

Cameron and Calcasieu Parishes have 64 public schools with a 2011 to 2012 enrollment of 33,925 students. There are eight hospitals in Cameron and Calcasieu Parishes with a total of 771 beds. Cameron Parish has one sheriff’s department and six fire departments. Calcasieu Parish has eight police departments, and 18 fire departments.

TABLE 4.9.5-1 Public Service Data for the Project Area						
Parish	**Education**		**Public Safety**		**Healthcare**	
	Number of Public Schools [a]	**Total Enrollment 2011-2012 [a]**	**Number of Police Departments [b]**	**Number of Fire Departments [c]**	**Number of Hospitals [d]**	**Number of Hospital Beds [d]**
Cameron	4	1,313	1	6	1	49
Calcasieu	60	32,612	8	18	9	904
Beauregard	12	6,043	3	5	1	60

[a] From Louisiana Department of Education 2013
[b] From Capital Impact Government Gateway 2013
[c] From Louisiana Office of State Fire Marshal 2013
[d] From Louisiana Hospital Association 2013
Note: Hospitals do not include rehabilitation, long term, and psychiatric hospitals.

The peak construction workforce of 3,500 workers is anticipated to last 6 months. If all of these workers relocate to the Pipeline Expansion area with two children each, local school system enrollment would increase by 7,000 students, or an increase of 20.6 percent. However, Cameron would not employ many of the workers for the full duration of construction, and it is unlikely that those workers would relocate with their children. For the average workforce of 2,300 and assuming two children per worker, school enrollment could increase by 4,600 students, or 13.6 percent. We believe this represents the worst-case scenario, resulting in moderate, temporary impacts on the schools. However, many construction workers do not have families or would not relocate their families while they work on the Terminal Expansion. Additionally, Cameron LNG estimated local workers would account for about 20 percent of the workforce based on construction of the existing terminal. As a result, the impacts on schools in the Project area would likely be much less than estimated.

During operation of the expanded terminal, the 130 permanent workers would not likely cause any adverse impact on local schools. If all 130 permanent workers have two children, this would result in 260 additional children in local parish school systems. Combined, this addition would represent less than a 0.1 percent increase in total enrollment across these school districts, with students spread out over many grade levels. As a result, we believe no adverse impacts from operation of the expanded terminal would occur on the parish's school districts.

During construction, enforcement and support activities associated with permitted large vehicle loads and widths could increase, workplace injuries may require emergency medical services, and periodic police services could be required. Local fire departments participate in a regional mutual aid program that provides emergency assistance to many petro-chemical facilities in the area, are experienced with industrial incidents, and could assist in emergencies during construction. In addition, Cameron LNG would expand its existing LNG Terminal first responder group that supports local services, to respond to incidents at the expanded terminal, thus reducing the need for local public service assistance. Therefore, we believe impacts on public services during construction of the Terminal Expansion would be temporary and minor.

We believe Cameron LNG's first responder group for the expanded LNG Terminal would minimize operation impacts on public services from the Terminal Expansion to less than significant levels. The 130 new permanent employees would represent a negligible impact on public services.

4.9.5.2 Pipeline Expansion

Beauregard Parish has 12 public schools with a total of 6,043 students enrolled for the 2011 to 2012 academic year. The Parish also has one hospital with 60 beds, three police departments, and five fire departments. Data on public services in Cameron and Calcasieu Parishes are provided above.

We believe Cameron Interstate's 470 construction workers would not likely bring family members to the area due to the pipeline's relatively short construction period. Further, the temporary increase in population due to construction would be negligible compared to the current population in the area. As a result, we believe the Pipeline Expansion would minimally impact schools in the Pipeline Expansion area. Although it is likely that there would be some need for increased police, fire, and medical services during construction, those public services would experience only minor impacts during construction.

Cameron Interstate's five new permanent positions would represent a negligible increase in the local population. Therefore, we believe local services would not be impacted.

4.9.6 Transportation

4.9.6.1 Terminal Expansion

Ground access to the existing Cameron LNG Terminal for deliveries of equipment and materials, as well as for personnel, is provided by existing roads. The entrance to the existing terminal is situated off LA-27, which is a two-lane highway with a posted speed limit of 55 miles per hour. Based on Cameron LNG's traffic studies (Neel-Schaffer 2012 and 2013), there are about 1,867 vehicles per day along the portion of LA-27 adjacent to the proposed site, with the roadway operating at a DOT Level of Service (LOS)-A[34].

Construction would increase traffic substantially in the vicinity of the proposed Terminal Expansion site due to the presence of worker vehicles, construction vehicles, and trucks taking materials and equipment to and from the site. According to the 2013 traffic study (Neel-Schaffer 2013), construction work would likely occur during two work shifts, one from 6:00 a.m. until 4:00 p.m. and the second between 5:00 p.m. and 3:00 a.m. There are two driveways at the Terminal Expansion Site that would be used to access the Terminal Expansion site. Cameron LNG would use the northern driveway for material deliveries and the driveway to the south for employee access. During the peak of construction, approximately 3,500 employees would travel to the worksite. This would result in up to 1,750 commuter vehicles entering or exiting the site per shift. Material deliveries would also add vehicle traffic to LA-27. Neel-Schaffer (2013)

[34] LOS is a letter designation that indicates a qualitative assessment of a road's operating conditions and refers to a standard measurement used by transportation officials which reflects the relative ease of traffic flow on a scale of A to F, with free-flow being rated LOS-A and congested conditions rated as LOS-F (U.S. Department of Transportation 2013).

indicated that there would be excessive delays of traffic at both driveway intersections during construction (DOT LOS-E). That would result in a significant impact to traffic flow along LA-27 in the Terminal Expansion Area during peak shift hours. Neel-Schaffer (2013) recommended that uniformed traffic control be used during commuting times to reduce the impact, the same mitigation employed during construction of the existing Cameron LNG Terminal. Cameron LNG stated that it had not received complaints regarding traffic disruption during construction of the existing terminal. However, other measures may also be effective in reducing the impacts on traffic along LA-27 in the vicinity of the Terminal Expansion site. **Therefore, we are recommending that:**

- **<u>Prior to construction</u>, Cameron LNG should file a traffic plan with the Secretary, for review and written approval by the Director of OEP, that includes the following:**
  - **a. uniformed traffic control at the access driveways of the Terminal Expansion site during construction commuting times;**
  - **b. mass transportation to and from the Terminal Expansion site for construction workers, including the identification of locations for park-and-ride lots, and a schedule for plan implementation; and**
  - **c. a traffic study during construction to assess the DOT's LOS . If the traffic study indicates a DOT LOS of D or worse, Cameron should implement additional mitigation measures to reduce traffic impacts.**

Barges would deliver the majority of large equipment and materials, such as soil and rock fill, to the work dock during construction. This would reduce the number of truck trips to and from the Terminal Expansion site as well as the potential for damage to local roadways and traffic congestion. Cameron LNG would attempt to schedule deliveries outside of peak traffic hours, when possible, to reduce congestion. The greatest traffic congestion would occur in the vicinity of the site access points on LA-27, resulting in moderate delays over many months for local drivers. Because the majority of this increase would occur outside of commuting times for the construction workforce, it would not add substantially to the impact of the workforce traveling to and from the site each day. In addition, trucks and heavy construction equipment could damage local roadways. However, Cameron would repair any roadway damage that it causes.

Operation of the Cameron LNG Terminal would require a permanent workforce of 130 employees who would commute to the site on a daily basis. This would result in a maximum of 130 commuter vehicles entering the site and 130 commuter vehicles exiting the site per day, distributed over two work shifts. Therefore, up to 65 commuter vehicles would enter the site during the morning peak commuting hours and up to 65 commuter vehicles would exit the site during the evening peak commuting hours. Based on Cameron's 2012 traffic impact study (Neel-Schaffer 2012), we believe this would not result in a significant impact on the existing traffic conditions along LA-27 in the vicinity of the Terminal Expansion site.

Operation of the expanded terminal would increase truck traffic, including deliveries of refrigerant and other supplies and materials, as well as removal of condensate derived from the liquefaction process. However, it is not likely that the increase in traffic would be substantial, and we believe there would be a minor impact on local roads for the life of the Project.

Marine Traffic Impacts

During construction of the Terminal Expansion, Cameron LNG would receive large equipment, bulk materials, and other supplies by barge at the proposed work dock on the Calcasieu Ship Channel. Barges would also use the existing dock on the Gulf Intracoastal Waterway near Old Highway 27. Most barges would likely travel the Gulf Intracoastal Waterway from the Port Arthur area to either the existing dock or to the confluence of the waterway with the channel and to the proposed work dock. Some barges may transit the channel from the Port of Port Charles and others travel up the channel from the Gulf of Mexico. The largest number of deliveries would occur at the beginning of construction (between months 2 and 7) when about 275 barges per month, or about 9 barges per day assuming 30 delivery days per month, are anticipated. Barge deliveries would decrease to 150 per month (about 5 per day) during months 8 through 10, and there would be 125 barges per month (about 4 per day) from months 11 through 14. After that there would be about 10 barges per month (about 1 barge every 3 days) for the duration of construction.

About 10 barges would stage in a common area on the Gulf Intracoastal Waterway every second day. That area is currently used as a barge staging area and Cameron LNG's use of the area would not result in an increase in disruption to vessel traffic along the waterway. Full barges would be moved to the construction dock and empty barges moved back to the staging area.

Cameron LNG would construct the work dock about 375 feet from the western edge of the Calcasieu Ship Channel, and barges tied up at the work dock would not affect commercial or recreational vessel traffic in the channel. In the initial phases of construction, the additional 9 barges per day may affect some recreational and commercial users of the channel, resulting in a minor, temporary, and we believe not significant, impact that would last for about 5 months. About 7 months after construction begins, barge traffic related to construction would represent a small increase in traffic in the channel, and we believe the impact would be minor and temporary.

Because the size and number of LNG carriers would not change from those currently authorized, we do not anticipate any additional impacts from LNG carriers beyond the impacts identified in our previous EIS and EAs for the existing Cameron LNG Terminal.[35]

During operation of the expanded terminal, Cameron LNG would use the work dock to receive some deliveries for maintenance and operation, although most deliveries would be made by truck. This would result in a minimal increase in barge traffic and a minor impact on marine traffic in the channel.

---

[35] Hackberry EIS (docket no. CP02-374), Cameron LNG Terminal Expansion EA (docket no. CP06-422), and Cameron LNG Export Project EA (docket no. CP10-496).

4.9.6.2 Pipeline Expansion

Cameron Interstate would conventionally bore all paved public roads to prevent impacts on roadways and traffic during road crossings as discussed in section 2.6.3. Cameron Interstate would attempt to schedule construction activities to avoid traffic flow interruptions on dirt and gravel roads, which it proposes to open-cut. Delivery of pipe and other materials to the construction right-of-way, the storage yard, and the compressor station site, may result in some disruption of traffic; however, this temporary impact would occur primarily in the early stages of construction.

The workforce of 270 personnel at the compressor station would access the work site from an existing access road off of Holbrook Park Road. Workers on the pipeline would commute to the construction right-of-way, and Cameron Interstate anticipates that most personnel would travel to and from the construction site outside of peak commuting hours. Therefore, we expect construction of the Pipeline Expansion to result in minor, temporary impacts on traffic flow by the construction workforce.

Operation of the pipeline would not result in any significant impacts on traffic or roadways within the Project area.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA, as amended, requires the FERC to take into account the effect of its undertakings on properties listed, or eligible for listing, on the NRHP and to afford the ACHP an opportunity to comment on the undertaking. Cameron LNG and Cameron Interstate, as non-federal parties, are assisting the FERC in meeting our obligations under Section 106 and the implementing regulations in 36 CFR 800 by preparing the necessary information, analyses, and recommendations, as authorized by 36 CFR 800.2(a)(3).

Construction and operation of the Project could affect historic properties (that is, cultural resources listed or eligible for listing on the NRHP). Historic properties include prehistoric or historic archaeological sites, districts, buildings, structures, and objects, as well as locations with traditional value to Native Americans or other groups. Such historic properties generally must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet one or more of the criteria specified in 36 CFR 60.4.

4.10.1 Terminal Expansion

Cameron LNG completed a records review and a Phase I cultural resources survey of the proposed Terminal Expansion (Thomas and Holland 2012). The investigations covered both archaeological and architectural resources. The resulting report was provided to the FERC and the Louisiana State Historic Preservation Office (SHPO).

The records review did not identify any known archaeological resources within the survey area, or any known historic architectural resources within or near the proposed site of the Terminal Expansion.

The Phase I cultural resources survey examined a 566-acre area that had not been previously surveyed, and re-examined a 69-acre portion that had been previously surveyed. The survey consisted of pedestrian surface inspection of areas with greater than 25 percent surface visibility, and systematic subsurface shovel testing of areas that were not inundated, obviously disturbed past the depth of potential archaeological deposits, or used for dredge spoil disposal. A total of 317 shovel tests were excavated. No archaeological resources were identified.

Cameron LNG also examined a 0.5-mile-wide area adjacent to the boundaries of the Terminal Expansion area and existing terminal for historic architectural resources, except in some areas where vegetation limited line of sight to shorter distances. No historic architectural resources were identified.

The Louisiana SHPO reviewed the Phase I cultural resources survey report, and in letters dated September 24 and December 5, 2012, concurred that no historic properties would be impacted and indicated that it had no further concerns regarding the Terminal Expansion. On April 24, 2013, the Louisiana SHPO concurred that a cultural resource survey was not required for the associated wetland mitigation and dredge disposal areas since these areas consisted of open water, marsh, and existing dredge disposal areas.

4.10.1.1 Unanticipated Discovery Plan

Cameron LNG prepared an Unanticipated Discovery Plan which it would implement in the event that cultural resources or human remains are encountered during construction. We requested revisions to the plan, and Cameron LNG provided a revised plan that we find acceptable.

4.10.1.2 Compliance with the National Historic Preservation Act

Cultural resource surveys have been completed for the Terminal Expansion. The Louisiana SHPO and the FERC agree that no historic properties would be affected. Therefore, the process of complying with Section 106 of the NHPA has been completed for the Terminal Expansion.

4.10.2 Pipeline Expansion

Cameron Interstate completed a records review and a Phase I cultural resources survey of the proposed Pipeline Expansion and related facilities (Thomas et al. 2012). The investigations covered both archaeological and architectural resources for the proposed pipeline right-of-way, Holbrook Compressor Station, contractor storage yard, access roads, the new interconnection to Trunkline, and modified interconnections with Transco, TETCO, TGP, and FGT pipelines. The resulting report was provided to the FERC and SHPO. A new metering facility at the existing LNG Terminal would be installed within an area previously surveyed, with no cultural resources identified (Ryan et al. 2002). Therefore, it was not included in the investigations for the Pipeline Expansion.

The records review identified three known archaeological sites previously documented within or near the survey area. One site (16BE47) mapped within the survey area was described as a ca. 1882 through 1963 artifact scatter associated with an abandoned bed of the Southern Pacific Railroad. This site was determined not eligible for the NRHP. The other two sites (16BE1690 and 16BE1691) were mapped outside of the survey area. No historic architectural resources were identified within the study area. In addition, the records review identified the Swires Family Cemetery (06-00001-A) 0.6 mile from the proposed route.

The Phase I cultural resources survey examined a 200-foot-wide to 400-foot-wide corridor encompassing the proposed pipeline right-of-way and associated extra work spaces, 50-foot-wide corridors along the access roads, a 25-acre parcel for the compressor station, a 21-acre parcel for the contractor storage yard, and parcels for the Trunkline interconnection and modified interconnections. In total, approximately 1,097 acres were surveyed.

The survey consisted of pedestrian surface inspection of areas with greater than 25 percent surface visibility, and systematic subsurface shovel testing of areas that were not inundated or obviously disturbed past the depth of potential archaeological deposits. The area examined through surface inspection and subsurface testing included the proposed pipeline right-of-way, the compressor station and contractor storage yard parcels, and the interconnections. The access roads, all existing, were examined through surface inspection. One approximately 1.7-mile-long segment along the pipeline route was denied access by the landowner. In this area, shovel tests were excavated (all negative) along the edge of the survey corridor where it occupied the existing pipeline right-of-way, and from there, visual inspection of the adjoining no-access property was carried out. Because of disturbances due to silviculture and the swampy nature of the land, no further work was recommended for this segment.

Cameron Interstate did not identify any archaeological resources within the survey area, including any cultural remains associated with previously recorded Site 16BE47, which was not re-located.

Cameron Interstate also examined the areas around the proposed compressor station, new interconnection, and four interconnection modifications for architectural resources that could be visually impacted by those facilities. It defined the area of potential visual impact as the visual horizon from each proposed facility to the adjacent tree line. Cameron Interstate did not identify any architectural resources within those areas.

The Louisiana SHPO reviewed the Phase I cultural resources survey report, and in letters dated September 24 and December 5, 2012, concurred that no historic properties would be impacted and indicated that it had no further concerns regarding the Pipeline Expansion.

4.10.2.1 Unanticipated Discovery Plan

Cameron Interstate prepared an Unanticipated Discovery Plan which it would implement in the event that cultural resources or human remains are encountered during construction. We requested revisions to the plan, and Cameron Interstate provided a revised plan that we find acceptable.

4.10.2.2 Compliance with the National Historic Preservation Act

Cultural resource surveys have been completed for the Pipeline Expansion. The Louisiana SHPO and the FERC agree that no historic properties would be affected. Therefore, the process of complying with Section 106 of the NHPA has been completed for the Pipeline Expansion.

4.10.3 Native American Consultation

We mailed our NOI to six federally recognized Native American tribes: the Jena Band of Choctaw Indians, the Caddo Nation, the Chitimacha Tribe of Louisiana, the Coushatta Tribe of Louisiana, the Alabama Coushatta Tribe of Texas, and the Tunica-Biloxi Indian Tribe of Louisiana. The NOI requested comments on the proposed Project and encouraged attendance at the FERC's public scoping meeting. We did not receive responses to our NOI from any of the tribes.

We sent a follow-up letter to each of the tribes on October 19, 2012. The letters requested comments from the tribes and assistance in identifying properties of traditional, religious, or cultural importance that may be affected by the proposed Project. We received a letter from the Coushatta Tribe of Louisiana expressing thanks "for the opportunity to review this report." To date no other responses have been received.

Cameron sent letters to the tribes on July 20 and August 1, 2012. The letters requested the tribes communicate any concerns about potential impacts the proposed Project may have on archaeological sites, burials, or traditional cultural properties. Cameron also sent follow-up letters to the tribes on October 31, 2012. In a response dated December 12, 2012, the Jena Band of Choctaw Indians requested that Cameron provide the cultural resource survey reports for review. Cameron provided the reports to the tribe on February 8, 2013. In a letter dated April 11, 2013, the tribe concurred with the findings and recommendations in the reports, and requested to be contacted immediately in the event of a significant unanticipated discovery. No other responses have been received to date to the original or follow-up letters.

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

4.11.1.1 Regional Climate

The general area in the vicinity of the proposed Project area has a modified marine climate which can be influenced by a predominant onshore flow of tropical marine air from the Gulf of Mexico. During onshore flow events, the area experiences a subtropical humid climate. In summer, sea breezes help decrease temperatures. Based on data from the National Climatic Data Center's (NCDC) Climatology of the United States No. 20 (NCDC 2010), which provides data from 1971 to 2000, maximum and minimum temperatures at the Port Arthur Airport in Beaumont, Texas (the data collection point that is closest to the proposed Project) usually occur in July and January, respectively.

Mean annual precipitation falling at the Port Arthur Airport is 59.9 inches, while monthly average precipitation is from 3.35 inches in February to 6.58 inches in June. Thunderstorms occur in the area approximately 60 days per year and the average annual snowfall is 0.3 inch.

Winds in the area are generally from the south, with average wind speeds around 9 miles per hour. Winds from the southwest through north-northwest are quite rare. Wind direction can vary by season; spring winds are from the south through southeast, summer winds are from the south and west-southwest; fall winds are from the north clockwise through south; and in winter, winds are from the north.

4.11.1.2 Existing Air Quality

Ambient Air Quality Standards

Air quality would be affected by construction activities and operation of the proposed facilities. With authority granted by the CAA, the EPA established NAAQS to protect human health (primary standards) and public welfare (secondary standards). EPA set NAAQS for the following air contaminants designated as "criteria pollutants:" nitrogen oxides (NO_X) including nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), lead (Pb), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), and particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$). These NAAQS reflect the relationship between pollutant concentrations and health and welfare effects. The NAAQS are codified in 40 CFR 50 and are summarized in table 4.11.1-1. The LDEQ adopted the NAAQS.

In December 2009, EPA updated the definition of air pollution to include six greenhouse gases (GHGs) after determining that GHGs in the atmosphere can endanger public health and welfare. The GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. GHGs can be ranked by their global warming potential (GWP), which is a relative measure of a GHG's ability to absorb solar radiation and its residence time in the atmosphere in comparison to that of CO_2. Thus, CO_2 has a GWP of 1. In comparison, CH_4 has a GWP of 21, and N_2O has a GWP of 310. [36]

Air Quality Control Regions and Attainment Status

An Air Quality Control Region (AQCR), as defined in the CAA (42 USC 7407), is a contiguous area considered to have relatively uniform ambient air quality, and is treated as a single unit for reducing air emissions and determining compliance with the NAAQS. Each AQCR, or smaller portion within an AQCR, is designated as attainment, unclassifiable, maintenance, or nonattainment. Areas where ambient air pollutant concentrations are below the NAAQS are designated as attainment, while areas where ambient air concentrations are greater than the NAAQS are designated as nonattainment. Areas previously designated as nonattainment that have subsequently demonstrated compliance with the NAAQS are designated as maintenance. Areas without data available are designated unclassifiable, and are treated as attainment areas for the purpose of stationary source air permitting.

The proposed Project would be constructed in Cameron, Calcasieu, and Beauregard Parishes, which are within the Southern Louisiana-Southeast Texas Interstate AQCR. All of these parishes are in attainment for all criteria pollutants. Calcasieu Parish is classified as a maintenance parish for O_3 and Cameron Parish is classified as an "adjoining" parish. To maintain a status of attainment, measures must be taken in both parishes to track emissions data for all criteria pollutants. Currently, there are no provisions or emissions thresholds associated with Calcasieu Parish's maintenance designation with which the Pipeline Expansion must comply. Both Calcasieu and Cameron Parish are in attainment for the current 8-hour O_3 NAAQS.

---

[36] In March 2013, the EPA proposed to change the GWP of CH_4 and N_2O to 25 and 298, respectively; however, this rule was not made final at the time this draft EIS was prepared. More information is available in Volume 78 of the Federal Register, Issue 63.

TABLE 4.11.1-1
National and Louisiana Ambient Air Quality Standards

Pollutant	Time Frame	Primary	Secondary
PM_{10}	Annual[a]	Revoked	Revoked
	24-hour[b]	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual[c]	12 µg/m^3	15 µg/m^3
	24-hour[d]	35 µg/m^3	35 µg/m^3
SO_2	Annual	0.030 ppm (80 µg/m^3)	NA
	24-hour[b]	0.14 ppm (365 µg/m^3)	NA
	3-hour[b]	NA	0.5 ppm (1,300 µg/m^3)
	1-hour [e]	75 ppb (196 µg/m^3)	NA
CO	8-hour[b]	9 ppm (10,000 µg/m^3)	NA
	1-hour[b]	35 ppm (40,000 µg/m^3)	NA
NO_2	Annual	0.053 ppm (100 µg/m^3)	0.053 ppm (100 µg/m^3)
	1-hour[f]	0.100 ppm	NA
O_3	8-hour[g]	0.075 ppm (147 µg/m^3)	0.075 ppm (147 µg/m^3)
	1-hour[h]	Revoked	Revoked
Pb	3-month rolling[i]	0.15 µg/m^3	0.15 µg/m^3
	Quarterly	1.5 µg/m^3	1.5 µg/m^3

Source: EPA 2010

Abbreviations:

PM_{10} = particulate matter less than 10 microns
$PM_{2.5}$ = particulate matter less than 2.5 microns
SO_2 = sulfur dioxide
CO = carbon monoxide
NO_2 = nitrogen dioxide
O_3 = ozone
Pb = lead
mg = milligram(s)
µg = microgram(s)
m^3 = cubic meter(s)
NA = not applicable
ppm = part(s) per million
ppb = part(s) per billion

Air Quality Monitoring and Existing Air Quality

EPA, along with state and local agencies, created a network of ambient air quality monitoring stations that collect data on background concentrations of priority pollutants across the U.S. To characterize the existing ambient air quality for the proposed Project, data were gathered from three air quality monitoring stations in Calcasieu Parish: Carlyss, Vinton, and Westlake. Outside of Calcasieu Parish, the next closest air monitoring station is about 80 miles from the proposed Project.

The monitors at Carlyss, Vinton, and Westlake measure O_3. The Westlake monitor also measures NO_X and SO_2, and the Vinton monitor also measures $PM_{2.5}$. In 2005, the nearest PM_{10} monitoring location was in Lafayette, approximately 80 miles from the Project. The nearest monitoring location for CO is in Baton Rouge, which is approximately 135 miles from the Project.

The most recent validated data from these monitoring sites are presented in table 4.11.1-2, which compares monitored data with the appropriate NAAQS standard for each criteria pollutant. All monitored values were below the NAAQS.

TABLE 4.11.1-2
Ambient Air Quality and Ambient Air Quality Standards[a]

Air Pollutant	Averaging Period	Highest Monitored Value	Monitoring Site	Year	NAAQS
Ozone (O_3)	8-hour	NA[b]	Carlyss, Vinton, Westlake	2010-2011	75 ppb
Sulfur Dioxide (SO_2)	1-hour	3 ppb	Westlake	2008-2010	75 ppb
Carbon Monoxide (CO)	1-hour	3.11 ppm	Baton Rouge	2008-2010	35 ppm
Nitrogen Dioxide (NO_2)	Annual	7.5 ppb	Westlake	2008-2010	53 ppb
Particulate Matter of 10 microns in diameter or less (PM_{10})	24-hour	88 $\mu g/m^3$	Port Allen	2008-2010	150 $\mu g/m^3$
Particulate Matter of less than 2.5 microns in diameter ($PM_{2.5}$)	Annual	9 $\mu g/m^3$	Vinton	2008-2010	15 $\mu g/m^3$

Abbreviations:
NA= not available ppb = parts per billion ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter NAAQS = National Ambient Air Quality Standards

[a] Data collected from monitoring stations closest to Project.

[b] The 2010 and 2011 data from Carlyss, Vinton, and Westlake included three O_3 exceedance days in 2011 but none in 2010.

Emissions from the Existing Cameron LNG Terminal

Table 4.11.1-3 lists emissions from the currently permitted Cameron LNG Terminal. The Cameron LNG Terminal is currently permitted under Part 70 Permit No. 0560-00184-V4.

TABLE 4.11.1-3
Emissions Summary for the Existing Cameron LNG Terminal

Emission Unit	Annual Pollutant Emissions (tons)						
	NO_X	CO	SO_2	PM_{10}	VOC	HAPs	GHG
Submerged Combustion Vaporizer CAP	230.0	182.65	3.16	33.60	24.32	0.36	527,665
Fuel Gas Heater CAP	1.40	0.88	0.01	0.12	0.09	<0.001	1,947
Emergency Generators (3)	4.59	2.43	0.27	0.15	4.59	0.003	477
Emergency Fire Water Pumps (3)	0.72	0.24	0.03	0.03	0.72	0.001	47
Emergency River Water Pumps (2)	0.24	0.11	0.02	0.02	0.24	0.0004	16
Diesel Storage Tank	--	--	--	--	0.01	--	--
Fugitives	--	--	--	--	0.04	--	133
Flare	0.19	1.06	<0.01	0.01	0.01	0.005	333
TOTAL	**237.14**	**187.38**	**3.50**	**33.93**	**30.02**	**0.37**	**530,618**

Abbreviations:
NO_X = oxides of nitrogen CO = carbon monoxide SO_2 = sulfur dioxide
VOC = volatile organic compounds HAPs = hazardous air pollutants GHG = greenhouse gas
PM_{10} = particulate matter less than 10 microns

4.11.1.3 Regulatory Requirements for Air Quality

Terminal Expansion

Federal Air Quality Requirements

New Source Review/Prevention of Significant Deterioration

Federal preconstruction review of certain large proposed projects varies for attainment and nonattainment areas. Federal preconstruction review for sources in nonattainment areas is referred to as Nonattainment New Source Review (NNSR), while federal preconstruction review for sources in attainment areas is formally referred to as Prevention of Significant Deterioration (PSD). The review process aids in preventing new sources from causing existing air quality to deteriorate beyond acceptable levels. The PSD regulations under 40 CFR 52.21 consider a major source as any source that (1) is in one or more of 28 listed source categories that emits or has the potential to emit 100 tons per year (tpy) or more of any pollutant regulated under the CAA, or (2) is in an unlisted source category and emits or has the potential to emit those pollutants in amounts greater than 250 tpy [40 CFR 52.21(b)]. The Terminal Expansion does not fall under a listed source category, but it is considered a major source because it has the potential to emit more than 250 tpy of a pollutant regulated under the CAA. Table 4.11.1-4 lists major source emission thresholds, and table 4.11.1-5 summarizes the potential-to-emit based on new equipment that would be used for the Terminal Expansion.

TABLE 4.11.1-4
Major Stationary Source/Major Modification Emission Thresholds

Pollutant	Major Stationary Source Threshold Level (tpy)	Major Modification Significant Net Increase (tpy)
O_3/VOC/NO_X	250	40
CO	250	100
SO_2	250	40
PM	250	25
PM_{10}	250	15
$PM_{2.5}$	250	10
Pb	250	0.6
GHG	100,000 tpy CO_2-eq/250 tpy GHGs[a]	75,000 tpy CO_2-eq />0 tpy GHGs[b]

Abbreviations:

O_3 = ozone
VOC = volatile organic compounds
NO_X = oxides of nitrogen
CO = carbon monoxide
SO_2 = sulfur dioxide
PM = particulate matter
PM_{10} = particulate matter less than 10 microns
$PM_{2.5}$ = particulate matter less than 2.5 microns
Pb = lead
tpy = tons per year
GHG = greenhouse gas
CO_2-eq = carbon dioxide equivalents

[a] A facility is considered a major stationary source if the potential-to-emit is greater than 100,000 tpy of CO_2-eq and greater than 250 tpy of GHG (sum of 6 six GHGs on a mass basis).

[b] A major modification must meet 2 emission conditions: must be greater than 75,000 tpy of CO_2-eq and exceed 0 tpy of GHG (sum of 6 GHGs on a mass basis).

TABLE 4.11.1-5 Terminal Expansion Project Potential-to-Emit							
Emission Unit (Quantity)	**Pollutant Emissions (tpy)**						
	NO_X	**CO**	**SO_2**	**PM_{10}**	**VOC**	**HAPs**	**GHG**
Refrigeration Compressor Turbines (6)	2,312.64	814.68	1.56	131.40	47.10	22.21	2,939,806
Thermal Oxidizer (1 with spare)	0.01	0.01	6.98	0.001	0.004	<0.001	462,939
Flares (5)	13.66	74.40	0.11	1.49	1.09	0.04	23,799
Emergency Generators (4 with spare)	7.65	4.05	0.45	0.25	7.65	0.008	795
Emergency Fire Water Pumps (3)	0.27	0.27	0.03	0.015	0.27	0.001	47
Emergency River Water Pumps (2)	0.10	0.10	0.01	0.004	0.10	0.0004	16
Condensate Storage Tank	--	--	--	--	3.58	--	--
Condensate loading	--	--	--	--	1.22	--	--
Fugitive emissions	--	--	--	--	36.68	--	2.012
TOTAL	**2,333.84**	**890.82**	**9.14**	**133.11**	**97.65**	**22.26**	**3,428,553**

Abbreviations:
NO_X = oxides of nitrogen
CO = carbon monoxide
SO_2 = sulfur dioxide
PM_{10} = particulate matter less than 10 microns
VOC = volatile organic compounds
HAPs = hazardous air pollutants
GHG = greenhouse gas (rounded to nearest whole number)
tpy = tons per year
-- = no emissions

There are three air quality classifications within each of the Air Quality Control Regions of the U.S.: Class I areas are designated as pristine natural areas or areas of natural significance and receive special protections under the CAA based on good air quality. Class III areas are heavily-industrialized zones that are established only on request and must meet all requirements outlined in 40 CFR 51.166. The remainder of the U.S. is designated as Class II. If a new source or major modification of an existing source is subject to the PSD program requirements and is within 62 miles (100 kilometers [km]) of a Class I area, the facility is required to notify the appropriate federal officials and assess the impacts of the proposed project on the Class I area. The closest designated Class I area to the Terminal Expansion is Breton National Wildlife Refuge, approximately 279 miles from the proposed site, and therefore a PSD Class I analysis is not required.

In May 2010, EPA issued the PSD GHG Tailoring Rule, designed to account for facilities that represent approximately 70 percent of GHG emissions from stationary sources while protecting smaller sources. Beginning in January 2011, a new industrial facility that is a major source for at least one non-GHG pollutant and which emits or has the potential to emit at least

75,000 tpy of CO_2-equivalent (CO_2-eq)[37] would also be subject to GHG permitting requirements under PSD. Any existing industrial facility that is already considered a major source of a non-GHG pollutant and which would increase its GHG emissions by more than 75,000 tpy CO_2-eq would also be subject to GHG permitting requirements under PSD. Beginning in July 2011, the new PSD major source threshold of 100,000 tpy of CO_2-eq became effective for new sources. For existing PSD major sources, the threshold for a modification is 75,000 tpy CO_2-eq. The Terminal Expansion would be a PSD major source, have projected CO_2-eq emissions above 75,000 tpy, and be subject to the PSD GHG Tailoring Rule.

Cameron LNG submitted a PSD air quality permit application for the proposed Terminal Expansion to LDEQ. The LDEQ issued a draft PSD permit (PSD-LA-766) on October 1, 2013.

New Source Performance Standards

The New Source Performance Standards (NSPS), codified in 40 CFR 60, regulate emission rates and provide requirements for new or significantly modified sources. NSPS requirements include emission limits, monitoring, reporting, and record keeping.

The standards in 40 CFR 60 Subpart KKKK apply to stationary combustion turbines that commenced construction, modification, or reconstruction after February 18, 2005 and have a heat input at peak load equal to or greater than 10.7 gigajoules per hour (10 million British thermal units [Btu] per hour). Cameron LNG would operate the refrigeration turbines of the Terminal Expansion in compliance with the applicable requirements of Subpart KKKK by accomplishing the following:

- operating within emission limits, with recorded source and use of sulfur fuel at or below 0.060 pounds per million Btu;
- operating and maintaining the turbines and associated control and monitoring equipment using good air pollution control procedures to minimize emissions at all times;
- reporting excess emissions (4-hour rolling unit operating hour average where the target value is outside acceptable range) for all periods of unit operation;
- conducting initial and annual performance tests to demonstrate emissions at least 75 percent of peak load;
- submitting results within 60 days of testing; and
- submitting fuel for analysis.

The emergency generators, emergency fire water pumps and emergency river water pumps would be subject to NSPS Subpart IIII – *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*. Cameron LNG would comply with the standards for these pumps by accomplishing the following:

[37] CO_2-eq is a measure used to compare GHGs based on their GWP. The carbon dioxide equivalent for a gas is calculated by multiplying tons of the gas by the associated GWP.

- operating below required emission limits;
- operating, maintaining, and altering the pumps in accordance with the manufacturer's instructions;
- using the required non-road diesel fuel;
- operating for maintenance as required for no more than 100 hours per year;
- undergoing the required performance tests; and
- timing operations on a non-resettable meter installed prior to initial startup of the engine.

Cameron LNG would comply with the standards for the emergency generators by accomplishing the following:

- using certified engines for the required emission limits for new non-road engines;
- using the required non-road diesel fuel;
- installing and configuring the generators in accordance with the manufacturer's requirements; and
- timing operations on a non-resettable meter installed prior to initial startup of the engine.

The new condensate storage tank would be subject to NSPS Subpart Kb – *Standards of Performance for Volatile Organic Liquid Storage Vessels* (including petroleum liquid storage vessels) for which construction, reconstruction, or modification commenced after July 23, 1984. Cameron LNG would comply with the standards by accomplishing the following:

- installing the required closed-vent system and control device;
- keeping records for the life of the source, including vessel dimension and capacity;
- obtaining the necessary data to calculate the true vapor pressure;
- preparing an operating plan for the facility;
- providing measured monitoring values for all operations without the flare pilot flame; and
- providing required reports on time.

National Emissions Standards for Hazardous Air Pollutants

The National Emissions Standards for Hazardous Air Pollutants (NESHAPs), codified in 40 CFR Parts 61 and 63, regulate the emissions of Hazardous Air Pollutants (HAPs) from new and existing sources. Part 61, promulgated before the 1990 CAA Amendments, regulates eight hazardous substances: asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride.

The 1990 CAA Amendments established a list of 189 HAPs, resulting in the promulgation of Part 63, also known as the Maximum Achievable Control Technology (MACT) standards. Part 63 regulates HAPs from major sources of HAPs and specific source categories emitting HAPs. Some NESHAPs may apply to non-major sources (area sources) of HAPs. Major source thresholds for NESHAPs are 10 tpy of any single HAP or 25 tpy of total HAPs.

The Terminal Expansion is not expected to include processes that are regulated by Part 61, but the terminal would be a major source of HAPs and subject to 40 CFR 63, Subpart YYYY - *NESHAPS for Stationary Combustion Turbines*. The refrigeration turbines of the expanded terminal would be operated in compliance with the applicable requirements of Subpart YYYY.

Title V Operating Permit

A Title V major source, as defined in 40 CFR, Part 70.2, is a source or group of stationary sources (including new and existing sources) within a contiguous area and under common control, emitting or with the potential to emit criteria pollutants or HAPs above the criteria pollutant threshold values (100 tpy for criteria pollutants). Cameron LNG currently operates the existing LNG Terminal under a Title V permit and the proposed expansion would be considered a major modification under the Title V program. Therefore, the current Title V permit must be modified for construction and operation of the Terminal Expansion. A draft air quality permit application for the proposed expansion was submitted to LDEQ and is considered a modification to the existing LNG Terminal Air Permit. The LDEQ issued the Title V Permit (0560-00184-V5) for the Terminal Expansion on October 1, 2013.

General Conformity

The General Conformity Rule was designed to require federal agencies to ensure that federally-funded or federally-approved projects conform to the applicable State Implementation Plan (SIP). Section 176(c) of the CAA prohibits federal actions in nonattainment or PSD maintenance areas that do not conform to the SIP for the attainment and maintenance of NAAQS. General Conformity regulations apply to project-wide emissions of pollutants for which the project areas are designated as nonattainment (or, for ozone, its precursors NO_X and VOC) that are not subject to NSR and that are greater than the significance thresholds established in the General Conformity regulations or 10 percent of the total emissions budget for the entire nonattainment area. Federal agencies are able to make a positive conformity determination for a proposed project if any of several criteria in the General Conformity Rule are met. These criteria include:

- emissions from the project that are specifically identified and accounted for in the SIP attainment or maintenance demonstration; or
- emissions from the action that are fully offset within the same area through a revision to the SIP, or a similarly enforceable measure that creates emissions reductions so there is no net increase in emissions of that pollutant.

The existing LNG Terminal and the proposed expansion would be entirely within an attainment area and would be subject to PSD permitting and, therefore, not subject to General Conformity.

GHG Reporting Rule

In September 2009, EPA issued the final Mandatory Reporting of Greenhouse Gases Rule, requiring reporting of GHG emissions from suppliers of fossil fuels and facilities that emit greater than or equal to 25,000 metric tpy of GHG (reported as CO_2-eq). In November 2010, EPA signed a rule finalizing GHG reporting requirements for the petroleum and natural gas industry in 40 CFR Part 98 Subpart W. The industry separates LNG storage facilities from LNG import and export equipment because the former are considered part of the source category regulated by Subpart W. The rule does not apply to construction emissions.

New LNG facilities associated with the Terminal Expansion would potentially be subject to the GHG Mandatory Reporting Rule. The rule establishes reporting requirements based on actual emissions; however it does not require emission controls. Cameron LNG would monitor emissions in accordance with the reporting rule. If actual emissions exceed the 25,000 tpy CO_2-eq reporting threshold, Cameron LNG would be required to report its GHG emissions to EPA.

Applicable State Air Quality Requirements

The Terminal Expansion facilities would be subject to state standards, codified in LAC Title 33, Part III. The regulations listed below would apply to the new facilities associated with the Terminal Expansion, including governing turbines, flares, generators, fire water pumps, condensate loading, amine units with incinerator, and fugitive emissions:.

- Section 1101 - Control of Air Pollution from Smoke;
- Section 1103 – Impairment of Visibility on Public Roads Prohibited;
- Section 1105 - Smoke from Flaring;
- Section 1109 - Outdoor Burning (smoke);
- Section 1305 - Control of Fugitive Emission (particulate matter);
- Section 1311 – Emission Limits (particulate matter);
- Section 1313 - Fuel Burning Equipment (particulate matter);
- Section 2103 – Storage of Volatile Organic Compounds;
- Section 2107 – Volatile Organic Compounds – Loading;
- Section 2111 – Pumps and Compressors; and
- Section 2113 - Housekeeping.

Cameron LNG would comply with all applicable state requirements.

Pipeline Expansion

Federal Air Quality Requirements

New Source Review/Prevention of Significant Deterioration

Neither the pipeline nor the Holbrook Compressor Station would be a listed source category, but the Holbrook Compressor Station would be considered a major PSD source because it would exceed the 250 tpy threshold during operation. Table 4.11.1-4 lists major source emission thresholds, and table 4.11.1-6 summarizes the potential-to-emit from the equipment proposed for the Holbrook Compressor Station.

TABLE 4.11.1-6
Pipeline Expansion Project Potential-to-Emit

Emission Unit (Quantity)	Pollutant Emissions (tpy)						
	NO_X	CO	SO_2	PM_{10}	VOC	HAPs	GHG
Natural Gas-Fired Compressors (12)	383.26	20.50	0.96	0.13	199.73	9.46	241,256
Emergency Generator	1.04	0.22	0.20	0.22	0.06	0.004	113
Fugitive Emissions	--	--	--	--	0.10	0.02	79
TOTAL	**384.30**	**20.72**	**1.16**	**0.34**	**199.91**	**9.48**	**241,448**

Abbreviations:
NO_X = oxides of nitrogen
CO = carbon monoxide
SO_2 = sulfur dioxide
PM_{10} = particulate matter less than 10 microns
VOC = volatile organic compounds
HAPs = hazardous air pollutants
tpy = tons per year
-- = no emissions
GHG = greenhouse gas (as CO_2-eq, rounded to whole numbers)

The closest designated Class I area to the pipeline route, the Breton National Wildlife Refuge, is approximately 279 miles away; therefore a PSD Class I analysis is not required.

The Holbrook Compressor Station would be a PSD major source and would have projected CO_2-eq emissions above 75,000 tpy. Therefore, the Pipeline Expansion would be subject to the PSD GHG Tailoring Rule. Cameron Interstate filed its PSD application with the LDEQ and a public notice of the PSD permit was issued by LDEQ on October 18, 2013 with a comment period that ended November 21, 2013.

New Source Performance Standards

Subpart IIII of 40 CFR 60 applies to each stationary compression ignition internal combustion engine that commenced construction after July 11, 2005. The new emergency generator at the compressor station would be constructed and operated in compliance with those requirements. Cameron Interstate would comply with those standards by accomplishing the following:

- certifying the compressors for the required emission standards;
- operating, maintaining, and altering the equipment in accordance with the manufacturer's recommendations;
- using approved non-road diesel fuel;
- conducting the required maintenance and readiness activities for no more than 100 hours per year and for no more than 50 hours per year for non-emergency testing; and
- timing operations on a non-resettable meter installed prior to initial startup of the engine.

Subpart JJJJ of 40 CFR 60 applies to each stationary compression ignition internal combustion engine that commenced construction after July 11, 2005. Cameron Interstate would operate the compressors in compliance with those requirements by accomplishing the following:

- certifying the equipment for the required emission standards;
- using propane as an alternative fuel for no more than 100 hours per year; and
- conducting recordkeeping at the required frequency.

National Emissions Standards for Hazardous Air Pollutants

The proposed pipeline and compressor station are not expected to include processes regulated by 40 CFR 61. The Holbrook Compressor Station would be a minor source of HAPs subject to 40 CFR 63, Subpart ZZZZ - *NESHAPS for Stationary Reciprocating Internal Combustion Engines*. Cameron Interstate would operate the compressors and emergency generator in compliance with the applicable requirements of Subpart ZZZZ by accomplishing the following:

- complying with Subpart JJJJ (see above New Source Performance Standards) for compressor operation; and
- complying with Subpart IIII for the emergency generator (see above New Source Performance Standards).

Title V Operating Permit

The Holbrook Compressor Station would be considered a major source and a Title V permit would be required for construction and operation of the facility. Cameron Interstate submitted a draft Title V permit application to LDEQ on October 16, 2012 and a public notice of the initial Title V permit was issued by LDEQ on October 18, 2013 with a comment period that ended November 21, 2013.

General Conformity

Because the proposed pipeline route is in an attainment area, general conformity does not apply. A portion of the Pipeline Expansion is in Calcasieu Parish, which is designated as a maintenance area for the 1-hour ozone standard. The Pipeline Expansion would conform to the Louisiana SIP, but emissions from the expanded system would be excluded from a conformity determination because it is subject to NSR.

GHG Reporting Rule

The Holbrook Compressor Station would be subject to the GHG Mandatory Reporting Rule. The rule establishes reporting requirements based on actual emissions; however it does not require emission controls. Cameron Interstate would monitor emissions in accordance with the reporting rule. If actual emissions exceed the 25,000 tpy CO_2-eq reporting threshold, Cameron Interstate would be required to report its GHG emissions to EPA.

Applicable State Air Quality Requirements

As discussed for the Terminal Expansion, construction and operation of the pipeline would be subject to the state air quality standards codified in LAC Title 33, Part III. The regulations that would apply to the pipeline and associated equipment and facilities are listed below:

- Section 1101 - Control of Air Pollution from Smoke;
- Section 1103 – Impairment of Visibility on Public Roads Prohibited;
- Section 1109 - Outdoor Burning (smoke);
- Section 1311 – Emission Limits (particulate matter);
- Section 2111 – Pumps and Compressors; and
- Section 2113 – Housekeeping.

Cameron Interstate would comply with all applicable state requirements.

4.11.1.4 Construction Air Emissions and Impacts

Terminal Expansion

Emissions

Potential impacts to ambient air quality for construction projects typically include generation of fugitive dust and combustion emissions from construction equipment operation. Fugitive dust results from construction activities such as land clearing, grading, excavation, and concrete work, as well as from vehicles traveling on paved and unpaved roads. Fugitive dust generation depends on the area of construction, silt and moisture contents of the soil, wind speed, frequency of precipitation, amount of vehicle traffic, and vehicle and roadway type. Fugitive dust may be produced during all phases of construction. Emissions are typically greatest during drier winter months and in areas of fine-textured soils. The control of fugitive particulate emissions is typically addressed through compliance with state or local nuisance regulations such as Louisiana state regulations Section 1305 - *Control of Fugitive Emission of Particulate Matter* and Section 1311 – *Emission Limits* (particulate matter). Cameron LNG would use dust suppression techniques, such as watering the construction areas to minimize fugitive dust during construction, in addition to the requirements in Louisiana state regulations Section 1305.

Construction-related air quality impacts are also associated with the operation of gasoline- or diesel-fueled engines in on-road, off-road, stationary and mobile equipment. A summary of expected construction emissions is provided in table 4.11.1-7.

As with any fossil fuel-fired activity, construction equipment used for the Terminal Expansion would also contribute GHG emissions, including CH_4, CO_2, and N_2O. Emissions of GHGs are typically estimated as CO_2-eq. Although EPA's reporting rule does not apply to construction emissions, we have included these GHG emissions in table 4.11.1-7 for accounting and disclosure purposes.

TABLE 4.11.1-7
Summary of Terminal Expansion Construction Emissions

Year	Annual Pollutant Emissions (tons)						
	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	GHG
2014	398.88	214.80	28.82	109.25	25.58	24.50	36,729
2015	190.14	336.37	6.32	104.66	21.00	32.15	38,116
2016	120.04	315.47	3.62	100.71	17.04	24.95	30,003
2017	13.53	47.89	1.05	93.66	9.99	3.13	4,436
TOTAL	**722.59**	**944.53**	**39.81**	**408.27**	**73.62**	**84.74**	**109,285**

Abbreviations:
NO_X = oxides of nitrogen
CO = carbon monoxide
SO_2 = sulfur dioxide
PM_{10} = particulate matter less than 10 microns
$PM_{2.5}$ = particulate matter less than 2.5 microns
VOC = volatile organic compounds
HAPs = hazardous air pollutants
GHG = greenhouse gas (as CO_2-eq, rounded to whole numbers)

Mitigation Measures

Once the construction phase is completed, the fugitive dust and emissions would subside; thus, the length of time the area near the site would be exposed to dust and emissions from construction activities would be limited. Cameron LNG would incorporate the following mitigation measures into the Terminal Expansion to minimize impacts on air quality during construction:

- use of modern, well-maintained machinery and vehicles meeting applicable emission performance standards to minimize combustion related emissions, including GHGs;
- shutting down idling fossil-fueled equipment when not in use, if practicable (i.e., during summer operations), to minimize combustion-related emissions, including GHGs;
- maintenance of tire pressures to manufacturer's specifications of on-road and off-road vehicles to minimize combustion related emissions, including GHGs;
- use of dust abatement techniques during construction, such as applying water or dust retardant chemicals, to control fugitive dust emissions;
- reduction of the amount of the disturbed land area where possible to control fugitive dust emissions;
- covering or maintaining at least 2 feet of freeboard in the beds of trucks hauling dirt, sand, soil, or other loose materials to control fugitive dust emissions;
- reuse of construction debris and use of locally made construction materials to the extent feasible to reduce associated GHG emissions; and
- minimization of tree removal during construction to the extent feasible, and replacement of landscaping (trees, shrubs, and grasses) to offset the loss of carbon sequestration associated with tree removal to reduce GHG emissions.

The mitigation measures employed by Cameron LNG would meet all LDEQ requirements for construction-related vehicle exhaust emissions. Vehicular exhaust and crankcase emissions from gasoline and diesel engines would comply with applicable EPA mobile source emission regulations (40 CFR 85) by using equipment manufactured to meet these specifications.

Cameron LNG's control measures to minimize fugitive dust due to vehicle travel would meet all LDEQ requirements for fugitive dust mitigation. These measures may include watering the disturbed construction area, washing construction equipment, and minimizing the area being disturbed to the extent possible during each phase of construction. With incorporation of Cameron LNG's proposed mitigation measures, we believe that fugitive dust emissions associated with vehicle travel in and around the construction area would not result in a significant impact on regional air quality.

The air emissions and fugitive dust that would occur during construction of the Terminal Expansion would be primarily limited to the existing terminal site. These emissions would represent a small portion of the parishes' yearly emissions inventories and would subside once construction has been completed. Further, Cameron LNG's proposed mitigation measures and its commitment to comply with applicable state and local regulations would minimize construction-related air emissions. Therefore, we believe the construction-related impact on local air quality during construction would not be significant.

Pipeline Expansion

Emissions

Construction of the Pipeline Expansion would impact air quality due to fugitive dust and combustion emissions from operation of gasoline- or diesel-fueled engines in on-road, off-road, stationary, and mobile equipment during construction of the pipeline and associated facilities. A summary of expected construction emissions is provided in table 4.11.1-8.

Construction of the Pipeline Expansion would also contribute GHG emissions, including CH_4, CO_2, and N_2O. Although EPA's reporting rule does not apply to construction emissions, we have included these GHG emissions in table 4.11.1-8 for accounting and disclosure purposes.

TABLE 4.11.1-8
Summary of Pipeline Expansion Construction Emissions

Year	Annual Pollutant Emissions (tons)						
	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	GHG
2015	34.03	67.99	6.7E-02	56.79	8.66	7.15	7,651
2016	12.05	25.83	2.7E-02	29.28	3.98	1.84	3,207
TOTAL	**46.08**	**93.82**	**9.4E-02**	**86.07**	**12.64**	**8.99**	**10,858**

Abbreviations:
NO_X = oxides of nitrogen
CO = carbon monoxide
SO_2 = sulfur dioxide
PM_{10} = particulate matter less than 10 microns
$PM_{2.5}$ = particulate matter less than 2.5 microns
VOC = volatile organic compounds
HAPs = hazardous air pollutants
GHG = greenhouse gas (as CO_2-eq, rounded to whole numbers)

Mitigation Measures

Because pipeline construction moves through an area relatively quickly, air emissions are typically intermittent and short-term. Cameron Interstate would employ the same mitigation measures for construction of the pipeline and compressor station as described for the Terminal Expansion. Air emissions resulting from construction of the Pipeline Expansion facilities would subside once construction is completed and would represent a small portion of the parishes' yearly emissions inventories. Therefore, the construction-related impact on local air quality would be temporary and would not be significant.

4.11.1.5 Operation Air Emissions Impacts and Mitigations

Terminal Expansion

Emissions

Emissions during operation of the terminal would be primarily from the following:

- six refrigeration turbines;
- three amine units controlled by a thermal oxidizer;
- three emergency generators;
- three firewater pumps;
- two river water pumps; and
- condensate loading and storage.

In addition, there would be emissions from mobile sources operating within the moored safety zone (mobile sources in and outside of the berthing area are addressed in section 4.13.2.11, Cumulative Impacts). Pollutants that would be emitted include NO_X, CO, GHG, SO_2, $PM_{2.5}$, PM_{10}, and VOCs. Table 4.11.1-5 lists a facility-wide emission summary based on its potential-to-emit.

Cameron LNG conducted air dispersion modeling for compliance with PSD and the NAAQS for CO, SO_2, and NO_2 for the Terminal Expansion stationary sources. Results of the modeling conducted are listed in table 4.11.1-9. The modeling was conducted in accordance with the LDEQ guidelines and procedures, as well as the June 28 and 29, 2010 and March 1, 2011 EPA memoranda for the new 1-hour NO_2 standard. Modeling was also conducted for mobile sources of air emissions, which include LNG ships and support vehicles; however, these mobile source emissions are authorized under Cameron LNG's existing operations and could occur independently of the proposed Terminal Expansion. Further, there would not be an increase in LNG carrier traffic for the Terminal Expansion Project beyond that currently authorized and the mobile source emissions are not considered in the air permitting process. Therefore, the mobile source emissions were not included in the analysis here. Mobile source emissions and modeling results are discussed in Section 4.13.2.11, Cumulative Impacts.

The model used was the American Meteorological Society/EPA Regulatory Model (AERMOD) version 12060. AERMOD incorporated data from AERMAP (version 11103), the terrain preprocessor, AERMET (version 11059), the meteorological preprocessor, and AERSURFACE (version 08009), which is used to estimate surface characteristics required for input to AERMET. A screening analysis was conducted to determine if emissions from the equipment listed above would cause a significant impact. The screening results (table 4.11.1-9) indicate that CO and SO_2 are below their respective PSD modeling significant impact levels (SILs). Therefore, further modeling was not required.

TABLE 4.11.1-9 Screening, Modeling, and Increment Consumption Analysis for Operation of the Terminal Expansion			
Screening Results			
Pollutant and Averaging Period	**Year of Highest Level[a]**	**Modeled Concentration (ug/m^3)**	**Significant Impact Level (ug/m^3)**
CO 1-hour	2007	162.80	2,000
CO 8-hour	2010	51.26	500
SO_2 3-hour	2008	9.19	25
SO_2 24-hour	2010	1.57	5
SO_2 Annual	All years equal	0.03	1
NO_2 1-hour	All years equal	35.36	7.5
NO_2 Annual	2011	0.83	1
Refined Modeling Analysis – NO_2			
Averaging Period	**Year of Highest Level**	**Total Concentration (ug/m^3) [Modeled+ Background[b]]**	**NAAQS (ug/m^3)**
1-hour	All years equal	3,113	188
Increment Consumption Analysis - NO_2			
Averaging Period	**Year of Highest Level**	**Project Contribution to Modeled Maximum Concentration (ug/m^3)**	**Significant Impact Level (ug/m^3)**
1-hour	All years equal	0.00014	1

Abbreviations:
μg/m^3 = micrograms per cubic meter
[a] Meteorological years used were 2007 to 2011.
[b] Background data used most appropriate air pollutant monitoring station, which would have included any emissions from existing terminal during 2007 to 2011.

The screening results for NO_2 indicated an exceedance of the SIL, and a refined analysis of NO_2 emissions was conducted. The results of the refined analysis for annual NO_2 NAAQS had no exceedances of the NAAQS, but the 1-hour NO_2 NAAQS results had exceedances of the standard at multiple locations (see table 4.11.1-9). The NO_2 1-hour NAAQS modeling also included a cumulative assessment of NO_2 emissions for existing major sources of air emissions in the area of impact for the Terminal Expansion. The area of impact for the Terminal Expansion was 37.3 miles (60 km) miles and included a total of 116 industrial emissions sources from 26 entities. A culpability analysis was conducted using the MAXDCONT post processor to determine if operation of the Terminal Expansion contributed significantly (7.5 ug/m^3) to any of the exceedances when combined in both time and space. The results listed in table 4.11.1-9 indicate that operation of the expanded terminal would not contribute significantly to exceedances of the 1-hour NAAQS for NO_2.

An increment consumption analysis was also conducted to compare results to Class II allowable PSD increment consumption standards. That analysis resulted in levels that were in exceedance of the Class II levels. Finally, an analysis was conducted to determine if any of the exceedances would be significant. This analysis indicated that operation of the Terminal Expansion would not exceed the SIL at any of the receptors above the increment consumption standard, and therefore, would not contribute significantly to consumption of the Class II increment.

Mitigation Measures

Cameron LNG would minimize potential impacts on air quality due to the operation of the Terminal Expansion by adhering to applicable federal and state regulations and installing BACT to minimize emissions. As presented in Cameron LNG's Title V Permit application modification, the BACT analysis includes identification of all applicable control technologies based on control effectiveness. The strictest controls are evaluated first and if those are technically or economically infeasible, or if environmental effects are significant, then the next most stringent control technology is reviewed. The process continues until the BACT level being considered cannot be eliminated based on technical or economic considerations, energy or environmental impacts. BACT is required for NO_X, CO, VOC, PM_{10}, $PM_{2.5}$, and GHG emissions for the proposed equipment.

BACT for Refrigeration Turbines

For NO_X, Dry Low-NO_X (DLN) is proposed on the refrigeration compressor turbines with an emission rate of 25 parts per million, volumetric dry (ppmvd) at 15 percent oxygen (O_2) (on an annual basis) as BACT, in addition to the use of good combustion practices. BACT for NO_X is also considered BACT for CO and VOC, as reducing CO and VOC emissions reduces NO_X emissions. For CO, the use of natural gas with an emission rate of 15 ppmvd at 15 percent O_2 (on an annual basis) is proposed as BACT, in addition to the use of good combustion practices. For VOC, good combustion practices and the use of natural gas are determined as BACT to minimize CO emissions from the compressor turbines to 0.040 pounds per million Btu. For PM (encompassing both PM_{10} and $PM_{2.5}$), good combustion practices and the use of natural gas are determined as BACT for turbine emissions.

BACT for Internal Combustion Engines

Internal combustions engines proposed for the Terminal Expansion include diesel-fired fire water pumps, river water pumps, and emergency generators, which are required to comply with NO_X, CO, VOC, and PM_{10} standards in 40 CFR 60 Subpart IIII (NSPS). In complying with Subpart IIII, the equipment would be incompliance with the requirements of 40 CFR 63 Subpart ZZZZ (NESHAPS). Compliance with 40 CFR 60 Subpart IIII is determined as BACT for NO_X, CO, VOC, PM_{10}, and $PM_{2.5}$ emissions.

BACT for Thermal Oxidizers

Two thermal oxidizers would be installed to control VOC and hydrogen sulfide (H_2S) within the acid gas vent streams generated by the amine units. This equipment would be designed to maximize the destruction efficiency by maximizing the combustion temperature by emitting a maximum of less than 0.01 pounds per hour of NO_X. Good equipment design, proper operating practices, and the use of natural gas are determined as BACT for NO_X, CO, VOC, PM_{10}, and $PM_{2.5}$ emissions from the thermal oxidizers.

BACT for Flares

Five flares are proposed: two low-pressure flares (one wet flare and one dry flare) and three high-pressure flares (one wet flare, one main dry flare, and one spare dry flare). The wet and dry flares control vents from the pressure relief devices and depressurizing valves of the liquefaction trains. For complete combustion of the flare gas, a flame is maintained at the flare tip whenever vent gas is routed to the flare. This practice, along with proper plant operations, would minimize CO, VOC, PM_{10}, and $PM_{2.5}$ emissions and is determined as BACT for the flares.

The existing flare, which controls natural gas and VOC from warm ship cool downs, emergency emissions, and maintenance activities, would not generate increased emissions as a result of operation of the Terminal Expansion. Physical modifications would not be made to this flare and BACT analysis is not required.

BACT from Condensate Tank, Loading Operations, and Fugitive Emissions

VOC emissions are highest during nighttime hours and tank loading. A closed-vent system routed to a control device would be used that meets the requirements of 40 CFR 60 Subpart Kb (NSPS) and thus are determined to be BACT for the tank. Good equipment design and proper operating practices are BACT for VOC emissions from loading. All rotary pumps and compressors handling VOC with a true vapor pressure of 1.5 pounds per square inch absolute or greater at handling conditions would be equipped with mechanical seals or other equivalent equipment which is determined as BACT for VOC emissions from fugitives.

BACT for Greenhouse Gas Emissions

Installing a leak detection and repair program to minimize methane emissions is determined as BACT for GHG emissions from fugitive sources, while proper plant operations to minimize flare gas are determined as BACT for GHG emissions for the flares. The use of natural gas fired high thermal efficiency turbines in combination with good combustion and operating practices are determined as BACT for GHG emissions from the turbines.

Pipeline Expansion

Emissions

The anticipated emissions during operation of the Pipeline Expansion would be from the Holbrook Compressor Station and from pipeline maintenance activities, including minor emissions from mowers and vehicles. Emissions from the Holbrook Compressor Station would be primarily from the 12 natural gas-fired compressor engines (totaling approximately 56,820 horsepower) and the emergency generator engine. Pollutants emitted from these units would include NO_X, CO, GHG, SO_2, and PM_{10}. There would also be fugitive emissions during operation of the compressor station. Table 4.11.1-7 presents an emission summary for the compressor station based on its potential-to-emit.

Cameron Interstate conducted air dispersion modeling for compliance with PSD and the NAAQS for both NO_X and $PM_{2.5.}$ The modeling was conducted in accordance with the LDEQ guidelines and procedures, as well as the June 28 and 29, 2010 and March 1, 2011 EPA memoranda for the new 1-hour NO_2 standard.

The model used was the AERMOD version 12345. AERMOD incorporated data from AERMAP (version 11103), the terrain preprocessor and AERMET (version 11059), the meteorological preprocessor. A screening analysis was conducted to determine if emissions from the equipment listed above would cause a significant impact. The screening results (table 4.11.1-10) indicate that $PM_{2.5}$ is below PSD modeling SILs and preconstruction exemption levels. Therefore, further modeling was not required for $PM_{2.5}$.

The screening results for maximum offsite concentrations of NO_2 were below preconstruction monitoring exemption levels. However, the annual and 1-hour averaging periods were exceeded for the SIL, and a refined analysis of NO_2 emissions was conducted. The results of the refined analysis for annual NO_2 NAAQS had no exceedances of the NAAQS, but the 1-hour NAAQS results had exceedances of the standard (see table 4.11.1-10). The culpability analysis conducted using the MAXDCONT post processor indicated that operation of the Holbrook Compressor Station would not contribute significantly to exceedances of the 1-hour NAAQS (see table 4.11.1-10).

An increment consumption analysis was also conducted to compare results to Class II allowable PSD increment consumption standards for the annual NO_2 NAAQS. That analysis resulted in levels that were below Class II levels and indicated that the Holbrook Compressor Station was in compliance with the standard.

This modeling included a total of 380 industrial emissions sources from 16 entities and represents a cumulative assessment of NO_2 emissions for existing major sources of air emissions in the area of impact for the Holbrook Compressor Station (37.3 miles [60 km]).

Mitigation Measures

Cameron Interstate has committed to comply with all applicable state and local air permitting requirements during construction and operation of the Holbrook Compressor Station. Under a new Title V permit for the Holbrook Compressor Station, a BACT analysis similar to that described above for the Terminal Expansion was performed. BACT would be implemented for the stationary gas compressor and emergency diesel generator and is required to control NO_X, VOC, and $PM_{2.5}$.

BACT for Compressors

For NO_X, lean-burn combustion with an emission rate of 0.7 grams per brake horsepower-hour (BHP-hr) for the compressors, along with good combustion practices, is determined as BACT.

TABLE 4.11.1-10

Screening, Modeling, and Increment Consumption Analysis for Operation of the Holbrook Compressor Station[a]

Screening Results

Pollutant and Averaging Period	Year of Highest Level	Modeled Concentration (ug/m^3)	Significant Impact Level (ug/m^3)	Monitoring Exemption Level (ug/m^3)
$PM_{2.5}$ 24-hour (5-year)	All years equal	0.96	1.2	4
$PM_{2.5}$ Annual	All years equal	0.004	0.3	NA
NO_2 1-hour (5-year)	All years equal	118	7.5	NA
NO_2 Annual	2007	3.95	1	14

Refined Modeling Analysis – NO_2

Averaging Period	Year of Highest Level	Modeled Concentration (ug/m^3)	Project Contribution to Modeled Maximum Concentration (ug/m^3)	NAAQS (ug/m^3)
1-hour (5-year)	All years equal	257[b]	0.00347	188
Annual	2007	73.81[c]	NR	100

Increment Consumption Analysis - NO_2

Averaging Period	Year of Highest Level	Modeled Maximum Concentration Annual Average All Sources (ug/m^3)	Increment Consumption Standard (ug/m^3)
Annual	2007	9.63	25

Abbreviations:
μg/m^3 = micrograms per cubic meter
NA = not applicable
NR = not required
[a] Meteorological years used were 2007 to 2011
[b] Maximum daily 8th high for all sources
[c] Annual average plus 5-year background concentration

For VOCs, CO oxidation catalyst control would be implemented, along with the use of good combustion practices which follow the manufacturer's recommendations for maximum fuel efficiency and minimal emissions of 0.36 grams per BHP-hr for the compressors, which is determined as BACT.

For $PM_{2.5}$, the use of natural gas, along with good combustion practices, is determined as BACT for the compressors, achieving emission limits of 7.7 x 10^{-5} pounds per million Btu.

BACT for Internal Combustion Engine

For NO_X, the use of low sulfur fuel, good combustion practices, including operation and maintenance of the generator as recommended by the manufacturer for maximum fuel efficiency and minimal emissions, and compliance with 40 CFR 60 Subpart IIII (NSPS) for a combined limit of 4.8 grams per BHP-hr of non-methane hydrocarbons and VOC are determined as BACT for the emergency generator.

For VOC, good combustion practices including operation and maintenance of the generator as recommended by the manufacturer for maximum fuel efficiency and minimal emissions with a limit of 0.28 grams per BHP-hr is determined as BACT for the emergency generator.

For PM2.5, the use of low sulfur fuel and an emergency generator certified by the manufacturer, and a non-emergency operational limitation of 100 hours per year is determined as BACT.

As a result of incorporation of BACT, we believe that air quality impacts due to construction and operation of the proposed Pipeline Expansion would be minor.

4.11.2 Noise

Sound is mechanical energy transmitted by pressure waves in media such as air or water (FTA 2006). When sound becomes excessive, annoying, or unwanted, it is referred to as noise. Noise levels are quantified using units of decibels (dB). Noise may be continuous (constant noise with a steady decibel level), steady (constant noise with a fluctuating decibel level), impulsive (having a high peak of short duration), stationary (occurring from a fixed source), intermittent (at intervals of high and low sound levels), or transient (occurring at different rates).

Ambient sound levels, or background sound levels, result from sound emanating from natural and artificial sources. The magnitude and frequency of background noise may vary considerably over the course of a day and throughout the year, caused in part by weather conditions, seasonal vegetative cover, and human activity. Two measures used by federal agencies to relate the time-varying quality of environmental sound levels to known effects 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 energy as the time-varying sound, averaged over a 24-hour period. The L_{dn} is the $L_{eq(24)}$ with 10 decibels on the A-weighted decibel scale (dBA) added to the nighttime sound levels between the hours of 10 p.m. and 7 a.m., to account for people's greater sensitivity to sound during nighttime hours.

The potential for noise impacts can be assessed by considering the sound level increase over existing levels at receptors, referred to as noise-sensitive areas (NSAs) such as residences, schools, or hospitals. In general, an increase of 3 dBA is barely detectable by the human ear and an increase of 5 dBA is considered clearly noticeable. Increases of 10 dBA are perceived as a doubling of noise or twice as loud.

During construction, sound levels would increase in the vicinity of the Terminal Expansion site and the Pipeline Expansion area. During operation, sound levels would increase in the vicinity of the Terminal Expansion site and the Holbrook Compressor Station. EPA indicated that an L_{dn} of 55 dBA protects the public from indoor and outdoor activity interference. We have adopted this criterion and use it to evaluate the potential noise impacts from operation of new and modified natural gas pipeline facilities. An L_{dn} of 55 dBA is equivalent to a continuous sound level of 48.6 dBA for facilities that generate constant sound levels.

The State of Louisiana, Cameron Parish, and Beauregard Parish do not have regulations that would limit noise from the Project.

Calcasieu Parish has a noise ordinance (Code of Ordinances, Chapter 18, Article VIII – Disturbing the Peace) that does not set specific sound level limits, but rather restricts excessive noise as follows: "No person shall make, continue, or cause to be made or continued any loud, unnecessary or excessive noise which unreasonably interferes with the comfort and repose of others within the jurisdiction of the parish." (Sec 18-96) (Municipal Code Corporation, 2003).

Applicable exemptions include:

- Sec 18-99, paragraph (3) "Noises made by persons having obtained a permit.";
- Sec 18-99, paragraph (4) "Any noise resulting from activities of temporary duration, for which a permit has been granted pursuant to this article, and which conforms to the conditions and limits stated thereon."; and
- Sec 18-100, paragraph (4) "Construction and demolition. The operating of any equipment used in construction work within 165 feet of any residential or noise sensitive area between sunset and sunrise on weekdays and Saturdays, and 9:00 p.m. and 8:00 a.m. on Sundays and holidays, except for emergency work."

4.11.2.1 Existing Sound Levels and Noise-Sensitive Areas

Cameron LNG and Cameron Interstate evaluated potential noise impacts during operation by conducting a background noise level survey and noise impact evaluation at the nearest NSAs, during operation of the Project. The noise impact evaluations included development of estimated sound level increases during construction and operation and comparing those estimates to our standard for permissible sound levels at NSAs.

Terminal Expansion

The only NSA in the vicinity of the Terminal Expansion site is a rural residence about 1.2 miles northwest of the site boundary. The NSA is on the Gulf Intracoastal Waterway, near the Ellender Bridge, west of LA-27. Ambient sound levels were determined based on measurements recorded during a July 2009 the FERC noise compliance survey for the existing Cameron LNG Terminal. The measurements were recorded at a sound level measurement location 1.1 miles southeast of the NSA and closer to the existing LNG Terminal.[38] However, both the NSA and sound level measurement location are within similar land use areas and have similar ambient sound levels. The next nearest NSA is 1.5 miles northwest of the acoustic center of the site and

[38] At the time the sound level measurements were recorded, the measurement location was a residence and considered an NSA. However, Cameron LNG purchased the property and it is no longer a residence.

would not be affected by increases in sound levels at the site of the expanded terminal; therefore, this NSA was not included in our analysis.

The primary sources of sound generation during the July 2009 measurements included distant traffic sounds from nearby LA-27, natural sounds from birds and insects, and sound from the existing LNG Terminal). Measurements were conducted between the hours of 10:15 pm and 10:45 pm. The $L_{eq(24)}$ was 44.5 dBA and the L_{dn} was 50.9 dBA.

Pipeline Expansion

Ambient sound levels in the vicinity of the proposed construction right-of-way and the Holbrook Compressor Station site were estimated based on typical sound levels by land use type. Land uses in those areas were determined through a review of aerial photography. This technique is consistent with estimates of ambient sound levels conducted by EPA (1978) and the American National Standards Institute (ANSI). The ANSI standard sound level estimation uses six land use categories and is generally consistent with the levels calculated by EPA (see table 4.11.2-1). All NSAs identified for the pipeline and associated facilities are in Category 6, Very Quiet Sparse Suburban or Rural Areas. For those land use areas, the assumed $L_{eq(24)}$ is 43 dBA, with an L_{dn} of 45 dBA. Table 4.11.2-2 lists each proposed HDD entry or exit site along with the nearest NSA.

The NSA nearest the Holbrook Compressor Station site is a residence approximately 3,200 feet (0.6 mile) from the proposed site. Other nearby residences range from 4,900 feet (0.9 mile) to 7,500 feet (1.4 miles) from the site. Figure 4.11-1 depicts the NSAs within 1 mile of the proposed Holbrook Compressor Station. Land use Category 6 was also used to estimate the ambient sound levels at these NSAs.

4.11.2.2 Construction Noise Impacts and Mitigation

Terminal Expansion

The most prevalent sound generating equipment during construction of the Terminal Expansion would be internal combustion engines of construction equipment (up to 90 dBA at 50 feet) and pile driving (up to 95 dBA at 50 feet). The sound levels experienced at the NSAs 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 generation source and the receptor. Sheet and pile driving could produce peak sound levels that would be perceptible above the prevalent sound levels during construction. Cameron LNG would restrict sheet and pile driving activities to daylight hours to prevent nighttime noise impacts. Increased sound levels during construction would occur for the duration of the construction period. Sound levels would be reduced a minimum of 6 dBA for each doubling of distance between the source and the receiver. Based on the distance to the NSA (1.2 miles or 6,336 feet), sound levels from construction equipment could reach 48 dBA, which is less than our noise criteria of an L_{dn} of 55 dBA noise, and would not be expected to result in adverse impacts on the NSA. Sheet and pile driving could contribute sound levels of 53 dBA, which is also less than our noise criteria, and would also not be expected to result in significant impacts on the NSA.

TABLE 4.11.2-1 American National Standards Institute Land Use Categories for Estimating Ambient Noise Levels				
Category	**Land Use**	**Description**	**Estimated Existing Daytime $L_{eq(24)}$ (dBA)**	**Estimated Existing L_{dn} (dBA)**
1	Noisy Commercial and Industrial Areas	Very heavy traffic conditions, such as in busy downtown commercial areas, at intersections of mass transportation and other vehicles, including trains, heavy motor trucks and other heavy traffic, and street corners where motor buses and heavy trucks accelerate	69	70
2	Moderate Commercial and Industrial Areas, and Noisy Residential Areas	Heavy traffic areas with conditions similar to Category 1 but with somewhat less traffic, routes of relatively heavy or fast automobile traffic but where heavy truck traffic is not extremely dense, and motor bus routes	64	65
3	Quiet Commercial, Industrial Areas, and Normal Urban and Noisy Residential Areas	Light traffic conditions where no mass transportation vehicles and relatively few automobiles and trucks pass, and where these vehicles generally travel at low speeds. Residential areas and commercial streets and intersections with little traffic comprise this category.	58	60
4	Quiet Urban and Normal	These areas are similar to Category 3 above but, for this group, the background is either distant traffic or is unidentifiable.	53	55
5	Quiet Suburban Residential Areas	Isolated areas, far from significant sources of sound	48	50
6	Very Quiet, Sparse Suburban or Rural Areas	These areas are similar to Category 5 above but are usually in unincorporated areas and, for this group, there are few if any near neighbors	43	45

Increases in sound levels during construction activities would be intermittent and would generally occur during daylight hours. However, certain activities may need to be conducted during non-daylight hours to avoid construction schedule delays, including the unloading/staging of materials, barge unloading, and welding activities. Construction noise levels for these activities are minimal. If perceived noise levels cause a nuisance at the nearby NSAs and residents are inconvenienced, Cameron LNG would provide alternative accommodations for residents during the activity contributing to noise levels that are greater than expected.

Pipeline Expansion

Sound level increases during pipeline construction would be intermittent and would generally occur during daylight hours, with the exception of some HDD activities. The most prevalent sound generating equipment would be internal combustion engines of construction equipment (up to 90 dBA at 50 feet).

TABLE 4.11.2-2 Noise Analysis for Daytime HDD Boring						
Station	**Distance (feet) /Direction**	**Land Use Category**	**Existing Daytime $L_{eq(24)}$ [a] (dBA)**	**Calculated HDD $L_{eq(24)}$ Noise Level**	**Combined Future Level (Existing Plus HDD)**	**Increase Over Existing $L_{eq(24)}$**
Houston River HDD Entry	850 / SE	5	48	58.4	58.8	10.8
Houston River HDD Exit	1700 / SW	5	48	46.0	50.1	2.1
Little River HDD Entry	3050 / SE	5	48	42.6	49.1	1.1
Little River HD Exit	2350 / NW	5	48	46.1	50.2	2.2
Beckwith Creek HDD Entry	1650 / SE	6	43	52.4	52.9	9.9
Beckwith Creek HDD Exit	2450 / S	6	43	42.5	45.8	2.8
Hickory Branch HDD Entry	6400 / SW	6	43	37.8	44.1	1.1
Hickory Branch HDD Exit	7900 SW	6	43	29.1	43.2	0.2
Indian Bayou HDD Entry	580 / N	5	48	61.5	61.7	13.7
Indian Bayou HDD Exit	1600 / E	5	48	46.9	50.5	2.5
Marsh Bayou HDD Entry	1200 / SW	6	43	55.5	55.7	12.7
Marsh Bayou HDD Exit	2000 / NW	6	43	44.4	46.8	3.8

[a] Estimated $L_{eq(24)}$ based on land use as set forth in ANSI 12.9-1993/Part 3.

Based on the type of equipment proposed for construction, sound levels would not be expected to exceed 90 dBA at 50 feet from the edge of the construction right-of-way for the pipeline or from the edge of the Holbrook Compressor Station site. Beyond these points, sound levels would be reduced a minimum of 6 dBA for each doubling of distance. The NSA closest to the Holbrook Compressor Station is about 0.6 mile from the site, and sound levels from construction would reach 65 dBA.

The HDD construction method is proposed at six waterbody crossings. The primary sound generation during HDD activities would be from the diesel engines that power the drilling equipment. Sound levels measured at HDD sites using a 600-horsepower diesel engine at full load indicate that the sound level is approximately 85 dBA at 50 feet from the edge of the entry site. HDD exit locations, which require less equipment, typically generate a sound level of approximately 79 dBA at 50 feet from the site. Table 4.11.2-2 lists the estimated HDD noise impacts at the NSAs nearest to the HDD sites, the closest of which is 584 feet from an HDD entry site.

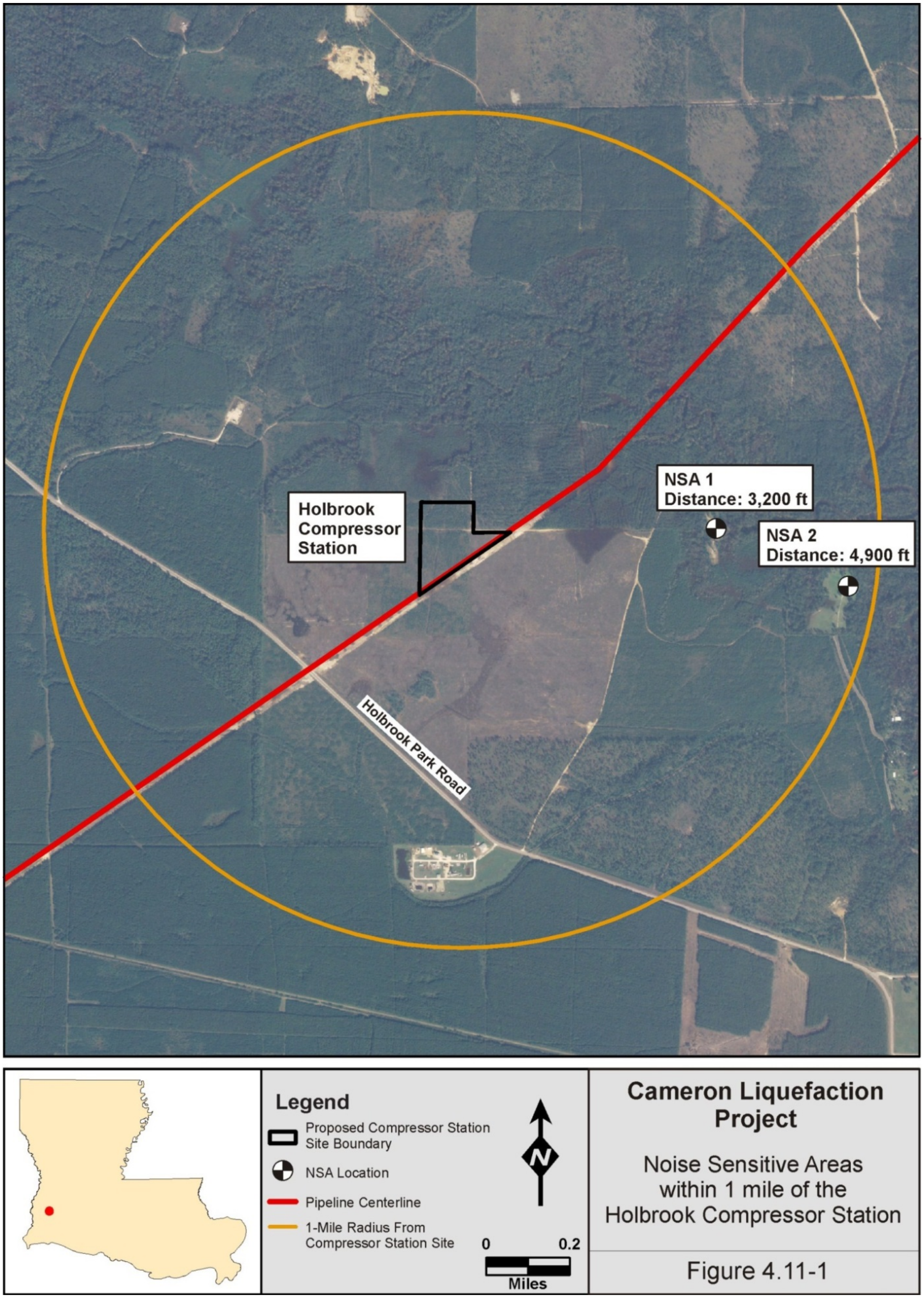

Holbrook Compressor Station
NSA 1
Distance: 3,200 ft
NSA 2
Distance: 4,900 ft
Holbrook Park Road
Legend
Proposed Compressor Station Site Boundary
NSA Location
Pipeline Centerline
1-Mile Radius From Compressor Station Site
N
0
0.2
Miles
Cameron Liquefaction Project
Noise Sensitive Areas within 1 mile of the Holbrook Compressor Station

Figure 4.11-1

With the exception of NSAs near the Little River HDD exit site and the Hickory Branch HDD exit site, sound levels from the HDD equipment would exceed our noise criteria of 55 dBA, including during nighttime hours. To ensure that noise level increases at the nearest residences are less than 10 dBA, with an L_{dn} of 55 dBA, due to HDD activities, Cameron Interstate committed to implement the following measures, as needed:

- reconfiguration of equipment locations to take advantage of natural and artificial noise barriers;
- installation of a partial noise barrier around the hydraulic power unit, including the engine and associated engine jacket-water cooler (for example covering two sides of the power unit with a plywood barrier system approximately 14 feet high);
- use of residential-grade silencers or mufflers on engines;
- use of gear box noise blankets and other mechanical noise dampening blankets, acoustical tents, and acoustical barriers; and
- use of "low noise" generators.

During initial drilling of the HDD entry points at the Houston River, Indian Bayou, Beckwith Creek, and Marsh Bayou sites, which are nearest to the NSAs (see table 4.11-2-2), Cameron Interstate would collect noise measurements to confirm that noise levels at the nearest NSAs are acceptable. Cameron Interstate would also reimburse nearby residents who may elect to use temporary housing at a local commercial hotel during HDD-related construction activities if the residents indicate that noise generated by the HDD activities are unacceptable. To ensure that HDD-related noise does not exceed an L_{dn} of 55 dBA and/or increase noise over ambient conditions greater than 10 dBA, **we are recommending that:**

- **Cameron Interstate file <u>in the weekly construction status reports</u> the following for the entry points of the Houston River, Indian Bayou, Beckwith Creek, and Marsh Bayou HDD sites:**
  - **a. the noise measurements from the nearest NSA, obtained at the start of drilling operations;**
  - **b. the noise mitigation that Cameron implemented at the start of drilling operations; and**
  - **c. any additional mitigation measures that Cameron would implement if the initial noise measurements exceeded an L_{dn} of 55 dBA at the nearest NSA and/or increased noise is over ambient conditions greater than 10 dB.**

Cameron Interstate would comply with the requirements of the noise ordinance in Calcasieu Parish and would limit construction to the daytime hours as listed above. With regard to Section 18-100, any HDD activities requiring 24-hour operations would not be exempt from noise restrictions in Calcasieu Parish. We believe that Cameron Interstate's commitments would lessen impacts on residents to the extent practicable.

Noise associated with pipeline construction activities would be intermittent because of the transitory nature of the construction activities. Cameron Interstate would limit operation of construction equipment to only that necessary to perform the required activities. While the noise levels attributable to the construction equipment could noticeably increase ambient noise levels at the NSAs nearest the pipeline right-of-way and the Holbrook Compressor Station site, the noise increase during the construction phase would be temporary and localized. With construction mostly limited to daytime hours, incorporation of Cameron Interstate's proposed mitigation, and implementation of our recommendation, we believe that the landowners and residents near the pipeline and compressor station site would not be significantly affected by construction-related noise.

4.11.2.3 Operation Noise Impacts and Mitigation

Terminal Expansion

Operation of the expanded terminal would generate sound levels that would occur throughout the life of the Project. Noise would generally be produced on a continuous basis at the liquefaction facility by a number of sources which would include various types of compressors and cooling fans. Operational noise levels were assessed based on all three liquefaction trains and associated equipment operating at full capacity concurrently. The estimated L_{dn} of the Terminal Expansion facilities would be 54.2 dBA at the nearest NSA and would increase the noise level by 3.3 dBA at the nearest NSA, from 50.9 dBA to 54.2 dBA, which is slightly above the "barely detectable" increase level of about 3 dBA above the current ambient noise level. This estimated noise level would be below our noise criteria of 55 dBA L_{dn}.

Cameron LNG would house the compressors in acoustically-treated enclosures and install exhaust stack silencers on certain of the combustion turbines with specific noise design limits. Refrigeration turbine air intakes and exhausts would be fitted with appropriate silencers that would extend outside the buildings.

As discussed in Sections 1.0 and 2.7.1, while liquefying natural gas and exporting LNG, the Terminal Expansion would retain the capability to regasify (vaporize) imported LNG. While the design of the facility would allow for simultaneous liquefaction and regasification, market conditions would make that an unrealistic scenario, and Cameron LNG's commercial agreements preclude simultaneous regasification and liquefaction. Therefore, at any point in time the expanded terminal would be operated exclusively as a liquefaction/ export facility or exclusively as an import/ regasification facility, and there is no potential for noise levels to exceed 55 dBA under this scenario.

Operation of the Terminal Expansion would occur in phases with the first liquefaction train and associated facilities to be completed and in service by summer 2017, followed by the second liquefaction train, and the third liquefaction train, with full service anticipated for summer 2018. Therefore, to ensure that NSAs are not adversely impacted by the phased operation of the expanded Cameron LNG Terminal, **we are recommending that:**

- **Cameron LNG file a full load noise survey with the Secretary for the Terminal Expansion <u>no later than 60 days</u> after each liquefaction train is placed into service for the first and second liquefaction train. If the noise**

attributable to the operation of the equipment at the Terminal Expansion exceeds an L_{dn} of 55 dBA at the nearby NSA, Cameron LNG should reduce operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the nearby NSA is achieved. Cameron LNG should confirm compliance with the above requirement by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.

In compliance with the condition above, Cameron LNG would need to complete two noise surveys after the first and second liquefaction trains are placed in-service to ensure that the phased-in liquefaction trains are below 55 dBA L_{dn} at the nearest NSA. If the noise levels reported in any of the noise surveys are over 55 dBA L_{dn}, Cameron LNG would need to implement the required mitigation to reduce the noise impacts on the nearest NSAs within the time specified in the condition. Once the third liquefaction train is installed and placed into service, **we are recommending that:**

- **Cameron LNG file a noise survey with the Secretary no later than 60 days after placing the Terminal Expansion into service. If a full load noise survey is not possible, Cameron LNG should provide an interim survey at the maximum possible load and provide the full load survey within 6 months. If the noise attributable to the operation of all of the equipment at the Terminal Expansion under interim or full load conditions exceeds an L_{dn} of 55 dBA at the nearby NSA, Cameron LNG should file a report on what changes are needed and should install the additional noise controls to meet the level within 1 year of the in-service date. Cameron LNG should confirm compliance with the above requirement by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.**

Based on the results of the noise analysis and our recommendation, we believe that operational noise from the Terminal Expansion would have no significant impact on the noise environment in the vicinity of the Terminal Expansion.

Pipeline Expansion

There would be an increase in sound levels due to operation of the Holbrook Compressor Station and during maintenance activities. Those sound level increases would occur for the life of the Project. The major noise-generating equipment at the compressor station would be the reciprocating engines and the fin fan-type gas coolers. Table 4.11.2-3 summarizes the estimated ambient noise levels and the predicted operational noise levels at the nearby NSAs for the Holbrook Compressor Station.

The estimated L_{dn} of the Holbrook Compressor Station would be 49.5 dBA and would increase the noise level at the nearest NSA from 45 dBA to 50.8 dBA. While overall noise levels at the nearest NSA would be below our criteria of 55 dBA L_{dn}, the potential increase would be about 5.8 dB, which would be a noticeable increase in noise at the NSA. Cameron Interstate would implement mitigation measures to reduce noise impacts, such as installing the compressor units in an acoustically-designed building. Cameron Interstate would also install exhaust stack silencers and combustion air intake silencers, as necessary to comply with our noise criteria.

TABLE 4.11.2-3 Estimated Noise Levels at Noise Sensitive Areas Near the Holbrook Compressor Station				
Noise Sensitive Location	Distance and Direction	Sound Levels (dBA)		Change in Background Sound Level (dBA)
		Background (L_{dn})	Estimated L_{dn} During Operation [including background levels]	
1	3,200 feet (E)	45	50.8	5.8
2	4,900 feet (ESE)	45	47.6	2.6
3	6,000 feet. (ESE)	45	46.9	1.9
4	6,100 feet (ESE)	45	46.8	1.8
5	6,600 feet (ESE)	45	46.5	1.5
6	7,500 feet (SE)	45	46.3	1.3

Abbreviations:
NSA= Noise Sensitive Area; E = east
ESE = east-southeast; SE = southeast
L_{dn} = day-night equivalent sound level; dBA = decibels on the A-weighted scale

Based on our noise analysis, noise levels attributable to operation of the Holbrook Compressor Station would be less than 55 dBA L_{dn} at all nearby NSAs. To ensure that the noise from the compressor station does not exceed an L_{dn} of 55 dBA at the nearest NSAs, **we are recommending that:**

- **Cameron Interstate file a noise survey for the Holbrook Compressor Station no later than 60 days after placing the station into service. If a full power load condition noise survey is not possible, Cameron Interstate should file an interim survey at the maximum possible power load within 60 days of placing the station into service and file the full power load survey within 6 months. If the noise attributable to operation of all equipment at the station under interim or full power load conditions exceeds an L_{dn} of 55 dBA at any nearby NSA, Cameron Interstate should:**
    - **a. file a report with the Secretary, for review and written approval by the Director of OEP, on what changes are needed;**
    - **b. install additional noise controls to meet that level within 1 year of the in-service date; and**
    - **c. confirm compliance with this requirement by filing a second full power load noise survey with the Secretary for review and approval by the Director of OEP no later than 60 days after it installs the additional noise controls.**

The compressor station site is near several parcels on Holbrook Road for which the current landowner has indicated the potential desire for residential and/or commercial/business development. In its negotiations for acquiring the compressor station site, Cameron Interstate agreed to maintain the station property at a minimum distance of 1,500 feet north north-east of Holbrook Park Road. The land purchase option agreement also contains provision for noise requirements to which the landowner and Cameron Interstate have agreed. Specifically, Cameron Interstate would design the compressor station such that the noise level at 1,000 feet from the property site not exceed 55 dBA.

The only sound level increases associated with operation of the pipeline would be indirect noise resulting from vehicle and equipment use during maintenance and inspection activities. However, these activities would be transient, short-term, and would not be significantly more audible than normal vehicle traffic at the nearest NSAs along the pipeline right-of-way.

Based on the noise analysis and our recommendation, we believe that operation of the Pipeline Expansion would have no significant impact on the noise environment in the vicinity of the Pipeline Expansion.

4.12 SAFETY

4.12.1 Regulatory Agencies

Three federal agencies share regulatory authority over the siting, design, construction and operation of LNG import terminals: the Coast Guard, the DOT, and the FERC. The Coast Guard has authority over the safety of an LNG facility's marine transfer area and LNG marine traffic, as well as over security plans for the entire LNG facility and LNG marine traffic. The DOT establishes federal safety standards for siting, construction, operation, and maintenance of onshore LNG facilities, as well as for the siting of marine cargo transfer systems at waterfront LNG plants. Those standards are codified in 49 CFR 193. Under the NGA and delegated authority from the DOE, the FERC authorizes the siting and construction of LNG import and export facilities.

In 1985, the FERC and DOT entered into a memorandum of understanding (MOU) regarding the execution of each agency's respective statutory responsibilities to ensure the safe siting and operation of LNG facilities. In addition to the FERC's existing ability to impose requirements to ensure or enhance the operational reliability of LNG facilities, the MOU specified that the FERC may, with appropriate consultation with DOT, impose more stringent safety requirements than those in Part 193.

In February 2004, the Coast Guard, DOT, and the FERC entered into an Interagency Agreement to ensure greater coordination among these three agencies in addressing the full range of safety and security issues at LNG terminals, including terminal facilities and tanker operations, and maximizing the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. Under the Interagency Agreement, the FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with terminal construction and operation. The DOT and

Coast Guard participate as cooperating agencies and assist in assessing any mitigation measures that may become conditions of approval for any project.

As part of the review required for a FERC authorization, Commission staff must ensure that all proposed facilities would operate safely and securely and are designed in accordance with the applicable requirements set forth in the DOT regulations in 49 CFR 193. The design information that must be filed in the application to the Commission is specified by 18 CFR 380.12 (m) and (o). The level of detail necessary for this submittal requires the Project sponsor to perform substantial front-end engineering of the complete facility. The design information is required to be site-specific and developed to the extent that further detailed design would not result in changes to the siting considerations, basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs which we considered during our review process.

The following sections contain the conclusions of our reliability and safety analysis and incorporate comments of the DOT and the Coast Guard as cooperating agencies. In accordance with the working arrangements allowed by the 1985 MOU, the DOT has reviewed our analysis of the applicant's compliance with the requirements in Part 193, as well as our recommended mitigation measures, and has no objections at this time. In accordance with 33 CFR 127, the Coast Guard has reviewed the proposed liquefaction facilities and stated that a Letter of Intent (LOI) or a revision to the WSA is not required for the Terminal Expansion Project because the proposed modifications lie outside the Marine Transfer Area. A copy of the correspondence between Cameron LNG and the Coast Guard is included in Appendix A.11 of the application.[39]

Section 4.12.2 discusses the principal properties and hazards associated with LNG; section 4.12.3 discusses our technical review of the preliminary design; section 4.12.4 discusses siting requirements for the Terminal Expansion facilities; section 4.12.5 includes a siting analysis of hazards resulting from a land based LNG spill; section 4.12.6 discusses emergency response and evacuation planning, section 4.12.7 discusses the Terminal Expansion security, and section 4.12.8 discusses pipeline safety.

4.12.2 Hazards

Before liquefaction, Cameron LNG would pre-treat the feed gas for the removal of mercury, hydrogen sulfide, and carbon dioxide. The hazards associated with the removal of these substances from the feed gas stream result from the physical and chemical properties, flammability, and toxicity of mercury, hydrogen sulfide, and amine. Cameron LNG proposes a design capacity to handle up to 100 micrograms per normal cubic meter ($\mu g/Nm^3$) mercury, 4 parts per million by volume hydrogen sulfide, and 3 percent by volume (%-vol) CO_2. However, lower quantities and concentrations of these substances would be expected in the natural gas feed stream and would not pose a hazard to the public. Mercury in the feed gas would be removed by adsorption in the mercury removal units. Hydrogen sulfide would be removed by permanently bonding to scavenger beds, the equipment that contains absorbing materials to reduce hydrogen sulfide concentration in the feed stream. Cameron LNG would need to replace the mercury and scavenger beds by the end of their service life. Maintenance and safety procedures would cover the proper replacement and disposal of these beds. The amine solution would be contained, as

[39] Accession number: 20121207-5141.

discussed under “Impoundment Sizing” in Section 4.12.5, and handled at temperatures below the point at which it could produce enough vapors to form a flammable mixture. Therefore, the amine solution would not pose a significant hazard to the public, which would have no access to the on-site areas.

Cameron LNG would install a heavy hydrocarbon removal system to remove pentane and heavier hydrocarbons that may be present in the feed gas. During this removal process, natural gas liquid (NGL) would be extracted and handled on-site at temperature and pressure conditions under which a loss of containment would result primarily in a vapor release and the ability to produce damaging overpressures. The resulting stabilized condensate, which includes pentane and heavier hydrocarbons, would be stored on-site at atmospheric pressure and temperature. Due to the temperature and pressure conditions under which the stabilized condensate would be stored and handled, a loss of containment would primarily result in a liquid release. The liquid spill would be contained in impoundments, as discussed under “Impoundment Sizing” in Section 4.12.5, and would not present an offsite hazard to the public. The principal hazards associated with the storage and sendout of condensate would result from loss of containment and the flammability and toxicity of the substances used or produced in the heavy hydrocarbon removal system.

The principal hazards associated with the liquefaction and storage of LNG and refrigerants result from loss of containment, vapor dispersion characteristics, flammability, and the ability to produce damaging overpressures. A loss of the containment provided by storage tanks or process piping would result in the formation of flammable vapor at the release location, as well as from any LNG or liquid flammable refrigerant that pooled. Releases occurring in the presence of an ignition source would most likely result in a fire at the vapor source. A spill without ignition would form a vapor cloud that would travel with the prevailing wind until it either dispersed below the flammable limits or encountered an ignition source. In some instances, ignition of a vapor cloud may produce damaging overpressures. These hazards are described in more detail below.

4.12.2.1 Loss of Containment

Cameron LNG would store the following on-site: LNG at atmospheric pressure and at a cryogenic temperature of approximately -260 °F; liquid ethylene at approximately 754 pounds per square inch gage and -26°F; and liquid propane at ambient temperature and elevated pressures (similar to the conditions typically used in propane storage and distribution).

The mixed refrigerant process stream would consist of methane, ethylene, propane, and nitrogen. Cryogenic temperatures as low as -260°F would occur within the mixed refrigerant process stream used to liquefy the feed gas. The temperature of NGL in the heavy hydrocarbon removal process stream would be as low as -137°F. Loss of containment of LNG, mixed refrigerant liquid (MRL), and NGL could lead to the release of both liquid and vapor into the immediate area. Exposure to either cold liquid or vapor could cause freeze burns and, depending on the length of exposure, more serious injury or death. However, spills would be contained to on-site areas and the cold state of these releases would be greatly limited due to the continuous mixing with the warmer air. The cold temperatures from the release would not present a hazard to the public, which would not have access to on-site areas.

LNG and MRL are cryogenic liquids that would quickly cool any materials contacted by the liquid on release, causing extreme thermal stress in materials not specifically designed for such conditions. These thermal stresses could subsequently subject the material to brittleness, fracture, or other loss of tensile strength. These temperatures, however, would be accounted for in the design of equipment and structural supports, and would not be substantially different from the hazards associated with the storage and transportation of liquid oxygen (-296ºF) or several other cryogenic liquids that have been routinely produced and transported in the United States.

4.12.2.2 Vapor Dispersion

In the event of a loss of containment, LNG, ethylene, propane, and NGL would vaporize on release from any storage or process facilities. Depending on the size of the release, cryogenic liquids, such as LNG and MRL, as well as NGL may form a liquid pool and vaporize. Additional vaporization would result from exposure to ambient heat sources, such as water or soil. When released from a containment vessel or transfer system, LNG will generally produce 620 to 630 standard cubic feet (ft^3) of natural gas for each cubic foot of liquid. Ethylene will produce approximately 375 ft^3 of gas for each cubic foot of liquid. Propane will produce approximately 250 ft^3 of gas for each cubic foot of liquid. The composition of NGL would vary throughout the heavy hydrocarbon removal process and may produce up to 380 ft^3 of gas for each cubic foot of liquid. In the event of a loss of containment of stabilized condensate, the stabilized condensate would spill primarily as a liquid and form a pool, but would vaporize much more slowly than NGL.

If the loss of containment does not result in immediate ignition of the hydrocarbons, the vapor cloud would travel with the prevailing wind until it either encountered an ignition source or dispersed below its flammable limits. An LNG release would form a denser-than-air vapor cloud that would sink to the ground due to the cold temperature of the vapor. As the LNG vapor cloud disperses downwind and mixes with the warm surrounding air, the LNG vapor cloud may become buoyant. However, experimental observations and vapor dispersion modeling indicate the LNG vapor cloud would not typically be warm, or buoyant, enough to lift off from the ground before the LNG vapor cloud disperses below its lower flammability limit (LFL). A liquid ethylene release would form a denser-than-air vapor cloud that would sink to the ground due to the cold temperature of the vapor. As the ethylene vapor cloud disperses downwind and mixes with the warm surrounding air, the ethylene vapor would become neutrally buoyant. A propane release would form a denser-than-air vapor cloud that would sink to the ground; however, propane would remain denser than the surrounding air, even after warming to ambient temperatures. The concentration of NGL would vary throughout the heavy hydrocarbon removal process; however, a release at any point in the NGL stream would form a denser-than-air vapor cloud that would also sink to the ground, even after warming to ambient temperatures.

Methane and heavier hydrocarbons are classified as simple asphyxiates and may pose extreme health hazards, including death, if inhaled in significant quantities within a limited time. Very cold methane and heavier hydrocarbons vapors may also cause freeze burns. However, the locations of concentrations where cold temperatures and oxygen-deprivation effects could occur are greatly limited due to the continuous mixing with the warmer air surrounding the spill site. For that reason, exposure injuries from contact with releases of methane and heavier hydrocarbons normally represent negligible risks to the public.

4.12.2.3 Vapor Cloud Ignition

Flammability of the vapor cloud is dependent on the concentration of the vapor when mixed with the surrounding air. In general, higher concentrations within the vapor cloud would exist near the spill, and lower concentrations would exist near the edge of the cloud as it disperses downwind. Mixtures occurring between the LFL and the upper flammability limit (UFL) can be ignited. Concentrations above the UFL or below the LFL would not ignite.

The LFL and UFL for methane are approximately 5%-vol and 15%-vol in air, respectively. Propane has a narrower flammability range, with a LFL of approximately 2.1%-vol and a UFL of 9.5%-vol in air. Ethylene has a much wider flammability range and a LFL of approximately 2.7% vol and a UFL of 36%-vol in air. NGL has a LFL of approximately 2.3%-vol and a UFL of approximately 11.1%-vol. Condensate has a LFL of approximately 1.3%-vol and a UFL of approximately 7.6%-vol.

If the flammable portion of a vapor cloud encounters an ignition source, a flame would propagate through the flammable portions of the cloud. In most circumstances, the flame would be driven by the heat it generates. This process is known as a deflagration. An LNG vapor cloud deflagration in an uncongested and unconfined area travels at slower speeds and does not produce significant pressure waves. However, exposure to this LNG vapor cloud fire can cause severe burns and death, and can ignite combustible materials within the cloud. Overpressures of LNG, NGL, and refrigerant vapor clouds are discussed later in this section under "Overpressures."

A deflagration may propagate back to the spill site if the vapor concentration along this path is sufficiently high to support the combustion process. When the flame reaches vapor concentrations above the UFL, the deflagration could transition to a fireball and result in a pool or jet fire back at the source. A fireball would occur near the source of the release and would be of a relatively short duration compared to an ensuing jet or pool fire.

The extent of the affected area and the severity of the impacts on objects either within an ignited cloud or in the vicinity of a pool fire would primarily be dependent on the quantity and duration of the initial release, the surrounding terrain, and the environmental conditions present during the dispersion of the cloud. Radiant heat and dispersion modeling are discussed in section 4.12.5.

Fires may also cause failures of nearby storage vessels, piping, and equipment. The failure of a pressurized vessel could cause fragments of material to fly through the air at high velocities, posing damage to surrounding structures and a hazard for operating staff, emergency personnel, or other individuals in proximity to the event. In addition, failure of a pressurized vessel when the liquid is at a temperature significantly above its normal boiling point could result in a boiling-liquid-expanding-vapor explosion (BLEVE). BLEVEs of flammable liquids can produce overpressures and a subsequent fireball when the superheated liquid rapidly changes from a liquid to a vapor upon the release from the vessel.

4.12.2.4 Overpressures

If the deflagration in a flammable vapor cloud accelerates to a sufficiently high rate of speed, pressure waves that can cause damage would be generated. As a deflagration accelerates to super-sonic speeds, the large shock waves produced, rather than the heat, would begin to drive the flame, resulting in a detonation. The flame speeds are primarily dependent on the reactivity of the fuel, the ignition strength and location, the degree of congestion and confinement of the area occupied by the vapor cloud, and the flame travel distance.

The potential for unconfined LNG vapor cloud detonations was investigated by the Coast Guard in the late 1970s at the Naval Weapons Center in China Lake, California. Using methane, the primary component of natural gas, several experiments were conducted to determine whether unconfined LNG vapor clouds would detonate. Unconfined methane vapor clouds ignited with low-energy ignition sources (13.5 joules), produced flame speeds ranging from 12 to 20 mph. These flame speeds are much lower than the flame speeds associated with a deflagration with damaging overpressures or a detonation.

To examine the potential for detonation of an unconfined natural gas cloud containing heavier hydrocarbons that are more reactive, such as ethane and propane, the Coast Guard conducted further tests on ambient-temperature fuel mixtures of methane-ethane and methane-propane. The tests indicated that the addition of heavier hydrocarbons influenced the tendency of an unconfined natural gas vapor cloud to detonate. Less processed natural gas with greater amounts of heavier hydrocarbons would be more sensitive to detonation.

Although it has been possible to produce damaging overpressures and detonations of unconfined LNG vapor clouds, the feed gas stream proposed for the Terminal Expansion would have lower ethane and propane concentrations than those that resulted in damaging overpressures and detonations. The substantial amount of initiating explosives needed to create the shock initiation during the limited range of vapor-air concentrations also renders the possibility of detonation of these vapors at an LNG plant as unrealistic. Ignition of a confined LNG vapor cloud could result in higher overpressures. In order to prevent such an occurrence, Cameron LNG would take measures to mitigate the vapor dispersion and ignition into confined areas, such as buildings. Cameron LNG proposed to install hazard detection devices at all combustion and ventilation air intake equipment to enable isolation and deactivation of any combustion equipment whose continued operation could add to, or sustain, an emergency. In general, the primary hazards to the public from an LNG spill that disperses to an unconfined area, either on land or water, would be from dispersion of the flammable vapors or from radiant heat generated by a pool fire.

In comparison with LNG vapor clouds, there is a higher potential for unconfined propane clouds to produce damaging overpressures, and an even higher potential for unconfined ethylene vapor clouds to produce damaging overpressures. Unconfined ethylene vapor clouds also have the potential to transition to a detonation much more readily than propane. This has been shown by multiple experiments conducted by the Explosion Research Cooperative to develop predictive blast wave models for low, medium, and high reactivity fuels and varying degrees of congestion and confinement (Pierorazio 2005). The experiments used methane, propane, and ethylene, as the respective low, medium, and high reactivity fuels. In addition, the tests showed that if methane, propane, or ethylene is ignited within a confined space, such as in a building, they all have the potential to produce damaging overpressures. The MRL and NGL process streams would contain a mixture of components such as the ones discussed above (i.e., ethylene and propane). Therefore, a potential exists for these process streams to produce unconfined vapor clouds that could produce damaging overpressures in the event of a release.

Discussion of these hazards and potential mitigation are in section 4.12.5 for the Terminal Expansion facilities.

4.12.2.5 Past LNG Facility Incidents

With the exception of the October 20, 1944, failure at an LNG facility in Cleveland, Ohio, the operating history of the U.S. LNG industry has been free of safety-related incidents resulting in adverse effects on the public or the environment. The 1944 incident in Cleveland led to a fire that killed 128 people and injured 200 to 400 more people[40]. The failure of the LNG storage tank was due to the use of materials inadequately suited for cryogenic temperatures. LNG migrating through streets and into underground sewers due to the lack of adequate spill impoundments at the site was also a contributing factor. Current regulatory requirements ensure that proper materials suited for cryogenic temperatures are used and that spill impoundments are designed and constructed properly to contain a spill at the site.

Another operational accident occurred in 1979 at the Cove Point LNG facility in Lusby, Maryland. A pump seal failure resulted in gas vapors entering an electrical conduit and settling in a confined space. When a worker switched off a circuit breaker, the gas ignited, causing heavy damage to the building and a worker fatality. With the participation of the FERC, lessons learned from the 1979 Cove Point accident resulted in changing the national fire codes to ensure that the situation would not occur again.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria, LNG liquefaction facility, which killed 27 and injured 56 workers. No members of the public were injured. Findings of the accident investigation suggested that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced to the high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler firebox, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas (LPG) separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998 and 1999, Train 40 had been operating with its original equipment since start-up in 1981. To ensure that this potential hazard is addressed at the proposed Terminal Expansion, Cameron LNG proposed to install hazard detection devices at all combustion and ventilation air intake equipment to enable isolation and deactivation of any combustion equipment whose continued operation could add to, or sustain, an emergency.

4.12.3 Technical Review of the Preliminary Engineering Design

Operation of the proposed facility poses a potential hazard that could affect the public safety if strict design and operational measures to control potential accidents are not applied.

[40] 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," dated February 1946.

The primary concerns are those events that could lead to an LNG spill of sufficient magnitude to create an off-site hazard as discussed in section 4.12.2. However, it is important to recognize the stringent requirements in place for the design, construction, operation, and maintenance of the facility, as well as the extensive safety systems proposed to detect and control potential hazards.

As part of a project's preliminary safety review, Cameron LNG conducted a hazard identification study of the process flow diagram (PFD) to identify potential risk scenarios. A more detailed and thorough hazard and operability review (HAZOP) analysis would be performed by Cameron LNG during the final design phase to identify the major hazards that may be encountered during the operation of facilities. The HAZOP study would be intended to address hazards of the process, engineering and administrative controls, and would provide a qualitative evaluation of a range of possible safety, health, and environmental effects which may result from the design or operation of the facility. Recommendations to prevent or minimize these hazards would be generated from the results of the HAZOP review. These studies help establish the required safety control levels and identify whether additional process and safety instrumentation, mitigation, and/or administrative controls would be needed.

Once the design has been subjected to a HAZOP review, the design development team tracks changes in the facility design, operations, documentation, and personnel. Cameron LNG would evaluate these changes to ensure that the safety, health, and environmental risks arising from these changes are addressed and controlled. Resolutions of the recommendations generated by the HAZOP review would be monitored by the FERC staff. We have included a recommendation that Cameron LNG should file a hazard and operability study on the completed final design.

Based on these analyses, Cameron LNG would include various layers of protection or safeguards in the facility design to reduce the risk of a potentially hazardous scenario from developing into an event that could impact the off-site public. These layers of protection are independent of one another so that any one would perform its function regardless of the action or failure of any other protection layer or initiating event. These layers of protection typically include:

- a facility design that prevents hazardous events through the use of suitable materials of construction; operating and design limits for process piping, process vessels, and storage tanks; adequate design for wind, flood, seismic, and other outside hazards;
- control systems, including monitoring systems and process alarms, remotely-operated control and isolation valves, and operating procedures to ensure the facility stays within the established operating and design limits;
- safety-instrumented prevention systems, such as safety control valves and emergency shutdown systems, to prevent a release if operating and design limits are exceeded;
- physical protection systems, such as appropriate electrical area classification, proper equipment and building spacing, pressure relief valves, spill containment, and structural fire protection, to prevent escalation to a more severe event;

- site security measures for controlling access to the facility, including security inspections and patrols; response procedures to any breach of security and liaison with local law enforcement officials; and
- on-site and off-site emergency response, including hazard detection and control equipment, firewater systems, and coordination with local first responders to mitigate the consequences of a release and prevent it from escalating to an event that could impact the public.

The use of these protection layers would mitigate the potential for an initiating event to develop into an incident that could damage the facility, injure operating staff, or impact the safety of the off-site public. In addition, proper siting of the facility with regard to potential off-site consequences is required by DOT's regulations in 49 CFR 193, Subpart B to ensure that impacts to the public would be minimized. These siting requirements are discussed in Section 4.12.4.

As part of the application, Cameron LNG provided a front-end engineering design (FEED) for the Project. The FEED and specifications submitted for the proposed facilities to date are preliminary, but would serve as the basis for any detailed design to follow. We have analyzed the information filed by Cameron LNG to determine the extent that layers of protection or safeguards to enhance the safety, operability, and reliability of the facility are included in the FEED.

As a result of the technical review of the information provided by Cameron LNG in the submittal documents, we identified a number of concerns in an information data request letter issued on April 3, 2013 relating to the reliability, operability, and safety of the proposed design. Cameron LNG provided written responses to the information data request on April 29, 2013. However, some of these responses indicated that Cameron LNG would correct or modify its design in order to address issues raised in the information request. As a result, **we are recommending that:**

- **<u>Prior to construction of the final design</u>, Cameron LNG should file information/revisions with the Secretary, for review and approval by the Director of the Office of Energy Projects, pertaining to Cameron LNG's response numbers 30 and 71 of its April 29, 2013 filing, which indicated features to be included or considered in the final design.**

The objectives of our FEED review focused on the engineering design and safety concepts of the various protection layers, as well as the projected operational reliability of the proposed facilities. The design would use materials of construction suited to the pressure and temperature conditions of the process design. Piping would be designed in accordance with ASME B31.3. Pressure vessels would be designed in accordance with ASME Section VIII and the storage tanks would be designed in accordance with API Standard 620, per 49 CFR 193 and the NFPA's Standard 59A (NFPA 59A). Valves and other equipment would be designed to recommended and generally accepted good engineering practices. As proposed in the Basic Engineering Data section located in appendix C.13 of the application, Cameron LNG would design the facility to withstand a design wind velocity of a 183 mph, 3-second gust. The proposed LNG storage tank and liquefaction process area would be at a height of 5 feet and 11.5

feet, respectively, or greater above sea level (FEMA 2003) to minimize the risk of flooding. We also examined the seismic and structural design of the Terminal Expansion facility.

Cameron LNG would install process control valves and instrumentation to safely operate and monitor the facility. Alarms would have visual and audible notification in the control room to warn operators that process conditions may be approaching design limits. Operators would have the capability to take action from the control room to mitigate an upset.

Cameron LNG would expand the existing facility operation procedures to include the Terminal Expansion after completion of the final design; this timing is fully consistent with accepted industry practice. We have made recommendations for Cameron LNG to provide more information on the operating and maintenance procedures as they are developed, including hot work procedures and permits and personnel training. In addition, we have recommended measures such as labeling of instrumentation and valves (i.e., car-seals, locks) to address human factor considerations and improve facility safety. An alarm management program would also be in place to ensure effectiveness of the alarms.

Safety valves and instrumentation would be installed to monitor, alarm, shutdown, and isolate equipment and piping during process upsets or emergency conditions. Safety instrumented systems would comply with International Society for Automation Standard 84.01 and other recommended and generally accepted good engineering practices. We also made recommendations on the design, installation, and commissioning of instrumentation and emergency shutdown equipment to ensure appropriate cause and effect alarm or shutdown logic and enhanced representation of the emergency shutdown valves in the facility control system.

Safety relief valves and flares would be installed to protect the process equipment and piping. The safety relief valves would be designed to handle process upsets and thermal expansion within piping, per NFPA 59A and ASME Section VIII, and would be designed based on API 520, 521, 527, and other recommended and generally accepted good engineering practices. In addition, we made recommendations to ensure appropriate discharge of pressure relief devices and to include pressure relieving protection for flammable liquid piping.

In order to minimize the risk of an intentional event, Cameron LNG would provide security fencing, lighting, camera systems, and intrusion detection to deter, monitor, and detect intruders into the facility. In addition, as discussed in section 4.12.5, Cameron LNG must update the existing Facility Security Plan in accordance with the Coast Guard's regulations found in 33 CFR 105, Subpart D. We also made recommendations to provide security and incident reporting during operation.

In the event of a release, drainage systems from LNG storage and liquefaction process facilities would direct a spill away from equipment in order to minimize flammable vapors from dispersing to confined, occupied, or public areas and to minimize heat from impacting adjacent equipment and public areas if ignition occurs. Impoundment systems are further discussed in 4.12.5.

Cameron LNG performed a preliminary fire protection evaluation to ensure that adequate hazard detection, hazard control, and firewater coverage would be installed to detect and address any upset conditions. Structural fire protection, proposed to prevent failure of structural supports of equipment and pipe racks, would comply with NFPA 59A and other recommended and generally accepted good engineering practices. Cameron LNG would also install hazard detection systems to detect, alarm, and alert personnel in the area and control room to initiate an emergency shutdown and/or initiate appropriate procedures, and would meet NFPA 72, International Society for Automation 12.13, and other recommended and generally accepted good engineering practices. Hazard control devices would be installed to extinguish or control incipient fires and releases, and would meet NFPA 59A and NFPA 10, 11, 12, 17, and other recommended and generally accepted good engineering practices. Cameron LNG would provide automatic firewater systems and monitors for use during an emergency to cool the surface of storage vessels, piping, and equipment exposed to heat from a fire, and would meet NFPA 59A, 20, 22, and 24 requirements. We have made recommendations for Cameron LNG to provide more information on the design, installation, and commissioning of hazard detection, hazard control, and firewater systems as Cameron LNG would further develop this information during the final design phase.

Cameron LNG would also update the existing emergency procedures to include the Terminal Expansion in accordance with 49 CFR 193 and 33 CFR 127. The emergency procedures would provide for protection of personnel and the public as well as the prevention of property damage that may occur as a result of incidents at the facility.

If authorization is granted by the Commission, the next phase of the Terminal Expansion Project would include development of the final design, including final selection of equipment manufacturers, process conditions, and resolution of some safety-related issues. To ensure the final design would be consistent with the safety and operability characteristics identified in the FEED, information regarding the development of the final design, as detailed below, would need to be filed with the Secretary for review and written approval by the Director of the OEP before equipment construction at the site would be authorized.

In addition to the final design review, we would conduct inspections during construction and would review additional materials, including quality assurance and quality control plans, nonconformance reports, and cooldown and commissioning plans, to ensure that the installed design is consistent with the safety and operability characteristics of the FEED. We would also conduct inspections during operation to ensure that the facility is operated and maintained in accordance with the filed design throughout the life of the facility.

To ensure that the concerns we've identified relating to the reliability, operability, and safety of the proposed design are addressed by Cameron LNG, and to ensure that the facility is subject to the Commission's construction and operational inspection program, **we are recommending that the following measures should apply to the Cameron LNG Terminal Expansion. Information pertaining to these specific recommendations should be filed with the Secretary for review and written approval by the Director of OEP either: <u>prior to initial site preparation</u>; <u>prior to construction of final design</u>; <u>prior to commissioning</u>; <u>prior to introduction of hazardous fluids</u>; or <u>prior to commencement of service</u>, as indicated by each specific condition. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 683 (Docket No. RM06-24-000), including security information, should be submitted as critical energy infrastructure information pursuant to 18 CFR 388.112. See Critical Energy Infrastructure Information, Order No. 683, 71 Fed. Reg. 58,273 (October 3, 2006), FERC Stats. & Regs. ¶31,228 (2006).**

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 filed <u>a minimum of 30 days</u> before approval to proceed is requested.

- **The <u>final design</u> should include change logs that list and explain any changes made from the Front-End Engineering Design provided in Cameron LNG's application and filings. A list of all changes with an explanation for the design alteration should be provided and all changes should be clearly indicated on all diagrams and drawings.**
- **The <u>final design</u> should provide up-to-date Process Flow Diagrams with heat and material balances and Piping and Instrument Diagrams (P&IDs), which include the following information:**
    - **a. equipment tag number, name, size, duty, capacity, and design conditions;**
    - **b. equipment insulation type and thickness;**
    - **c. piping with line number, piping class specification, size, and insulation type and thickness;**
    - **d. piping specification breaks and insulation limits;**
    - **e. all control and manual valves numbered;**
    - **f. relief valves with set points; and**
    - **g. drawing revision number and date.**
- **The <u>final design</u> should provide an up-to-date complete equipment list, process and mechanical data sheets, and specifications.**
- **The <u>final design</u> should provide complete plan drawings and a list of the hazard detection equipment. 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.**
- **The <u>final design</u> should provide complete plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. The list should include the equipment tag number, type, capacity, equipment covered, and automatic and manual remote signals initiating discharge of the units. Plan drawings should clearly show the planned location by tag number of all fixed, wheeled, and hand-held extinguishers.**
- **The <u>final design</u> should provide facility plans showing the proposed location of, and area covered by, each monitor, hydrant, deluge system, hose, and sprinkler, as well as piping and instrumentation diagrams of the firewater system.**

- **The final design should include an updated fire protection evaluation of the proposed facilities carried out in accordance with the requirements of NFPA 59A 2001, chapter 9.1.2 as required by 49 CFR Part 193. A copy of the evaluation, a list of recommendations, and actions taken on the recommendations should be filed.**
- **The final design should ensure that the LNG storage tank piping supports are adequately designed for the higher rated in-tank pump flow rates.**
- **The final design should include a relief valve study to ensure the existing LNG storage tank vacuum relief valves provide adequate protection when the higher capacity in-tank pumps would be operating at full capacity.**
- **The final design should specify that for gas, refrigerants, NGL, condensate, or LNG service, the piping, and piping nipples 2 inches or less are to be no less than Schedule 160.**
- **The final design of the electrical purge seal arrangement should include an alternate or additional detection method to the proposed nitrogen system pressure indicators, to detect and alarm flammable vapors at the vent discharge to atmosphere in order to account for small leaks that pressure indicators may not be able to detect.**
- **The final design should provide an air gap or acceptable means downstream of the secondary seal to prevent the migration of flammable vapors from the secondary seal to the switchgear.**
- **The final design of the hazard detectors should account for the calibration gas when determining the Lower Flammability Limit (LFL) set points for methane, propane, and ethylene, and condensate.**
- **The final design should include pressure relieving protection for flammable liquid piping (i.e. refrigerants, liquid hydrocarbons, condensate products) which can be isolated by valves.**
- **The final design should specify that the pressure of the shell side of Inlet Gas Preheater, H1-1001, should not exceed the allowable operating pressure during pressure relief conditions, and the relieving device should discharge to a safe location.**
- **The final design should specify that the design temperature of the coil of the Hot Oil Heat Exchanger, H1-3013, is in accordance with Note 4 on page 5 of CAM1-PRC-DTS-H0035.**
- **The final design should specify that the C_{5+} Condensate Storage Tank fill connection is located above the maximum liquid level.**
- **The final design should address the potential for reverse flow through the Molecular Sieve Driers in the event that emergency vent valve XV1-10128 opens.**

- **The <u>final design</u> should include a hazard and operability review of the completed design prior to issuing the P&IDs for construction. A copy of the review, a list of recommendations, and actions taken on the recommendations, should be filed.**

- **The <u>final design</u> should include details of the shutdown logic, including cause-and-effect matrices for alarms and shutdowns, for the process instrumentation, fire and gas detection system, and emergency shutdown system.**

- **The <u>final design</u> should include a pressure survey of the anticipated operating and design conditions for the wet and dry flares. The survey should include a report showing the stream analysis, flow rates, temperatures and operating pressures from the relief discharge to the flare inlet.**

- **The <u>final design</u> should include a plan for clean-out, dry-out, purging, and tightness testing. This plan should address the requirements of the American Gas Association's Purging Principles and Practice required by 49 CFR Part 193 and should provide justification if not using an inert or non-flammable gas for cleanout, dry-out, purging, and tightness testing.**

- **The <u>final design</u> should the sizing basis and capacity for the final design of pressure and vacuum relief valves for major process equipment, vessels, storage tanks, and vent stacks.**

- **The <u>final design</u> should provide the procedures for pressure/leak tests which address the requirements of ASME VIII and ASME B31.3, as required by 49 CFR 193.**

- **<u>Prior to commissioning</u>, Cameron LNG should file plans and detailed procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service.**

- **<u>Prior to commissioning</u>, Cameron LNG should provide a detailed schedule for commissioning through equipment startup. The schedule should include milestones for all procedures and tests to be completed: prior to introduction of hazardous fluids; and during commissioning and startup. Cameron LNG should file documentation certifying that each of these milestones has been completed before authorization to commence the next phase of commissioning and startup will be issued.**

- **<u>Prior to commissioning</u>, Cameron LNG should tag all instrumentation and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.**

- **<u>Prior to commissioning</u>, Cameron LNG should file a tabulated list and drawings of the proposed hand-held fire extinguishers. The list should include the equipment tag number, extinguishing agent type, capacity,**

number, and location. The drawings should show the extinguishing agent type, capacity, and tag number of all hand-held fire extinguishers.

- **Prior to commissioning, Cameron LNG should file updates addressing the Terminal Expansion facilities in the operation and maintenance procedures and manuals, including hot work procedures and philosophy.**

- **Prior to commissioning, Cameron LNG should maintain a detailed training log to demonstrate that operating staff has completed the required training.**

- **Prior to introduction of hazardous fluids, Cameron LNG should complete a firewater pump acceptance test and firewater monitor and hydrant coverage test. The actual coverage area from each monitor and hydrant should be shown on facility plot plan(s).**

- **Prior to introduction of hazardous fluids, Cameron LNG should complete all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the Distributed Control System that demonstrates full functionality and operability of the system.**

- **Prior to commencement of service, progress on the construction of the proposed systems should be reported in monthly reports filed with the Secretary. Details should include a summary of activities, problems encountered, contractor non-conformance/deficiency logs, remedial actions taken, and current project schedule. Problems of significant magnitude should be reported to the FERC within 24 hours.**

In addition, we are recommending that the following measures should apply throughout the life of the facility:

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least an annual basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Cameron 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 semi-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 and exported LNG, liquefied and vaporized quantities, boil-off/flash gas, etc.), plant modifications, including future plans and progress thereof. Abnormalities should include, but not be limited to: unloading/loading/shipping problems, potential hazardous conditions from off-site vessels, storage tank stratification or rollover, geysering, storage tank**

pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, vapor or liquid releases, fires involving natural gas and/or from other sources, negative pressure (vacuum) within a storage tank and higher than predicted boil-off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted <u>within 45 days after each period ending June 30 and December 31</u>. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" also should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.

- **Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases, fires, explosions, mechanical failures, unusual over pressurization, and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) should be reported to the 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 <u>immediately</u>, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances, notification should be made to the FERC staff <u>within 24 hours</u>. This notification practice should be incorporated into the LNG facility's emergency plan. Examples of reportable LNG, NGL, condensate, or refrigerant 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. release of LNG, NGL, condensate, or refrigerants for 5 minutes or more;

  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, NGL, condensate, refrigerants, 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, refrigerants, NGL, condensate, or LNG;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes gas, NGL, condensate, refrigerants, 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, refrigerants, NGL, condensate, 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, NGL, condensate, refrigerants, or LNG;

l. safety-related incidents to LNG, condensate, or refrigerant 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, the 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.**

4.12.4 Siting Requirements

The Commission's regulations under 18 CFR 380.12(o)(14) require Cameron LNG to identify how the proposed design complies with the siting requirements of DOT's regulations in 49 CFR 193, Subpart B. The Part 193 requirements state that an operator or government agency must exercise control over the activities that can occur within an "exclusion zone," defined as the area around an LNG facility that could be exposed to specified levels of thermal radiation or flammable vapor in the event of a release. Approved mathematical models must be used to calculate the dimensions of these exclusion zones. The 2001 edition of NFPA 59A, an industry consensus safety standard for the siting, design, construction, operation, maintenance, and security of LNG facilities, is incorporated into Part 193 by reference, with regulatory preemption in the event of conflict. The following sections of Part 193 specifically address the siting requirements applicable to each LNG container and LNG transfer system:

- 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 (2001). In the event of a conflict with NFPA 59A (2001), the regulatory requirements in Part 193 prevail;

- Part 193.2057, Thermal radiation protection, requires that each LNG container and LNG transfer system have thermal exclusion zones in accordance with Section 2.2.3.2 of NFPA 59A (2001); and

- 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 (2001).

For the LNG facilities proposed for the Terminal Expansion Project, these Part 193 siting requirements would be applicable to the following equipment:

- one 42,267,526 gallon (net) full containment LNG storage tank and associated piping and appurtenances - Parts 193.2057 and 2059 require the establishment of thermal and flammable vapor exclusion zones for LNG tanks. NFPA 59A (2001), Section 2.2.3.2 specifies four thermal exclusion zones based on the design spill and the impounding area. NFPA 59A (2001), 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;

- a 30-inch-diameter LNG header used for ship loading - Parts 193.2001, 2057, and 2059 require thermal and flammable vapor exclusion zones for the marine cargo transfer system. NFPA 59A (2001) does not address LNG transfer systems;

- four 10,127 gpm in-tank pumps and associated piping and appurtenances for the proposed LNG storage tank; twelve 10,127-gpm in-tank pumps (four per tank) to replace the existing 3,706 in-tank pumps and associated piping and appurtenances; and six 6,058-gpm LNG product pumps (two per liquefaction train; one operating and one spare) and associated piping and appurtenances - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A (2001) 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 spills for containers and process areas; and

- three liquefaction heat exchangers (one per liquefaction train) and associated piping and appurtenances, including a 24-inch-diameter LNG rundown line - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A (2001) 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 spills for containers and process areas.

Previous FERC environmental assessments/impact statements for past projects have identified inconsistencies and areas of potential conflict between the requirements in Part 193 and NFPA 59A (2001). Sections 193.2057 and 193.2059 require exclusion zones for each LNG container and LNG transfer system, and an LNG transfer system is defined in Section 193.2007 to include cargo transfer system and transfer piping (whether permanent or temporary). However, NFPA 59A (2001) requires exclusion zones only for "transfer areas," which is defined as the part of the plant where the facility introduces or removes the liquids, such as truck loading or ship-unloading areas. The NFPA 59A (2001) definition does not include permanent plant piping, such as cargo transfer lines. Section 2.2.3.1 of NFPA 59A (2001) also states that transfer areas at the water edge of marine terminals are not subject to the siting requirements in that standard.

The DOT has addressed some of these issues in a March 2010 letter of interpretation. In that letter, DOT stated that: (1) the requirements in the NFPA 59A (2001) for transfer areas for LNG apply to the marine cargo transfer system at a proposed waterfront LNG facility, except where preempted by the regulations in Part 193; (2) the regulations in Part 193 for LNG transfer systems conflict with NFPA 59A (2001) on whether an exclusion zone analysis is required for transfer piping or permanent plant piping; and (3) the regulations in Part 193 prevailed as a result of that conflict. The DOT has determined that an exclusion zone analysis of the marine cargo transfer system is required.

In the FERC environmental assessments/impact statements for past projects, we have also noted that when the DOT incorporated NFPA 59A into its regulations, it removed the regulation that required impounding systems around transfer piping. As a result of that change, it is unclear whether Part 193 or the adopted sections of NFPA 59A (2001) require impoundments for LNG transfer systems. We note that Part 193 requires exclusion zones for LNG transfer systems, and that those zones were historically calculated based on impoundment systems. We also note that the omission of containment for transfer piping is not a sound engineering practice. For these reasons, we generally recommend containment for all LNG transfer piping within a plant's property lines.

Federal regulations issued by the Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.119 (Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents [PSM]), and the EPA under 40 CFR 68 (Risk Management Plans) cover hazardous substances, such as methane, propane, and ethylene at many facilities in the U.S. However, OSHA and EPA regulations are not applicable to facilities regulated under 49 CFR 193. On October 30, 1992, shortly after the promulgation of the OSHA Process Safety Management regulations, OSHA issued a letter of interpretation that precluded the enforcement of PSM regulations over gas transmission and distribution facilities. In a subsequent letter on December 9, 1998, OSHA further clarified that this letter of interpretation applies to LNG distribution and transmission facilities.

In addition, EPA's preamble to its final rule in Federal Register, Volume 63, Number 3, 639 645, clarified that exemption from the requirements in 40 CFR 68 for regulated substances in transportation, including storage incident to transportation, is not limited to pipelines. The preamble further clarified that the transportation exemption applies to LNG facilities subject to oversight or regulation under 49 CFR 193, including facilities used to liquefy natural gas or used to transfer, store, or vaporize LNG in conjunction with pipeline transportation. Therefore, the above OSHA and EPA regulations are not applicable to facilities regulated under 49 CFR 193. As stated in Section 193.2051, LNG facilities must be provided with the siting requirements of NFPA 59A (2001 edition). The siting requirements for flammable liquids within an LNG facility are contained in NFPA 59A, Chapter 2:

- NFPA 59A, Section 2.1.1 requires consideration of clearances between flammable refrigerant storage tanks, flammable liquid storage tanks, structures and plant equipment, both with respect to plant property lines and each other. This section also requires that other factors applicable to the specific site that have a bearing on the safety of plant personnel and surrounding public be considered, including an evaluation of potential incidents and safety measures incorporated in the design or operation of the facility.
- NFPA 59A Section 2.2.2.2 requires impoundments serving flammable refrigerants or flammable liquids to contain a 10-minute spill of a single accidental leakage source or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the DOT. In addition, NFPA Section 2.2.2.5 requires impoundments and drainage channels for flammable liquid containment to conform to NFPA 30, Flammable and Combustible Liquids Code.
- NFPA 59A Section 2.2.3.2 requires provisions to minimize the damaging effects of fire from reaching beyond a property line, and requires provisions to prevent a radiant heat flux level of 1,600 BTU/ft2-hr from reaching beyond a property line that can be built upon. The distance to this flux level is to be calculated with LNGFIRE or using models that have been validated by experimental test data appropriate for the hazard to be evaluated and that are acceptable to DOT.
- NFPA 59A Section 2.2.3.4 requires provisions to minimize the possibility of any flammable mixture of vapors from a design spill from reaching a property line that can be built upon and that would result in a distinct hazard. Determination of the distance that the flammable vapors extend is to be determined with DEGADIS or alternative models that take into account physical factors influencing LNG vapor dispersion. Alternative models must have been validated by experimental test data appropriate for the hazard to be evaluated and must be acceptable to DOT. Section 2.2.3.5 requires the design spill for impounding areas serving vaporization and process areas to be based on the flow from any single accidental leakage source.

For the following liquefaction facilities that are proposed for the Terminal Expansion, the FERC staff identified that the refrigerant siting requirements from Part 193 and NFPA 59A would be applicable to the following equipment:

- three liquefaction heat exchangers (one per liquefaction train) and associated piping and appurtenances;

- one 46,250-gallon ethylene storage bullet and associated piping;
- two 120,500-gallon propane storage bullets and associated piping;
- two 993,600-gallon stabilized condensate product storage tanks;
- one 260-gpm ethylene pump and associated piping;
- one 540-gpm propane pump and associated piping and appurtenances;
- two 485-gpm condensate product pumps and associated piping; two 94-gpm condensate shipping pumps and associated piping; and
- two 124-gpm NGL product pumps and associated piping and appurtenances.

4.12.5 Siting Analysis

Suitable sizing of impoundment systems and selection of design spills on which to base hazard analyses are critical for establishing an appropriate siting analysis. Although impoundment capacity and design spill scenarios for storage tank impoundments are well described by Part 193, a clear definition for other impoundments is not provided either directly by the regulations or by the adopted sections of NFPA 59A (2001). Under NFPA 59A (2001) Section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume that can be discharged from any single accidental leakage source during a 10-minute period or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the DOT. However, no definition of single accidental leakage source is provided in the regulations.

We prefer impoundments be sized based on the greatest flow capacity from a single transfer pipe for 10 minutes, while recognizing that different spill scenarios may be used for the single accidental leakage sources for the hazard calculations required by Part 193. A similar approach is used with impoundments for process vessels. We also prefer these impoundments be able to contain the contents of the largest process vessel served, while recognizing that smaller design spills may be appropriate for Part 193 calculations.

4.12.5.1 Impoundment Sizing

Part 193.2181 references NFPA 59A (2001) for siting, which specifies each impounding system serving an LNG storage tank must have a minimum volumetric liquid capacity of 110 percent of the LNG tank's maximum design liquid capacity for an impoundment serving a single tank. We also consider it prudent design practice to provide a barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property) in the event that the full containment storage tank primary and secondary containers have a common cause failure. The purpose of the barrier is to prevent liquid from flowing off the plant property, and does not define containment or an impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements already met by sumps and impoundments throughout the site.

Table 4.12.5-1 lists the spill volumes and their corresponding impoundment systems. For the Terminal Expansion, Cameron LNG proposes one full containment LNG storage tank where the outer tank wall would serve as the impoundment system. The proposed LNG storage tank would have a design maximum volume of 44,769,588 gallons. As shown in table 4.12.5-1, the outer tank would have a volumetric capacity of 52,199,423 gallons, which exceeds the 110 percent requirement by 2,952,876 gallons. The outer tank would contain 116 percent the design capacity of the inner tank, meeting the Part 193 requirements. The Cameron LNG Terminal has an existing earthen storm surge barrier around the perimeter of the facility, which also serves to limit liquid from flowing off the plant property in the case of a common cause failure of the existing full containment storage tank primary and secondary containers. Cameron LNG would extend this storm surge barrier around the proposed LNG storage tank. The existing storm surge barrier structure was constructed with a volume equivalent to one full storage tank. The new portion of the barrier surrounding the proposed LNG storage tank would increase this holding capacity and would meet our recommendation that a barrier be provided to prevent liquid from flowing off plant property.

TABLE 4.12.5-1
Impoundment Area Sizing

Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
LNG Storage Tank	44,769,588	Outer Tank Concrete Wall	52,199,423
30-inch Ship Loading Header	528,340	LNG Spill Impoundment	781,510
In-tank Pump Withdrawal Header	405,080	LNG Spill Impoundment	781,510
LNG Rundown Line (south)	174,750	LNG Spill Impoundment	781,510
LNG Rundown Line (north)	174,750	Liquefaction Area Sump	191,500
24-inch MRL Process Piping	107,750	Liquefaction Area Sump	191,500
Ethylene Storage Tank	46,250	Refrigerant Storage Sump	181,777
Propane Storage Tank	120,500	Refrigerant Storage Sump	181,777
Condensate Storage Tank	993,600	Condensate Containment	1,451,638
Fresh Amine Tank	142,130	Amine Diked Area	311,062
Lean Amine Tank	142,130	Amine Diked Area	311,062

Potential spills occurring from the 30-inch-diameter LNG ship loading header, the 24-inch-diameter in-tank pump withdrawal header, and the 24-inch-diameter LNG rundown line south of the liquefaction process area would drain toward the concrete troughs and would be directed to the existing LNG Spill Impoundment Basin. The existing LNG Spill Impoundment Basin is 85 feet long, 60.7 feet wide, and 21.25 feet deep with a usable capacity of 781,510 gallons. The existing LNG Spill Impoundment Basin is within the storm surge barrier at the center of the Cameron LNG Terminal vaporization area, the existing LNG storage tank area, and the south jetty area. For the Terminal Expansion Project, the largest spill to the existing LNG

Spill Impoundment Basin would be a 10-minute spill volume of 528,340 gallons from a guillotine rupture of the existing 30-inch-diameter LNG ship loading header. The LNG Spill Impoundment Basin would also contain spills from the in-tank pump withdrawal header and the LNG rundown line. The proposed LNG storage tank would be equipped with four in-tank pumps, each rated at 10,127 gpm. With all four in-tank pumps operating, the volume for a 10-minute spill from the in-tank pump withdrawal header would be 405,080 gallons. Any spills from the 24-inch-diameter LNG rundown line occurring south of the liquefaction trains would be sloped toward the existing LNG Spill Impoundment Basin. A 10-minute spill volume from the 24-inch-diameter LNG rundown line would be 174,750 gallons. These spills would be contained in the existing LNG Spill Impoundment Basin.

Cameron LNG proposes to construct two new concrete impoundment sumps, the Refrigerant Storage Sump and the Liquefaction Area Sump, to contain possible LNG and other hydrocarbon liquid spills from the refrigerant storage area and the liquefaction process area. The refrigerant storage tanks and associate piping within the curbed and concrete padded area would be sloped to direct any spills into the Refrigerant Storage Sump, which would be approximately 200 feet directly south of the refrigerant storage area. The Refrigerant Storage Sump would be 30 feet long, 30 feet wide, and 27 feet deep with a usable volume of 181,777 gallons. The proposed Refrigerant Storage Sump would contain spills from the 57,800-gallon ethylene storage tank and the 120,500-gallon propane storage tank.

Potential LNG, MRL, and NGL spills within the curbed and concrete-padded area from the liquefaction process trains would be sloped to the Liquefaction Area Sump, which would be east of the liquefaction process area. The proposed Liquefaction Area Sump would be 32 feet long, 32 feet wide, and 25 feet deep with a usable volume of 191,500 gallons. The largest spill into the Liquefaction Area Sump would be a guillotine rupture of the 24-inch-diameter LNG rundown line adjacent to the liquefaction process area, which would result in a 10-minute spill volume of 174,750 gallons. The largest refrigerant spill would be a 10-minute spill volume of 107,750 gallons from the 24-inch-diameter heavy MRL process piping located at the liquefaction heat exchanger. A 10-minute spill from the NGL line at the Medium Pressure (MP) Separator would be a volume of 3,410 gallons. These spills would be contained in the proposed Liquefaction Area Sump.

Cameron LNG proposes to install two stabilized condensate product storage tanks, each with a maximum volumetric capacity of 993,600 gallons. Each stabilized condensate storage tank would have its own secondary containment. Containment for a stabilized condensate product storage tank would be provided by a concrete pad and wall that would be 166.5 feet long, 166.5 feet wide, and 7 feet high, with a usable volume of 1,451,638 gallons.

Cameron LNG proposes to install a 142,130-gallon fresh amine tank and a 142,130-gallon lean amine tank within a 140-foot-long by 80-foot-wide by 4-foot-high common diked area. The diked area would have a usable volumetric capacity of 311,062 gallons and would hold the entire contents of both amine tanks.

4.12.5.2 Design Spills

Design spills are used in the determination of the hazard calculations required by Part 193. Prior to the incorporation of NFPA 59A in 2000, the design spill in Part 193 assumed the full rupture of "a single transfer pipe which has the greatest overall flow capacity" for not less than 10 minutes (old Part 193.2059(d)). With the adoption of NFPA 59A, the basis for the design spill for impounding areas serving only vaporization, process, or LNG transfer areas became the flow from any single accidental leakage source. Neither Part 193 nor NFPA 59A (2001) defines "single accidental leakage source."

In a letter to the FERC staff, dated August 6, 2013, DOT requested that LNG facility applicants contact the Office of Pipeline Safety's Engineering and Research Division regarding the Part 193 siting requirements.[41] Specifically, the letter stated that DOT required a technical review of the applicant's design spill criteria for single accidental leakage sources on a case-by-case basis to determine compliance with Part 193.

In response, Cameron LNG provided DOT with its design spill criteria and identified leakage scenarios for the proposed equipment. DOT reviewed the data and methodology Cameron LNG used to determine the design spills based on the flow from various leakage sources including piping, containers, and equipment containing LNG, refrigerants, and flammable fluids. On November 18, 2013, DOT provided a letter to the FERC staff stating that DOT had no objection to Cameron LNG's methodology for determining the candidate design spills to be used in establishing the Part 193 siting requirements for the proposed LNG liquefaction facilities.[42][43]

DOT's conclusions on the candidate design spills used in the siting calculations required by Part 193 was based on preliminary design information which may be revised as the engineering design progresses. If Cameron LNG's design or operation of the proposed facility differs from the details provided in the documents on which DOT based its review, then the facility may not comply with the siting requirements of Part 193. As a result, **we are recommending that:**

- **<u>Prior to the construction of the final design</u>, Cameron LNG should file with the Secretary for review and approval by the Director of OEP, certification that the final design is consistent with the information provided to DOT as described in the design spill determination letter dated November 18, 2013 (Accession Number 20131121-4000). In the event that any modifications to the design alters the candidate design spills on which the Title 49 CFR Part 193 siting analysis was based, Cameron LNG should consult with DOT on any actions necessary to comply with Part 193.**

[41] August 6, 2013 Letter from Kenneth Lee, Director of Engineering and Research Division, Office of Pipeline Safety to Terry Turpin, LNG Engineering and Compliance Branch, Office of Energy Projects. Filed in Docket Number CP13-25 on August 13, 2013. Accession Number 20130813-4019

[42] November 18,2013 Letter "Re: Cameron LNG, LLC, Cameron LNG Liquefaction Project, FERC Docket No. CP13-25-000, Design Spill Determination" from Kenneth Lee to Lauren H. O'Donnell. Filed in Docket Number CP13-25 on November 21, 2013. Accession Number 20131121-4000

[43] PHMSA based this decision on the following documents: (1) Resource Report 11 Reliability and Public Safety, FERC Docket Accession Number 20121207-5141; (2) Cameron response to FERC/PHMSA Data Request, FERC Docket Accession Number 20130829-5203; and (3) Cameron response to FERC/PHMSA Data Request, FERC Docket Accession Number 20130920-5157.

As design spills vary depending on the hazard (vapor dispersion, overpressure or radiant heat), the specific design spills used for the Cameron LNG siting analysis are discussed under "Vapor Dispersion Analysis" and "Thermal Radiation Analysis" in this section.

4.12.5.3 Vapor Dispersion Analysis

As discussed in Section 4.12.2, 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 limit or encountered an ignition source. In order to address this hazard, 49 CFR § 193.2059 requires each LNG container and LNG transfer system to have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA 59A (2001). Taken together, Part 193 and NFPA 59A (2001) require that flammable vapors either from an LNG tank impoundment or a single accidental leakage source do not extend beyond a facility property line that can be built upon.

Title 49 CFR §193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (one-half the 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 regulations in Part 193 specifically approve the use of two models for performing these dispersion calculations, DEGADIS and FEM3A. The use of alternative models is also allowed, but must be specifically approved by the DOT. Although Part 193 does not require the use of a particular source term model, modeling of the spill and resulting vapor production is necessary prior to the use of vapor dispersion models. In the past, applicants have typically used the SOURCE5 program to model the vapor production from an LNG spill.

Based on requests for clarification on the source term requirements of Part 193, the DOT issued two formal interpretations in July of 2010 regarding the regulations under 49 CFR 193.[44] In these interpretations, the DOT stated that:

- SOURCE5 could no longer be used to determine the vapor gas exclusion zone for compliance with § 193.2059 unless the deficiencies identified in the Fire Protection Research Foundation's reports "Evaluating Vapor Dispersion Models for Safety Analysis of LNG Facilities Research Project (Apr. 2007)" and "LNG Source Term Models for Hazard Analysis: A Review of the State-of-the-Art and an Approach to Model Assessment (Mar. 2009)" had been addressed; and
- source term models must have a credible scientific basis and must not ignore phenomena which can influence the discharge, vaporization, and conveyance of LNG.

[44] PHMSA Interpretation "Re: Request for Written Interpretation on the Applicability of 49 CFR 193 to Proposed Waterfront Liquefied Natural Gas Plant in the City of Fall River, Massachusetts" (July 7, 2010) and PHMSA Interpretation "Re: Request for Written Interpretation on the Applicability of 49 CFR 193 to Proposed LNG Import Terminal in Robbinston, Maine" (July 16, 2010).

As a result of these interpretations, alternative dispersion models became necessary in order to examine the effects of jetting, flashing and conveyance of LNG for exclusion zone calculations. In August 2010, the DOT issued Advisory Bulletin ADB-10-07 to provide guidance on obtaining approval of alternative vapor-gas dispersion models under Subpart B of 49 CFR 193. In October 2011, two dispersion models were approved by DOT for use in vapor dispersion exclusion zone calculations: PHAST-UDM Version 6.6 and Version 6.7 (submitted by Det Norske Veritas) and FLACS Version 9.1 Release 2 (submitted by GexCon). PHAST 6.7 and FLACS 9.1, with their built-in source term models, were used to calculate dispersion distances.

As discussed under "Design Spills" in Section 4.12.5.2, failure scenarios must be selected as the basis for the Part 193 dispersion analyses. Process conditions at the failure location would affect the resulting vapor dispersion distances. In determining the spill conditions for these leakage sources, process flow diagrams for the proposed design, used in conjunction with the heat and material balance information (i.e., flow, temperature, and pressure), can be used to estimate the flow rates and process conditions at the location of the spill. In general, higher flow rates would result in larger spills and longer dispersion distances; higher temperatures would result in higher rates of flashing; and higher pressures would result in higher rates of jetting and aerosol formation. Therefore, two scenarios may be considered for each design spill:

- the pressure in the line is assumed to be maintained by pumps and/or hydrostatic head to produce the highest rate of flashing and jetting (i.e. flashing and jetting scenario); and
- the pressure in the line is assumed to be depressurized by the breach and/or emergency shutdowns to produce the highest rate of liquid flow within a curbed, trenched, or impounded area (i.e. liquid scenario).

Alternatively, a single scenario for each design spill could be selected if adequately supported with an assessment of the depressurization calculations and/or an analysis of process instrumentation and shutdown logic acceptable to DOT.

In addition, the location and orientation of the leakage source must be considered. The closer a leakage source is to the property line, the higher the likelihood that the vapor cloud would extend off-site. As most flashing and jetting scenarios would not have appreciable liquid rainout and accumulation, the siting of impoundment systems would be driven by liquid scenarios, while siting of piping and other remaining portions of the plant would be driven by flashing and jetting scenarios.

Cameron LNG reviewed multiple releases for the liquid scenarios and for the flashing and jetting scenarios. Cameron LNG used the following conditions, corresponding to 49 CFR §193.2059, for the vapor dispersion calculations: ambient temperature of 68°F, relative humidity of 50 percent, wind speed of 4.5 mph, atmospheric stability class of F and a ground surface roughness of 0.03 m. In addition, a sensitivity analysis to the wind speed and direction was provided to demonstrate the longest predicted downwind dispersion distance in accordance with the PHAST and FLACS Final Decisions.

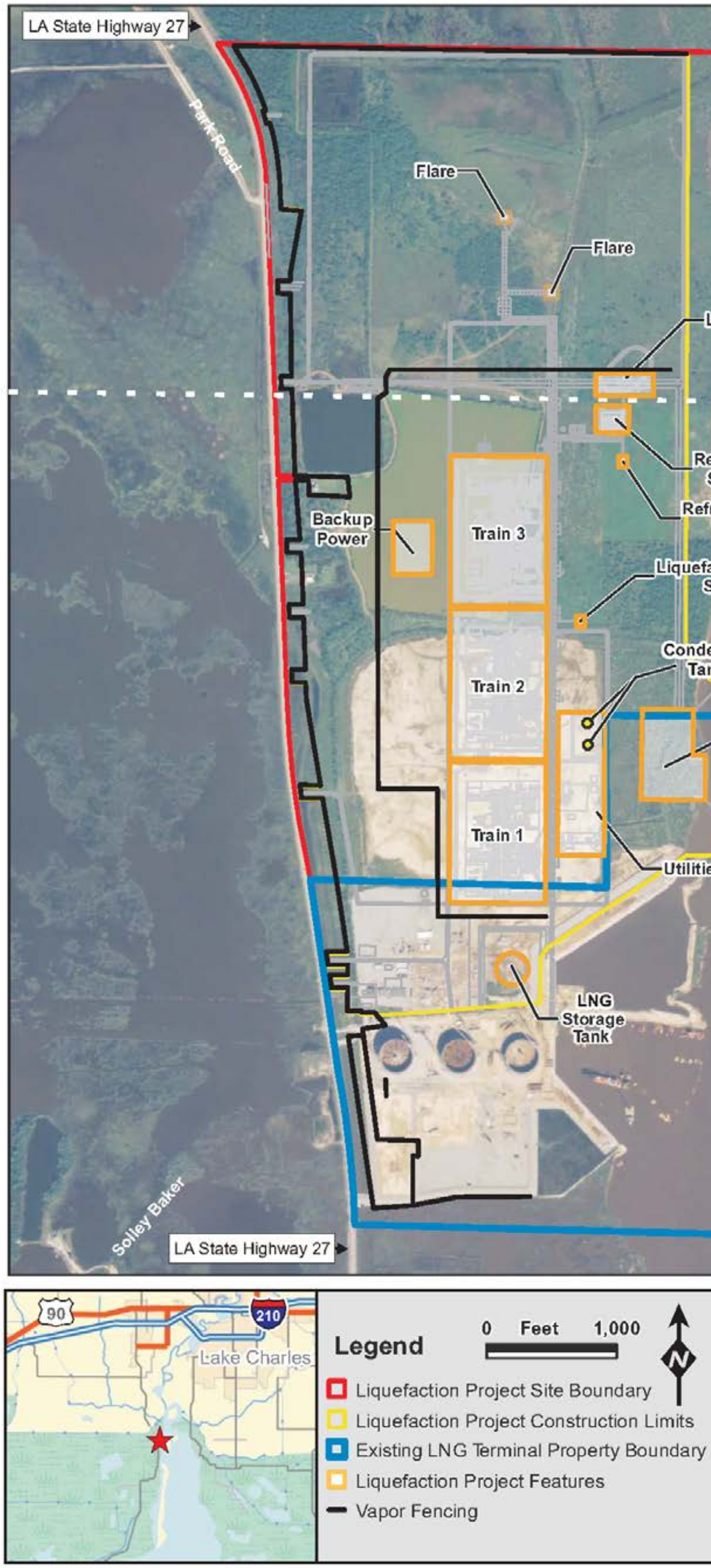
Cameron LNG accounted for the facility geometry, including the impoundment and trench geometry details as established by available plant layout drawings. The plant geometry accounts for any on-site wind channeling that could occur. The releases were initiated after sufficient time had passed in the model simulations to allow the wind profile to stabilize from effects due to the presence of buildings and other on-site obstructions.

Vapor Dispersion Analyses for LNG

According to table 2.2.3.5 of NFPA 59A, the design spill is the largest flow from the container (i.e., storage tank) withdrawal pumps for a 10-minute duration at full-rated capacity. In order to address the highest rate of LNG flow (i.e., liquid scenario) into the existing LNG Impoundment Basin, Cameron LNG specified the design spill as the guillotine rupture of the 30-inch-diameter LNG ship loading line with six in-tank pumps from multiple LNG storage tanks operating in parallel. This liquid spill would result in a maximum flow rate of 52,834 gpm for a 10-minute duration. FLACS was used to predict the extent of the ½-LFL vapor cloud. In the FLACS simulation, Cameron LNG selected a spill location on the 30-inch-diameter ship loading line within the existing Terminal at the shortest distance to the Cameron LNG Terminal's west property line along LA-27. Cameron LNG proposes to install two layers of 20-foot-high vapor fences along the north and west property lines, as shown in figure 4.12-1, to confine the vapor clouds and limit the extent of the vapor dispersion zones. In addition, a third layer of vapor fencing, approximately 100 feet long, would be provided at the 30-inch-diameter ship loading line located near the west property line. In the FLACS simulation, Cameron LNG modeled the vapor fences as 0 percent porosity.

Cameron LNG stated the design of the vapor fences would be completed during detailed engineering and would take into account wind load and overpressure. Cameron LNG also stated that the vapor fences would be periodically inspected and repaired as needed through the life of the facility. In order to ensure that the vapor fences are designed to withstand the wind load and overpressure and are maintained throughout the life of the facility, **we are recommending that:**

- **<u>Prior to construction of the final design,</u> Cameron LNG should file with the Secretary for review and approval by the Director of OEP, the details of the vapor fences as well as procedures to maintain and inspect the vapor barriers provided to meet the siting provisions of 49 CFR § 193.2059. This information should be filed a minimum of 30 days before approval to proceed is requested.**



Cameron Liquefaction Project

Vapor Fences Proposed at the Cameron LNG Terminal

Figure 4.12-1

In addition, the vapor fence layout, provided in resource report 11 of the application, showed a vapor fence segment directly north of the liquefaction facility, encompassing the refrigerant storage and truck loading area. However, the vapor fence layout did not include the truck turnaround route, as this vapor fence segment would intersect with the truck turnaround route for trucks exiting the truck loading area (see figure 4.12-1). In order to address the discrepancy in the vapor fence layout, **we are recommending that**:

- **<u>Prior to the end of the draft EIS comment period</u>, Cameron LNG should file with the Secretary the revised location of the vapor fences, corresponding to the most recent facility plot plan, to show that the vapor fences do not obstruct the trucking route. Cameron LNG should also revise the modeling analysis as necessary.**

The FLACS results indicated that the ½-LFL vapor cloud would extend beyond the vapor fences as well as Cameron LNG property but would remain within an area designated as the Barbe Limit of Exclusion Zone, located west of the Cameron LNG property line and across highway LA-27. The Barbe Limit of Exclusion Zone is defined by a September 17, 2003 Servitude and Easement Agreement between Cameron LNG and the Lake Charles Harbor and Terminal District, established to grant Cameron LNG legal control over the thermal radiation exclusion zones from the LNG storage tanks which were placed into service in July 2009. Based on our consultation with the DOT, we conclude that the vapor dispersion over highway LA-27 and the Barbe Limit of Exclusion Zone would not be prohibited by Part 193.

In order to address the highest rate of LNG flow (i.e. liquid scenario) into the Liquefaction Area Sump, Cameron LNG specified the design spill as a hole equivalent to ⅓ diameter of the 24-inch-diameter LNG rundown header located east of the liquefaction process area, resulting in a 12,020 gpm spill rate. The FLACS results indicate that the ½-LFL vapor cloud would remain within Cameron LNG's property boundary at all times.

Cameron LNG used PHAST Version 6.7 to perform diameter sensitivity, wind sensitivity, and elevation sensitivity studies in order to achieve worst case jetting and flashing scenarios. For the jetting and flashing scenario of an LNG spill from the 30-inch-diameter ship loading line, Cameron LNG considered a release source at the shortest distance to the west property line along LA-27. The diameter sensitivity study indicated that a release from a 10-inch-diameter hole from the ship loading line would generate the highest vapor production rate, which would consequently result in longer ½-LFL vapor cloud distances. Cameron LNG proposed to install impingement shrouds around the entire 30-inch-diameter ship loading line in order to mitigate high momentum jetting and flashing releases and induce liquid rainout. The impingement shrouds would be designed and constructed to withstand the mechanical stress and thermal environment of a release. The Terminal's maintenance and inspection program would be updated to ensure the integrity and replacement of these impingement shrouds in the event of damage. As Cameron LNG's impingement shroud design is only at a preliminary stage, **we are recommending that:**

- **<u>Prior to construction of the final design,</u> Cameron LNG should file with the Secretary, for review and approval by the Director of OEP, the details of the impingement shrouds final design as well as procedures to maintain and**

inspect the impingement shrouds. This information should be filed a minimum of <u>30 days before</u> approval to proceed is requested.

The installation of the impingement shrouds allowed Cameron LNG to model the downward release in PHAST, which resulted in a significant liquid rainout into the trench. Cameron LNG also used Starr-CCM+, a commercially available computational fluid dynamics code developed by CD-Adapco, to support the assumption that the impingement shrouds would direct the flow of LNG downward. The resulting liquid and vapor mass flow rates were used as input to FLACS. The FLACS results indicated the ½-LFL for the liquid rainout into the trench would remain within Cameron LNG property, and the ½-LFL for LNG flashing and jetting would extend beyond the first two layers of vapor fences but would be confined by the third layer of vapor fence. The ½-LFL vapor cloud for the flashing and jetting scenario from the 30-inch-diameter ship loading line would remain within the property line considering installation of the vapor fences and impingement shrouds. Cameron LNG also analyzed a design spill from each in-tank pump discharge header at the LNG storage tank area. This 24-inch-diameter in-tank pump discharge header runs from the top of the LNG storage tank down the side of the tank and connects to the 30-inch-diameter ship loading line. Cameron LNG selected a 1-inch-diameter hole on the 24-inch-diameter in-tank pump discharge header from the existing LNG storage tank located at the shortest distance to the west property line.

Cameron LNG performed a sensitivity study using PHAST for design spills along the 24-inch-diameter in-tank pump discharge header at the top, middle, and bottom of the LNG storage tank at various wind speeds. The PHAST results indicated no liquid rainout. The PHAST results indicate that the ½-LFL vapor cloud for the LNG flashing and jetting scenarios at the top and middle of the LNG storage tank would extend 225 feet at an elevation of 162 feet and 180 feet at an elevation of 77 feet, respectively. The ½-LFL vapor clouds from these two releases would not reach the ground level and would remain within Cameron LNG property. Regarding the release from the 24-inch-diameter in-tank pump discharge header at the LNG storage tank ground elevation, Cameron LNG previously used FLACS to model a spill from a 2-inch-diameter hole with the same process conditions and demonstrated that the ½-LFL vapor cloud would be contained within Cameron LNG property by the vapor fences; therefore, a smaller release from the 1-inch-diameter hole would not extend beyond the vapor fences.

Cameron LNG considered the highest rate of LNG flashing and jetting from the liquefaction process area would be a release from an 8-inch-diameter hole from the 24-inch-diameter LNG rundown line. Impingement shrouds would also be installed along the 24-inch-diameter LNG rundown line to mitigate the vapor production rate and induce rainout. The liquid portion from this release into the trench was modeled using FLACS, and the vapor portion was modeled using PHAST. Other design spill considerations for LNG flashing and jetting from the liquefaction process area include a 1-inch-diameter hole from the LNG pump single discharge line and a 1-inch-diameter hole from the 24-inch-diameter LNG product line downstream of the liquefaction heat exchanger. Table 4.12.5-2 provides the results for LNG jetting and flashing scenarios from the liquefaction process area. The distances to the ½-LFL vapor cloud for all LNG flashing and jetting scenarios from the liquefaction process area would also remain within Cameron LNG property.

TABLE 4.12.5-2 Vapor Dispersion Scenarios from LNG Flashing and Jetting Releases			
Scenario	**Release location**	**Wind speed (meters/second)**	**Approximate downwind distance to ½-LFL[a] (feet)**
1	In-tank Pump Discharge Header at Top of the LNG Storage Tank	20	225
2	In-tank Pump Discharge Header at Middle of LNG Storage Tank	16	180
3	In-tank Pump Discharge Header at Ground Level	-	320[b]
4	LNG Rundown Header	1	1,253
5	LNG Pump Discharge	1	655
6	Liquefaction Heat Exchanger	2	390

[a] LFL = lower flammability limit

[b] Approximate distance from the spill source to the vapor fence.

Based on our consultation with the DOT, we conclude the vapor dispersion analyses based on the project design as filed by Cameron LNG would meet the requirements of Title 49 CFR 193.2059.

Vapor Dispersion Analyses for Other Hazardous Fluids

Even though Cameron LNG considered all possible releases from the MRL process system, the propane pre-cool system, and the heavy hydrocarbon removal system at the liquefaction process area, only the spills that produced the highest release rates and consequently the longest ½-LFL vapor clouds are discussed in this section. The highest rate of MRL release would be from a 1-inch-diameter hole at the MRL process line downstream of the mixed refrigerant chiller. Cameron LNG stated that methane was considered as a single component for the MRL flammable vapor dispersion analysis, and ethylene was chosen as input for the overpressure analysis due to its higher reactivity. While we agree that ethylene as a single component may result in the longest distance to the 1-psi overpressure, using methane as a single component input to PHAST may not result in the longest flammable vapor dispersion distance. In order to address this, we used the composition of MRL for the richest case given in the heat and material balance sheets as input to PHAST for a horizontal release. PHAST result indicated no liquid rainout, and the ½-LFL distance is shown in table 4.12.5-3.

Propane would be used in the liquefaction cycle to pre-cool the feed gas and mixed refrigerant vapor. The worst case scenario for a propane liquid release at the liquefaction process area would be a horizontal release of the 4-inch connection at the propane condenser header. The highest rate of NGL release would be a 1-inch-diameter hole from the 4-inch-diameter NGL process line downstream of the High Pressure Separator. The results for these design spills considered in the liquefaction area are provided in table 4.12.5-3 and show that the ½-LFL vapor clouds would remain within Cameron LNG's property.

TABLE 4.12.5-3 Vapor Dispersion Scenarios from Refrigerant, NGL, and Condensate Releases				
Scenario	**Material**	**Release Location**	**Wind speed (meters/second)**	**Approximate downwind distance to ½-LFL (feet)**
1	Mixed Refrigerant	Liquefaction Process	1	297
2	Propane	Liquefaction Process	1	985
3	NGL	Liquefaction Process	3	958
4	Ethylene	Refrigerant Storage	5	826
5	Propane	Refrigerant Storage	6	485
5	Ethylene	Truck Unloading	6	1,200
6	Propane	Truck Unloading	7	870
7	Condensate	Condensate Storage	2	1,873

At the refrigerant storage area where the ethylene and propane storage tanks would be located, Cameron LNG considered design spills from a 1-inch-diameter hole for both of the ethylene and propane make-up lines. PHAST results indicated that ethylene and propane spills from the 1-inch-diameter holes would result in no liquid rainout.

In the refrigerant truck unloading area, Cameron LNG considered design spills from the 2-inch-diameter transfer lines from the propane and ethylene trucks to the propane and ethylene make-up tanks. The maximum spill duration were assumed to be the de-inventory time of the ethylene and propane trucks for 5 minutes and 6 minutes, respectively. The results for the design spills in the horizontal direction considered in the truck loading area resulted in no liquid rainout.

In order to determine the longest ½-LFL vapor cloud distance for a release from the stabilized condensate storage area, Cameron LNG assumed the entire content of one stabilized condensate tank would be instantaneously spilled into the containment area. The ½ -LFL vapor cloud would remain within Cameron LNG's property.

Table 4.12.5-3 provides the PHAST Version 6.7 results for the refrigerants and NGL jetting and flashing scenarios as well as stabilized condensate liquid spill scenario. The PHAST simulations indicated that horizontal direction releases from the liquefaction process area, refrigerant storage area, and truck unloading area would result in jetting and flashing without any liquid accumulation due to the process conditions and hole sizes.

The distances to the ½-LFL vapor cloud for all refrigerant and NGL release scenarios discussed above would remain within the Cameron LNG property. Based on our consultation with the DOT, we conclude the vapor dispersion analyses based on the project design as filed by Cameron LNG would meet the requirements of Title 49 CFR 193.2051 and NFPA 59A section 2.2.3.4 (2001 edition).

Since the stabilized condensate would contain benzene, a toxic product, Cameron LNG used PHAST Version 6.7 to calculate the dispersion distances to toxic threshold exposure limits based on the Acute Exposure Guideline Level (AEGLs). AEGLs are recommended for use by federal, state, and local agencies, as well as the private sector for emergency planning, prevention, and response activities related to the accidental release of hazardous substances. Other federal agencies, such as the Department of Energy, use AEGLs as the primary measure of toxicity.

There are three AEGLs which are distinguished by varying degrees of severity of toxic effects with AEGL-1 (level 1) being the least severe to AEGL-3 being the most severe. AEGL-1 is the airborne concentration of a substance that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, these effects are not disabling and are transient and reversible upon cessation of the exposure. AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape. AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death. The EPA provides AEGLs for a list of chemicals at varying exposure times (10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours). Table 4.12.5-4 shows the toxic concentrations of benzene at each AEGL and corresponding exposure time based on EPA's published information (EPA 2012).

TABLE 4.12.5-4
Acute Exposure Guideline Levels (in ppm) for Benzene

Guideline Level	10-minute	30-minute	60-minute	4-hour	8-hour
AEGL 1	130	73	52	18	9
AEGL 2	2,000	1,100	800	400	200
AEGL 3	9,700	5,600	4,000	2,000	990

Cameron LNG's toxicity analysis conservatively assumed that the entire content of the stabilized condensate tank for the richest case was instantaneously spilled into the containment area. Similar to flammability concentrations, a safety factor of 2 (i.e. ½ AEGL) was also applied to reflect uncertainties associated with the model. The maximum dispersion distance to the 9 ppm benzene concentration (i.e., ½ AEGL-1 at 4 hours) was found to extend 1.1 miles. This vapor cloud would travel offsite and extend over Gulf Port Oil and Gas's field office, Cardinal Hunting Club's building, a private boat storage shed, and three abandoned drilling rig locations. Cameron LNG would update its Emergency Response Plan to notify the Gulf Port Oil and Gas, the Cardinal Club, and the boat storage shed owner in the event of an emergency that involves a stabilized condensate tank failure. There would be no residences, parks, hospitals, churches or other sensitive areas within this distance. Additionally, the toxicity effects associated with AEGL-1 are non-disabling and reversible. Based on our consultation with the DOT regarding the Part 193 requirements for the stabilized condensate, we conclude the stabilized condensate would not present a significant impact to the public.

Overpressure Considerations

As discussed in section 4.12.2, the propensity of a vapor cloud to detonate or produce damaging overpressures is influenced by the reactivity of the material, the level of confinement and congestion surrounding and within the vapor cloud, and the flame travel distance. It is possible that the prevailing wind direction may cause the vapor cloud to travel into a partially confined or congested area.

LNG Vapor Clouds

As adopted by Part 193, section 2.1.1 of NFPA 59A (2001) requires an evaluation of potential incidents and safety measures incorporated in the design or operation of the facility be considered. As discussed under "Overpressures" in section 4.12.2, unconfined LNG vapor clouds would not be expected to produce damaging overpressures. The presence of heavier hydrocarbons influences the propensity for a detonation or deflagration with damaging overpressures. Less processed product with greater amounts of heavier hydrocarbons is more sensitive to detonation. The Terminal Expansion would be designed to receive feed gas with methane concentrations as low as 91 percent. These compositions are not in the range shown to exhibit overpressures and flame speeds associated with high-order explosions and detonations.

The Coast Guard studies referenced under "Overpressures" in section 4.12.2 indicated overpressures of 4 bar and flame speeds of 35 m/s (meters per second) were produced from vapor clouds of 86 percent to 96 percent methane in near stoichiometric proportions using exploding charges as the ignition source. The 4 bar overpressure was the same overpressure produced during the calibration test involving exploding the charge ignition source alone, so it remains unclear that the overpressure was attributable to the vapor deflagration. However, unconfined methane vapor clouds ignited with low energy ignition sources have been shown to produce flame speeds ranging from 5.2 to 7.3 m/s, which is much less than the flame speeds associated with explosions or detonations.

Additional tests were conducted to study the influence of confinement and congestion on the propensity of a vapor cloud to detonate or produce damaging overpressures. The tests used obstacles to create a partially confined and turbulent scenario, but found that flame speeds developed for methane were not significantly higher than the unconfined case and were not in the range associated with detonations.

Given the LNG compositions which would be handled onsite, potential ignition sources, and the expected vapor dispersion characteristics, damaging overpressures would not be expected to occur from ignition of an unconfined vapor cloud. However, ignition of a confined natural gas vapor cloud could result in higher overpressures. In order to prevent such an occurrence, the liquefaction process area and the refrigerant storage area would be located away from proposed and existing buildings in the Cameron LNG Terminal. In addition, Cameron LNG proposes to install flammable gas detectors in occupied building heating, ventilation, and air conditioning (HVAC) inlets to reduce the likelihood of flammable vapors dispersing into these buildings.

As discussed in section "Vapor Dispersion Analysis," methane vapor from potential LNG releases at the ship loading header would be limited and confined within three layers of 20-foot-high vapor fences. Of the three vapor fence layers, Cameron LNG identified the shortest distance between any parallel vapor fences would be 20 feet apart, which would approximately be the same as the fence height. PHAST Version 6.7 was used to predict the 1-psi overpressure distance from the methane vapor trapped between the vapor fences. The PHAST results indicated that the maximum overpressure due to ignition of the methane vapor cloud between the vapor fences would be 0.46 psi and would extend 72 feet from the ignition location. This distance would remain within Cameron LNG's property.

Vapor Clouds from Other Hazardous Fluids

The refrigerants which would be used in the liquefaction process streams have a higher reactivity than LNG, and in some circumstances may produce damaging overpressures when ignited. In order to evaluate this hazard, Cameron LNG used PHAST Version 6.7 to perform an explosion overpressure analysis. Three explosion models including the trinitrotoluene-equivalent model, the Netherland Organization for Applied Scientific Research TNO multi-energy model, and the Baker-Strehlow-Tang model were used as inputs in the PHAST overpressure analysis. Cameron LNG used the vapor dispersion results, previously discussed in section "Vapor Dispersion Analysis," from the releases of refrigerants from the liquefaction process area, the refrigerant storage area, and the truck unloading area as input to the explosion models.

Table 4.12.5-5 provides the worst-case results of the three explosion models for each scenario. PHAST results showed that the maximum overpressure from the ignition of the propane and NGL vapor clouds at the proposed LNG storage tank would be 2.3 psi. Cameron LNG indicated that the LNG storage tank would be designed for an external blast loading of 2.4 psi. For the mixed refrigerant overpressure scenario, Cameron LNG selected ethylene as the input to the PHAST model because it is a higher reactivity fuel compared to other mixed refrigerant components. In all overpressure scenarios, the 1-psi overpressure distance would remain within the Cameron LNG property. Based on our consultation with the DOT, we conclude the overpressure analyses based on the project design as filed by Cameron LNG would meet the requirements of Title 49 CFR 193.2051 and NFPA 59A section 2.1.1 (2001 edition).

TABLE 4.12.5-5
Overpressure Scenarios from Refrigerant Releases

Scenario	Material	Release Locations	Approximate 1-psi overpressure distance (feet)
1	MRL	Liquefaction Process Area	479
2	Propane	Liquefaction Process Area	778
3	NGL	Liquefaction Process Area	617
4	Ethylene	Refrigerant Storage Area	975
5	Propane	Refrigerant Storage Area	470
6	Ethylene	Truck Unloading Area	1,460
7	Propane	Truck Unloading Area	843

Thermal Radiation Analysis

As discussed in section 4.12.2, if flammable vapors are ignited, the deflagration could propagate back to the spill source and result in a pool fire causing high levels of thermal radiation (i.e., heat from a fire). In order to address this, 49 CFR § 193.2057 requires each LNG container and LNG transfer system to have a thermal exclusion zone in accordance with Section 2.2.3.2 of NFPA 59A (2001). Together, Part 193 and NFPA 59A (2001) specify different hazard endpoints for spills into LNG storage tank containment and spills into impoundments for process or transfer areas. For LNG storage tank spills, there are three radiant heat flux levels which must be considered:

- 1,600 Btu/ft^2-hr - This level can extend beyond the facility's property line that can be built upon but cannot include areas that, at the time of facility siting, are used for outdoor assembly by groups of 50 or more persons;

- 3,000 Btu/ft^2-hr - This level can extend beyond the facility's property line that can be built upon but cannot include areas that, at the time of facility siting, contain assembly, educational, health care, detention or residential buildings or structures; and

- 10,000 Btu/ft^2-hr - This level cannot extend beyond the facility's property line that can be built upon.

The requirements for spills from process or transfer areas are more stringent. For these impoundments, the 1,600 Btu/ft^2-hr flux level cannot extend beyond the facility's property line that can be built upon.

Part 193 requires the use of the LNGFIRE3 computer program model developed by the Gas Research Institute to determine the extent of the thermal radiation distances. Part 193 stipulates that the wind speed, ambient temperature, and relative humidity that 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. Cameron LNG selected the following ambient conditions to produce the maximum exclusion distances: wind speeds of 9-23 mph, ambient temperature of 32°F, and 20 percent relative humidity. We agree with Cameron LNG's selection of atmospheric conditions.

For its analysis, Cameron LNG calculated thermal radiation distances for the 1,600-, 3,000-, and 10,000-Btu/ft^2-hr incident radiant heat levels for the LNG storage tank using the outer tank's concrete wall diameter (260 feet) as the pool diameter. The flame base was set equal to the top of the concrete wall (142 feet). Target heights were set at the ground level. In addition, Cameron LNG calculated thermal radiation distances using LNGFIRE3 for the 1,600-Btu/ft^2-hr incident radiant heat level centered on the existing LNG Spill Impoundment Basin.

Cameron LNG also used LNGFIREIII to predict the thermal radiation distance at the level of 1,600-BTU/ft^2-hr for fires from the Liquefaction Area Sump, the Refrigerant Storage Sump, and the Condensate Storage Tank Dikes. Although LNGFIREIII is specifically designed to calculate thermal radiation flux levels for LNG pool fires, LNGFIREIII could also be used to conservatively calculate the thermal radiation flux levels for flammable hydrocarbons such as ethylene, propane, NGL, and condensate. Two of the parameters used by LNGFIREIII to calculate the thermal radiation flux is the mass burning rate of the fuel and the surface emissive power (SEP) of the flame, which is an average value of the thermal radiation flux emitted by the fire. The mass burning rate and SEP of an ethylene, propane, NGL, or condensate fire would be less than an equally sized LNG fire. Since the thermal radiation from a pool fire is dependent on the mass burning rate and SEP, the thermal radiation distances required for ethylene, propane, NGL, and condensate fires would not extend as far as the exclusion zone distance previously calculated for an LNG fire in the same sump.

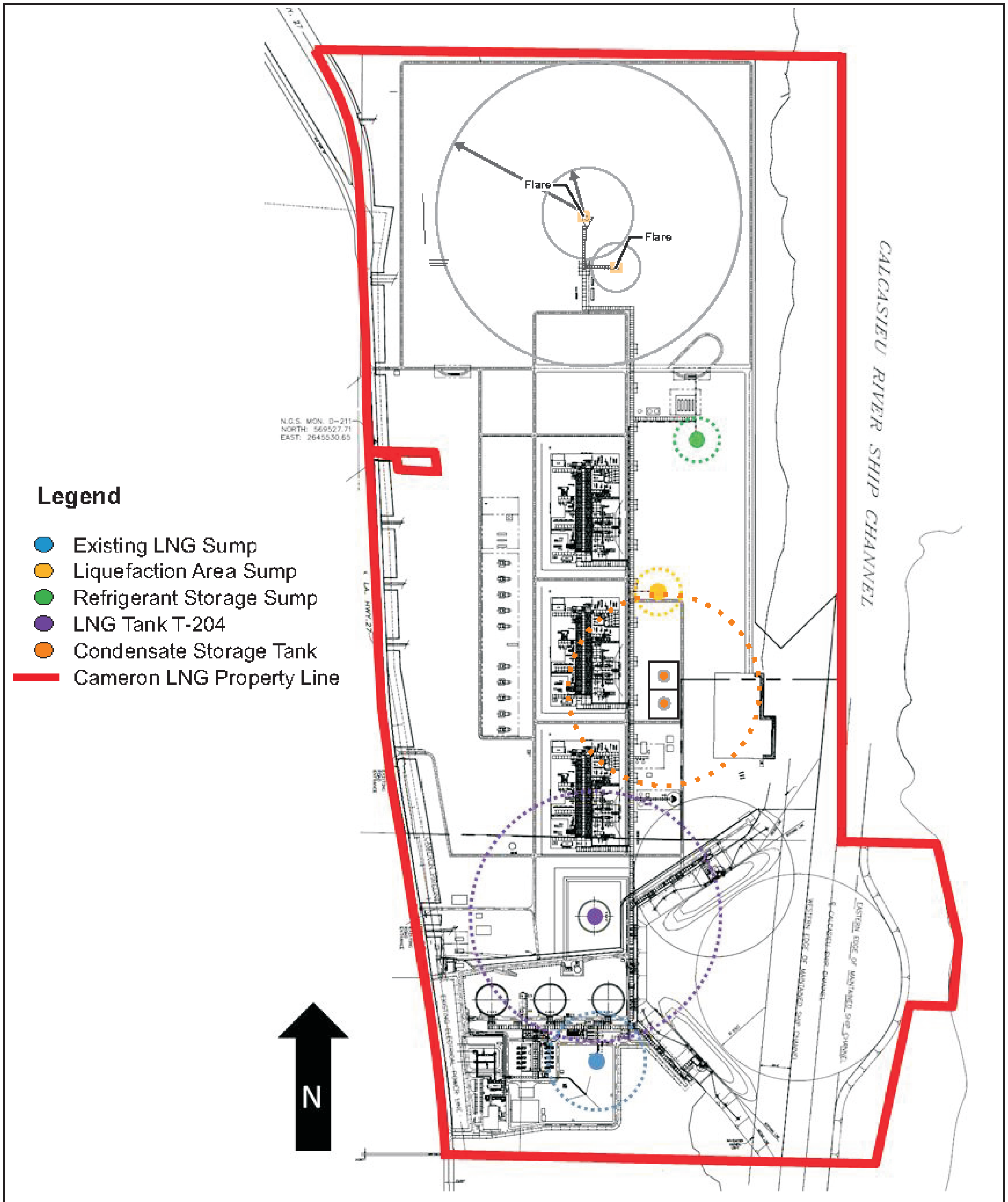
The resulting maximum thermal radiation distances are shown in table 4.12.5-6 and figure 4.12-2. The 10,000-, 3,000-, and 1,600-Btu/ft^2-hr heat fluxes from the LNG storage tank and the 1,600-Btu/ft^2-hr heat flux from the existing LNG Impoundment Basin, the Liquefaction Area Sump, the Refrigerant Storage Sump, and the stabilized condensate storage tank dike would remain within the facility property lines. Based on our consultation with the DOT, we conclude that these thermal radiation analyses based on the Project design as filed by Cameron LNG would meet the requirements specified by Part 193 and NFPA 59A (2001).

TABLE 4.12.5-6

Thermal Radiation Exclusion Zones for Impoundment Basins

Flux Level (Btu/ft^2-hr)	Full-Containment Tank Outer Containment (feet)[a]	Existing LNG Impoundment Basin (feet)[a]	Liquefaction Area Sum (feet)[a]	Refrigerant Storage Sump (feet)[a]	Condensate Storage Tank Dike (feet)[a]
10,000	369	194	130	125	453
3,000	752	296	168	160	622
1,600	977	372	196	186	745

[a] from center of impoundment



Cameron Liquefaction Project

Thermal Radiation Exclusion Zones 1,600-BTU/ft2 for LNG Storage Tank, Condensate Storage Tank, and Impoundment Sumps

Figure 4.12-2

BLEVE

Cameron LNG proposes to locate the ethylene and propane storage systems away from potential fire sources and outside all thermal radiation zones. These remote locations would result in negligible risk of a BLEVE occurring at the refrigerant storage area. There would be two stabilized condensate storage tanks at the site. Since the two stabilized condensate storage tanks would be located adjacent to each other, the radiant heat from a tank fire would impinge over the adjacent tank. In order to address the potential fireball and overpressure from a BLEVE, Cameron LNG used PHAST Version 6.7 to estimate the distance to the 5 kW per square meter (kW/m^2) radiant heat level 1-psi overpressure. PHAST results show that the distance to the 5 kW/m^2 radiant heat level from a fireball scenario would be 4,565 feet away from the center of the stabilized condensate storage tank and extend beyond Cameron LNG's property. Cameron LNG identified a private boat storage shed and three abandoned drilling rig locations within this distance; however, there would be no parks, hospitals, churches, or other occupied locations or dwellings. Cameron LNG would update its Emergency Response Plan to notify the boat storage shed owner in the event of an emergency that involves a stabilized condensate tank failure. Based on our consultation with the DOT, we conclude that the overpressure and thermal radiant heat level would meet the requirements specified by Part 193 and NFPA 59A (2001).

4.12.6 Emergency Response

Section 3A(e) of the NGA, added by Section 311 of the EPAct, stipulated that in any order authorizing an LNG terminal, the Commission shall require the LNG terminal operator to develop an emergency response plan (ERP) in consultation with the Coast Guard and state and local agencies. The ERP has been in place since the Cameron LNG Terminal began operation in July of 2009. The existing ERP would need to be updated to include the proposed liquefaction facilities and emergencies related to refrigerant handling. Therefore, **we are recommending that:**

- **Cameron LNG should update its ERP to include the Terminal Expansion facilities as well as instructions to handle on-site refrigerant and NGL-related emergencies. Cameron LNG should file the ERP with the Secretary for review and written approval by the Director of OEP <u>prior to initial site preparation</u>.**

- **The ERP 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. Cameron LNG should file the Cost-Sharing Plan for review and written approval by the Director of OEP <u>prior to initial site preparation</u>.**

4.12.7 Facility Security and LNG Vessel Safety

The security requirements for the 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 liquefaction facility are in the Coast Guard regulations in 33 CFR 127. Requirements for maintaining security of the terminal are in 33 CFR 105.

The Cameron LNG Terminal commenced service in July 2009 and has been receiving LNG shipments for import and re-export purposes. The existing facility has a Facility Security Plan, as required by 33 CFR 105, which has been approved by the Coast Guard. In addition, the LNG ship transits to the existing facility are performed under the "LNG Vessel Management and Emergency Plan" established by the Coast Guard for the Calcasieu Ship Channel. There are no proposed changes in the marine systems or the expected number of vessels as a result of the export project.

In a letter to the Coast Guard dated February 27, 2012, Cameron LNG detailed the Terminal Expansion modifications and stated it believed there would be no additional waterway impacts beyond those examined for the 346 ship transits assumed in the December 2005 WSA submitted to the Coast Guard for import operations. In a letter dated March 16, 2012, the Coast Guard stated that a LOI or a revision to the WSA was not required. However, the Coast Guard specified that applicable amendments to the Operations Manual, Emergency Manual, and Facility Security Plan must be made that capture changes to the operations associated with the Terminal Expansion Project. As required by 33 CFR 105 and 127, Cameron LNG would amend these documents and submit them to the Coast Guard prior to operation of the facility as an export terminal.

4.12.8 Pipeline Safety Standards

Regarding Cameron Interstate's proposed facilities for the Pipeline Expansion, the transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000 ^{o}F and is flammable at concentrations between 5 and 15 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.

DOT is mandated to provide pipeline safety under 49 USC 601. The PHMSA Office of Pipeline Safety (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. 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. The state of Louisiana has a Section 5(a) certification.

DOT pipeline standards are published in 49 CFR 190 to 199. Part 192 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, 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 DOT in accordance with Section 3(e) of the Natural Gas Pipeline Safety Act. Cameron Interstate has stated that it would design, construct, operate, and maintain its pipeline and aboveground facilities associated with the Pipeline Expansion in accordance with or exceeding the DOT's Minimum Federal Safety Standards in 49 CFR 192.

The FERC accepts this certification and does not impose additional safety standards other than 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 pipelines under the Commission's jurisdiction. The FERC also participates as a member of DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

The regulations at 49 CFR 192 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 220.0 yards on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined as follows:

- Class 1 - location with 10 or fewer buildings intended for human occupancy;
- Class 2 - location with more than 10 but less than 46 buildings intended for human occupancy;
- Class 3 - location with 46 or more buildings intended for human occupancy, or where the pipeline lies within 100 yards of any building or small well-defined outside area occupied by 20 or more people during normal use; and

- 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. Buried pipelines constructed on land in Class 1 locations must be provided with a minimum coverage of 30.0 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 36.0 inches in normal soil and 24 inches in consolidated rock. All pipelines installed in navigable rivers, streams, and harbors must have a minimum cover of 48.0 inches in normal soil or 24.0 inches in consolidated rock.

In some cases, Cameron Interstate's safety standards for the Pipeline Expansion would exceed the DOT minimum requirements. For example, Cameron Interstate would test 100 percent of mainline welds, whereas the minimum requirement for nondestructive testing is at least 10 percent in Class 1 locations (88.3 percent of the pipeline), at least 15 percent in Class 2 locations (11.2 percent of the pipeline), and at least 90 percent in Class 3 locations (0.5 percent of the pipeline). In addition, Cameron Interstate would provide 36 inches of cover for the entire length of pipeline, unless alternative measures are required on a site-specific basis. Currently, DOT would require only 11.7 percent of the pipeline length to meet 36 inches of cover while the remaining 88.3 percent would only require 30.0 inches of cover.

Part 192.179 specifies the maximum distance from a point on a pipeline to a sectionalizing block valve: each point on a pipeline in a Class 1 location must be within 10.0 miles of a block valve, in Class 2 locations the distance is 7.5 miles, and in Class 3 and 4 locations, the distance is 4.0 and 2.5 miles respectively. Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, MAOP, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas.

If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location above existing design for the pipeline, Cameron Interstate would reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness, if required, to comply with 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. Since December 17, 2004, gas transmission operators are required to develop and follow a written integrity management program that contains all the elements described in 49 CFR 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 (HCA). DOT (68 FR 69778, 69 FR 18228, and 69 FR 29903) defines HCAs as they relate to the different class zones, potential impact circles, or areas containing an identified site as defined in 49 CFR 192.903.

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 require an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate in 49 USC 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high density population area.

The HCA may be defined in one of two ways. In the first method an HCA includes:

- current Class 3 and 4 locations;
- any area in Class 1 or 2 locations where the potential impact radius is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle; or
- any area in Class 1 or 2 locations where the potential impact circle includes an identified site.

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 the HCAs. DOT regulations specify the requirements for the integrity management plan in 49 CFR 192.911.

Table 4.12.8-1 identifies preliminary class locations for the Pipeline Expansion, by milepost, based on the definitions in 49 CFR 192. The majority of the proposed route crosses open land that is sparsely populated, with about 18.5 miles in a Class 1 area, 2.3 miles in a Class 2 area, and 0.1 mile in a Class 3 area. None of the proposed route is in a Class 4 area. Prior to construction of the pipeline, Cameron Interstate would reassess the class locations along the pipeline route and ensure the pipeline is designed and constructed for the current class locations as well as for any anticipated future changes in class locations. Cameron Interstate also would assess the pipeline route for HCAs in accordance with 49 CFR Part 192.761 prior to construction. The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every 7 years.

The minimum standards for operating and maintaining pipeline facilities are prescribed in 49 CFR Part 192, including the requirement to establish a written plan governing these activities. Cameron Interstate would continuously monitor and control its pipeline via computer at the manned gas control center maintained in Houston, Texas. Cameron Interstate also operates a local area office along the proposed pipeline route where qualified, full-time staff are available to provide appropriate emergency response as necessary. The staff is fully trained in safe pipeline operations, hazardous material handling, public liaison programs, maintenance, and normal, abnormal, and emergency procedures.

TABLE 4.12.8-1 Preliminary Area Class Locations for the Pipeline Expansion [a]			
Milepost From	Milepost To	Length (miles)	Location Class
0.0	0.7	0.7	2
0.7	1.1	0.4	1
1.1	1.8	0.7	2
1.8	14.7	13.0	1
14.7	15.8	1.0	2
15.8	17.1	1.4	1
17.1	17.2	0.1	3
17.2	21.0	3.7	1
Miles Class 1		18.5	
Miles Class 2		2.3	
Miles Class 3		0.1	
Total Miles		**21.0**	

[a] The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends.

Cameron Interstate would patrol and inspect its pipeline via aerial or ground vehicles on a periodic basis in accordance with DOT requirements or better. The frequency of these inspections would be affected by activity along the pipeline route, such as construction or possible encroachment. These inspections would identify conditions indicative of pipeline leaks, evidence of pipeline damage or deterioration, damage to erosion controls, loss of cover, third-party activities or conditions which may presently or in the future affect pipeline integrity, safety, or operation of the pipeline. The pipeline system would participate in the state "One Call" program.

Under 49 CFR 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 the following:

- 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 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. Cameron Interstate 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.

Cameron Interstate would expand its current emergency plan to include the Pipeline Expansion.

4.12.8.1 Pipeline Accident Data

The DOT requires all operators of natural gas transmission pipelines to notify the DOT of any significant incidents and to submit a report within 20 days. Significant incidents are defined as any leaks that:

- cause a death or personal injury requiring hospitalization; or
- involve property damage of more than $50,000 in 1984 dollars.[45]

During the 20-year period from 1992 through 2011, a total of 1,197 significant incidents (PHMSA 2012c) were reported on the more than 300,000 total miles of natural gas transmission pipelines nationwide (PHMSA 2012a).

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.8-2 provides a distribution of the causal factors, as well as the number of each incident by cause. The dominant incident cause is corrosion and pipeline material, weld, or equipment failure constituting 45.3 percent of all significant incidents. The pipelines included in the data set in table 4.12.8-2 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline. The frequency of significant incidents is strongly dependent on pipeline age. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process.

[45] $50,000 in 1984 dollars is approximately $110,487 as of January 2012 (Bureau of Labor Statistics 2013).

TABLE 4.12.8-2 Significant Incidents by Cause Natural Gas Transmission Pipelines (1992 through 2011) [a]		
Cause	**Number of Incidents**	**Percent of Total Incidents [b]**
Corrosion	272	22.7
Pipeline Material, Weld, or Equipment Failure	271	22.6
Excavation [c]	207	17.3
Natural Force Damage	147	12.3
Other Outside Forces [d]	63	5.3
Incorrect operation	30	2.5
All Other Causes [e]	207	17.3
Total	**1,197**	**–**

[a] From PHMSA (2012c).
[b] Due to rounding, column may not equal 100 percent.
[c] Includes third-party damage.
[d] Fire, explosion, vehicle damage, previous damage, intentional damage.
[e] Miscellaneous causes or unknown causes.

The use of both an external protective coating and a cathodic protection system (a technique to reduce corrosion [rust] of the natural gas pipeline), required on all pipelines installed after July 1971, significantly reduces the corrosion rate compared to unprotected or partially protected pipe.

Outside forces, including excavations and natural events, are the cause in 34.9 percent of significant pipeline incidents. Table 4.12.8-3 presents information on the outside forces incidents by cause. These mostly 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.

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 pipeline systems 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.

Since 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 (for example, oil pipelines and cable television) to provide pre-construction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts.

TABLE 4.12.8-3 Outside Forces Incidents by Cause (1992-2011) [a]		
Cause	**Number of Incidents**	**Percent of Total Incidents [b]**
Third-party excavation damage	173	14.5
Operator excavation damage	26	2.2
Unspecified equipment damage/Previous damage	8	0.7
Heavy Rain/Floods	70	5.8
Earth Movement	39	3.3
Lightning/Temperature/High Winds	21	1.8
Other/Unspecified Natural Force	17	1.4
Vehicle (not engaged with excavation)	41	3.4
Fire/Explosion	8	0.7
Previous Mechanical Damage	5	0.4
Fishing or Maritime Activity	5	0.4
Intentional Damage	1	0.1
Other/Unspecified Outside Force	3	0.3
Total	**417**	**–**

[a] Data for excavation, other outside forces, and natural force damage are from table 4.12.9-1.

[b] The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends.

4.12.8.2 Impacts on Public Safety

The service incident data summarized in table 4.12.8-2 include pipeline failures of all magnitudes with widely varying consequences.

Table 4.12.8-4 presents the average annual injuries and fatalities that occurred on natural gas transmission lines between 2007 and 2011. The data have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Fatalities for natural gas transmission lines averaged two per year over the 20-year period from 1992 to 2011 (PHMSA 2012c).

The majority of fatalities from pipelines involve local distribution pipelines. These are natural gas pipelines that are not regulated by the FERC and that distribute natural gas to homes and businesses after transportation through interstate natural gas transmission pipelines. In general, these distribution lines are smaller diameter pipes, often made of plastic or cast iron rather than welded steel, and tend to be older pipelines that are more susceptible to damage. In addition, distribution systems do not have large rights-of-way and pipeline markers common to the FERC-regulated natural gas transmission pipelines.

TABLE 4.12.8-4 Annual Average Fatalities Associated With Natural Gas Transmission Pipelines [a]				
Year	**Injuries**		**Fatalities**	
	Employees	**Public**	**Employees**	**Public**
2007	6	1	1	1
2008	3	2	0	0
2009	4	7	0	0
2010	10	51	2	8
2011	1	0	0	0
Total	**24**	**61**	**3**	**9**

[a] From PHMSA (2012b)

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.8-5 in order to provide a relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Furthermore, the fatality rate is more than 25 times lower than the fatalities from natural hazards such as lightning, tornados, floods, and earthquakes.

TABLE 4.12.8-5 Nationwide Accidental Deaths [a]	
Type of Accident	**Annual Number of Deaths**
All Accidents	123,706
Motor Vehicle	43,945
Falls	22,631
Drowning	3,443
Fire, Smoke Inhalation, Burns	3,286
Poisoning	29,846
Floods [b]	93
Tornados [b]	74
Lighting [b]	54
Natural Gas Transmission Pipelines [c]	2

[a] All data, unless otherwise noted, reflect 2007 statistics from U.S. Census Bureau (U.S. Census Bureau 2011).

[b] 30-year average from NOAA (2012).

[c] Data from PHMSA (2012b)

The available data show that natural gas transmission pipelines continue to be a safe, reliable means of energy transportation. From 1992 to 2011, there were an average of 60 significant incidents and 2 fatalities per year. The number of significant incidents over the more than 300,000 miles of natural gas transmission lines indicates the risk is low for an incident at any given location. As described above, the Pipeline Expansion would be constructed and operated in accordance with DOT; therefore we believe that operation of the Pipeline Expansion would be safe and would represent only a slight increase in risk to the nearby public.

4.13 CUMULATIVE IMPACTS

NEPA requires the lead federal agency to consider the potential cumulative impacts of proposals under their review. Cumulative impacts may result when the environmental effects associated with the proposed action are superimposed on or added to impacts associated with past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. Generally, we believe that cumulative impacts could result only from the construction of other projects in the same vicinity and impacting the same resource areas as the proposed facilities. In such a situation, although the impact associated with each project might be minor, the cumulative impact resulting from all projects being constructed in the same general area could be greater.

Our analysis includes other projects in the vicinity of the proposed Project that affect the same resources as the proposed Project in the same approximate time frame. Specifically, actions included in the cumulative impact analysis must:

- impact a resource area potentially affected by the proposed Project;
- cause the impact within all or part of the same area affected by the proposed Project for that resource; and
- cause the impact within all or part of the time span as that of the potential impact from the proposed Project.

Using this approach, the potential for cumulative impacts was assessed by combining the potential environmental impacts of the proposed Project with the impacts of identified projects. The cumulative impact area for each resource is defined in section 4.13.2.

4.13.1 Projects and Activities Considered

There are many existing, under construction, planned, and reasonably foreseeable projects in the vicinity of Cameron's Project. Table 4.13.1-1 lists the substantial projects and activities we considered in this cumulative impact analysis. In addition, agriculture and silviculture activities occur in the Project area.

Descriptions of potential cumulative impacts by resource category are presented in section 4.13.2. In addition to the projects listed in table 4.13.1-1, we considered impacts from past projects in the area, including oil and gas exploration and development projects, and agricultural activities in the vicinity of the proposed Project. Impacts associated with maintenance of existing facilities and permanent rights-of-way near the proposed Pipeline Expansion right-of-way would also contribute to cumulative impacts.

TABLE 4.13.1-1 Activities and Projects Considered in the Cumulative Impact Analysis [a]			
Activity/Project	**Location**	**Description**	**Timeframe**
Existing Facilities and Ongoing and Completed Activities			
Cameron LNG Terminal	Cameron Parish, LA	LNG Terminal	In operation
Sabine Pass LNG Terminal	Cameron Parish, LA	LNG Terminal	In operation
Golden Pass LNG Terminal	Jefferson County, TX	LNG Terminal	In operation
Trunkline Lake Charles LNG Terminal	Calcasieu Parish, LA	LNG Terminal	In operation
Cameron Interstate Pipeline	Cameron, Calcasieu, and Beauregard Parishes, LA	36-mile-long natural gas pipeline and Ragley Compressor Station	In operation
LA Storage Pipeline	Calcasieu and Beauregard Parishes, LA	23.3-mile-long natural gas pipeline collocated largely with existing Cameron Interstate Pipeline	In operation
Targa Pipeline	Cameron Parish, LA	175-mile-long natural gas pipeline extending into Cameron Parish from off-shore locations	In operation
Cheniere Creole Trail Pipeline	Cameron, Calcasieu, Beauregard, Jefferson Davis, Allen, and Acadia Parishes, LA	Portion of 94-mile-long natural gas pipeline extending from Sabine Pass LNG Terminal	In operation
Texas Eastern Transmission Company	Calcasieu and Beauregard Parishes, LA	Portion of 9,200-mile-long natural gas pipeline system extending from the Gulf Coast to the northeastern United States	In operation
Florida Gas Transmission	Calcasieu Parish, LA	5,300-mile-long natural gas pipeline system extending from the Gulf Coast to Florida	In operation
Tennessee Gas Pipeline	Cameron and Calcasieu Parishes, LA	13,900-mile-long natural gas pipeline system extending from the Gulf Coast to the northeastern United States	In operation
Transcontinental Gas Pipe Line	Cameron and Calcasieu Parishes, LA	10,200-mile-long natural gas pipeline system extending from the Gulf Coast to the northeastern United States	In operation
Trunkline Pipeline	Calcasieu and Beauregard Parishes, LA	3,059-mile-long pipeline system extending from the Gulf Coast to the mid-western United States	In operation
ConocoPhillips Pipeline	Calcasieu and Beauregard Parishes, LA	Liquids pipeline extending through Beauregard Parish	In operation
Spectra Energy Pipeline	Calcasieu and Beauregard Parishes, LA	Natural gas pipeline extending through Beauregard Parish	In operation
Entergy Electrical Transmission Line	Calcasieu Parish, LA	Electrical transmission line	In operation

TABLE 4.13.1-1
Activities and Projects Considered in the Cumulative Impact Analysis [a] – Continued

Activity/Project	County or Parish and State	Description	Timeframe
Existing Facilities and Ongoing and Completed Activities			
Louisiana State Highway 27, including bridge over Intracoastal Waterway	Cameron Parish, LA	Two-lane state highway; Main access route to the Cameron LNG Terminal	In operation
Interstate 10 Calcasieu River Bridge Maintenance Project	Cameron Parish, LA	Roadway and bridge maintenance	Maintenance completed 2012
Dredging of West Calcasieu Port	Calcasieu Parish, LA	Removal of 180,000 cubic yards of dredge material for expansion of barge basin	Dredging completed 2012
Dredging Calcasieu Pass Loop and East Fork of Calcasieu Ship Channel	Calcasieu Parish, LA	Removal of about 2.2 million cubic yards of dredge material due to infiltration after Hurricane Rita	Dredging completed in 2011
Sasol North America Chemical Complex	Westlake, LA (Calcasieu Parish)	Seven chemical manufacturing units and related facilities	In operation
Currently Proposed, Under Construction, and Planned, or Reasonably Foreseeable Projects			
Sabine Pass Liquefaction Project	Cameron Parish, LA	Addition of liquefaction and associated facilities to the Sabine Pass LNG Terminal	Under construction: anticipated In-service 2015
Lake Charles Liquefaction Project	Calcasieu and Beauregard Parishes, LA	Addition of liquefaction and associated facilities to the Trunkline LNG Terminal; 3 new pipelines ranging from 0.47 mile to 16.4 miles in length; new 59,840-horsepower compressor station; and upgraded compressor stations	In pre-filing: anticipated in-service in 2018
Golden Pass Liquefaction Project	Jefferson County, TX	Addition of liquefaction and associated facilities to the Golden Pass LNG Terminal	In pre-filing: anticipated in-service in 2019
Magnolia LNG Export Terminal	Calcasieu Parish, LA	Planned LNG export terminal	In pre-filing: scheduled completion October 2017
Gasfin LNG Export Terminal	Cameron Parish, LA	Planned LNG export terminal	In preliminary planning stage, no schedule announced
Waller Point LNG Export Terminal	Cameron Parish, LA	Planned LNG export terminal	In preliminary planning stage, no schedule announced

TABLE 4.13.1-1 Activities and Projects Considered in the Cumulative Impact Analysis [a] – Continued			
Activity/Project	**County or Parish and State**	**Description**	**Timeframe**
Natural Gas Liquids Pipeline	Cameron Parish, LA	Portion of 4.5-mile-long, 6-inch-diameter non-jurisdictional pipeline outside of the Terminal Expansion site, extending southwest from the site boundary to a storage/transfer facility (as an option to NGL transport by truck; see section 1.4)	Application filed: no schedule announced; if constructed, likely during 2014 or later
NGL Transport by Truck from Expanded Terminal	Cameron and Calcasieu Parishes, LA	Non-jurisdictional truck traffic outside of the expanded terminal, transporting NGL from the site (as an option to the NGL Pipeline; see Section 1.4)	If used, startup at beginning of operation of the Project in 2017.
Creole Trail Pipeline Gillis Compressor Station	Calcasieu Parish, LA	53,125 horsepower compressor station about 12.5 miles from proposed Holbrook Compressor Station	Construction began in fourth quarter 2013
Lake Charles Clean Energy (LCCE) Gasification Project	Lake Charles, LA	Cogeneration facility that would convert petroleum coke to methanol	Application filed: scheduled completion 2017
Lake Charles Carbon Capture and Sequestration Project	Lake Charles, LA	Facility to capture, purify carbon dioxide (CO_2) from the LCCE Gasification Project, and transport it in a 12-mile-long, 16-inch-diameter pipeline from the facility to the existing Green Pipeline for enhanced oil recovery in Texas	Application filed: scheduled completion 2017
Beauregard Electric Transmission Line	Calcasieu Parish, LA	3.5-mile-long electrical distribution line to provide power to the proposed Holbrook Compressor Station	Planned completion 2015 or 2016
Entergy 230-kV Electrical Transmission Line	Cameron and Calcasieu Parishes, LA	12-mile-long electrical transmission line to provide power to the proposed Terminal Expansion	In preliminary planning stage, no schedule announced; will be concurrent with construction of Terminal Expansion if approved.
Liberty Gas Storage Project	Cameron Parish, LA	Natural Gas Storage facility, including 5.5-mile-long pipeline to the existing Cameron Interstate Pipeline and compressor station.	Construction planned to begin in early 2015
COE Maintenance Dredging of Calcasieu River	Cameron and Calcasieu Parishes, LA	Dredging along 68-mile-long Calcasieu River navigation channel	Ongoing (biannual)

TABLE 4.13.1-1 Activities and Projects Considered in the Cumulative Impact Analysis [a] – Continued			
Activity/Project	**County or Parish and State**	**Description**	**Timeframe**
Golden Nugget	Lake Charles, LA	Riverboat/Dockside casino	Under construction, opening planned for the third quarter of 2014
IFG Port Holdings Export Grain Terminal	Calcasieu Parish, LA	Replacement/upgrade of existing grain export terminal	Under construction, opening planned for 2014
Sasol North America Ethane Cracker	Westlake, LA (Calcasieu Parish)	The facility will convert ethane contained in natural gas to ethylene	Construction from 2014 through 2017
Sasol North America Gas-to-Liquids Plant	Westlake, LA (Calcasieu Parish)	The plant will convert natural gas into liquid fuels and chemicals	Construction from 2016 through 2020
G2X Energy	Lake Charles, LA	Natural gas-to-gasoline facility	Construction to begin early 2014 pending permit approval, opening planned for 2017
AAR	Lake Charles, LA	Aircraft Maintenance, Repair and Overhaul facility at Chennault International Airport	Under construction, opening planned for 2017

[a] This table is not intended to provide an all-inclusive listing of projects; however, it does list those projects that are most likely to contribute to the cumulative impacts within the vicinity of the proposed Project.

4.13.1.1 Existing LNG Terminals and Future LNG Liquefaction Projects

We identified four existing LNG import terminals and three planned[46] liquefaction and export projects in the general vicinity of the proposed Project that could contribute to cumulative impacts with those of the proposed Terminal Expansion. The four existing terminals are the Cameron, Lake Charles, Sabine Pass, and Golden Pass LNG Terminals (see figure 3.3-1). Each of these facilities also has planned/proposed liquefaction projects as well. The planned liquefaction and export projects are the Magnolia LNG, Waller Point, and Gasfin Projects (see figure 3.3-1). Brief descriptions of each of the LNG projects are provided below. This cumulative impacts analysis considered the impacts of operation of the existing terminals as well as the potential construction and operational impacts of the planned or proposed liquefaction projects.

[46] Proposed LNG projects are projects for which the proponent has submitted a formal application with the FERC; planned LNG projects are projects that are either in pre-filing at the FERC or have been announced, but have not initiated the pre-filing process.

Cameron LNG Terminal

As described in further detail throughout this EIS, the existing Cameron LNG Terminal is adjacent to the proposed Terminal Expansion site. The impacts of operation of the LNG terminal – which include the impacts associated with berthing, loading or unloading of up to two LNG tankers simultaneously, vaporization and associated activities, and the use of three LNG storage tanks (see section 2.1.1 for additional information on facilities at the existing Cameron LNG Terminal) – are considered in this cumulative impacts analysis, along with the impacts of the other proposed and planned projects.

Lake Charles LNG Terminal

The existing Lake Charles LNG Terminal is in Cameron Parish, approximately 6 miles straight-line distance north-northeast of the proposed Terminal Expansion (see figure 3.3-1). The planned Lake Charles Liquefaction Project would be adjacent to that site and would include the addition of three liquefaction trains and associated facilities. The Lake Charles Liquefaction Project is in the pre-filing review process.[47] Section 3.1.1.1 provides additional information on the Lake Charles LNG Terminal.

Magnolia LNG Project

Magnolia LNG announced its planned stand-alone LNG export terminal at the Port of Lake Charles. Magnolia LNG would construct its facility in Calcasieu Parish, approximately 5.5 miles straight-line distance northeast of the Terminal Expansion, at the port's Industrial Canal, off the Calcasieu Ship Channel and across from the Lake Charles LNG Terminal (see figure 3.3-1). Magnolia LNG is in the FERC pre-filing process.[48] Magnolia plans to begin construction in the first quarter of 2015 and start commercial operations in October 2017. Section 3.1.1.2 provides additional information on the Magnolia LNG Terminal.

Gasfin LNG Project

Gasfin Development USA, LLC (Gasfin) announced its plan for a stand-alone liquefaction project in Cameron Parish. The Gasfin LNG Project would be constructed approximately 16 miles south of the Terminal Expansion, on the east side of the Calcasieu Ship Channel (see figure 3.3-1). The project is in the initial development phase and an anticipated schedule has not been released.

Waller Point LNG Project

Waller Point LNG also announced a planned stand-alone LNG export terminal in Cameron Parish. The Waller Point LNG Project would be constructed about 17 miles south of the Terminal Expansion on the western shore of the entrance to the Calcasieu Ship Channel. The project is in the initial development phase and Waller Point LNG has not announced a planned schedule.

---

[47] Docket No. PF12-8.
[48] Docket No. PF13-9.

Sabine Pass LNG Terminal

The Sabine Pass LNG Terminal is in Cameron Parish, approximately 38 miles southwest of the proposed Terminal Expansion, near the Texas/Louisiana border. The Sabine Pass Liquefaction Project was authorized by the Commission in April 2012 and is currently under construction, with an anticipated in-service date in 2015.[49] The initial phase of the project will include two liquefaction trains with further expansion of up to two additional trains based on customer interest. Due to the distance of this facility from the proposed Project, we do not believe the impacts would have a cumulative effect on any resources in the Project area, including air quality impacts as discussed in section 4.13.2.11.

Golden Pass LNG Terminal

The Golden Pass LNG Terminal is in Jefferson County, Texas, approximately 40 miles southwest of the proposed terminal. The planned liquefaction project at the existing terminal was in the pre-filing stage at the time this EIS was prepared.[50] Due to the distance of this facility from the proposed Project, we do not believe the impacts would have a cumulative effect on any resources in the Project area, including air quality impacts as discussed in section 4.13.2.11.

4.13.1.2 Currently Operating Oil and Gas Facilities

There are oil and gas wells in the vicinity of the proposed Terminal Expansion site, particularly in the West Hackberry Oilfield, which is generally west of the Terminal Expansion site. In addition, there are many oil and gas gathering and transmission pipelines and related facilities. Those facilities are in place and generally would not contribute to the cumulative impacts associated with construction of the expanded terminal; however, the operation of the wells permanently removed both wetlands and vegetation. There are no major storage or processing facilities in the vicinity.

The Pipeline Expansion route would be parallel and adjacent to or overlap portions of other rights-of-way, including those of the existing Cameron Interstate, LA Storage, Cheniere Creole Trail, Spectra Energy, ConocoPhillips, and Targa pipelines; and the planned Entergy Electrical Transmission Line. The Pipeline Expansion would connect to the existing FGT, Tennessee Gas, TETCO, Transco, and Trunkline Pipelines. These pipelines have been in service for a number of years and the only impacts relating to the cumulative impact analysis include maintenance of the permanent rights-of-way in the vicinity of the interconnections and emissions from compressor stations associated with the pipelines.

4.13.1.3 Future Oil and Gas Facilities

Leucadia Energy Projects

Leucadia Energy, LLC (Leucadia) has proposed to construct the Lake Charles Carbon Capture and Sequestration (CCS) Project in Lake Charles (Calcasieu Parish), approximately 11 miles straight-line distance north-northeast of the proposed terminal site. The Lake Charles CCS

---

[49] Docket No. CP11-72.
[50] Docket No. PF13-14.

Project would involve the capture and sequestration of CO_2 from Leucadia's Lake Charles Clean Energy (LCCE) Gasification Project, a proposed petroleum coke gasification plant at the Port of Lake Charles. The LCCE Gasification Project would convert petroleum coke into syngas to produce methanol, hydrogen gas, and sulfuric acid, as well as CO_2. The LCCE Gasification Project is sited on approximately 70 acres of previously undeveloped land on the west bank of the Calcasieu River.

As part of the Lake Charles CCS Project, Leucadia would construct about 12 miles of 16-inch-diameter CO_2 pipeline and associated ancillary equipment to connect to the existing Green Pipeline in the vicinity of Buhler, Louisiana. The interconnection with the Green Pipeline would be about 1.4 miles southeast of MP 4.9 of Cameron Interstate's Pipeline Expansion route. In its draft EIS for the Lake Charles CCS Project, DOE (2013) stated that the CO_2 pipeline route would parallel existing linear rights-of-way to the extent possible and cross under the Houston River and I-10. The pipeline's Houston River crossing would be about 10 river miles downstream of Cameron Interstate's proposed Houston River crossing and would be accomplished using the HDD method.

DOE (2013) stated that the Lake Charles CCS Project and the LCCE Gasification Project would be constructed concurrently, with construction planned to begin in the fourth quarter of 2013, and operation to begin approximately 40 months later (early 2017).

Non-Jurisdictional Condensate Transport Projects

As discussed in section 1.4, Cameron LNG identified a potential 4-mile-long, 6-inch-diameter pipeline that would transport stabilized condensate, produced as a by-product of the liquefaction process, to a storage and transport facility. The pipeline would extend from the expanded terminal to Targa NGL storage facility near Hackberry. The planned route extends generally west-southwest from the Terminal Expansion site, through an area consisting of about 75 percent shallow open water and 25 percent broken marsh wetland. If the condensate pipeline is approved and constructed, construction would likely occur between 2015 and mid-2017, to allow operation when the first liquefaction train of the expanded terminal is planned to be in operation.

Even if the NGL pipeline is constructed, trucks may also be used to transport condensate from the truck loading/unloading facility at the expanded terminal. Tanker truck shipping of the condensate is considered a non-jurisdictional activity and is included in this cumulative impact analysis (see section 1.4). If used to transport condensate, tanker trucks would load condensate for delivery to the market place using public roads, primarily LA-27 and I-10. This traffic would not begin earlier than when the expanded terminal is operational in 2017. Tanker truck transport of LNG must comply with DOT requirements for the transportation of hazardous materials. The distance from the Terminal Expansion site to I-10 is about 15 miles.

Liberty Gas Storage Expansion Project

The Liberty Gas Storage Expansion Project received its FERC Certificate in June 2009. The Order granting the Certificate was issued to Liberty Gas Storage, LLC and was transferred to LA Storage, LLC. The project site is on an approximately 159.5-acre parcel on the southern shore of Black Lake in Cameron Parish, about 5.3 miles southwest of the proposed Terminal

Expansion site. LA Storage will convert three existing salt dome (brine-storage) caverns for natural gas storage, develop one new salt dome cavern for natural gas storage, and construct and operate one 18,940-horsepower compressor station and associated facilities.

LA Storage will also construct and operate a 5.1-mile-long, 36-inch-diameter, bi-directional natural gas pipeline connecting the storage facility to the Cameron Interstate Pipeline west of the Terminal Expansion site. The pipeline will extend across Black Lake and its associated wetlands to the interconnection with the Cameron Interstate Pipeline near the shoreline of Black Lake and the Gulf Intracoastal Waterway. The shortest distance between the pipeline and the Terminal Expansion site is about 1.8 miles. The project will also include an approximately 4-mile-long, 16-inch-diameter, brine disposal pipeline that will connect to the brine facilities on the Liberty Project site to saltwater disposal wells sited southeast of the storage site. LA Storage will begin construction in 2015, and plans to complete construction prior to startup of the liquefaction facilities at the expanded terminal.

G2X Energy Natural Gas-to-Gasoline Plant

G2X Energy plans to construct a Natural Gas-to-Gasoline Plant along the industrial canal of the Port of Lake Charles on a 200-acre site owned by the Lake Charles Harbor & Terminal District. The facility would produce a total of 12,500 barrels per day of product (90 percent gasoline). The project would include a berthing facility, and product from the project will be shipped to customers by marine vessels or by pipeline. The site is about 5 miles north-northeast of the Terminal Expansion. Pending approval of its permits, G2X Energy expects to begin construction of the facility in 2014, with completion planned for 2017.

Sasol North America Projects

Sasol North America (Sasol) operates a chemical complex in Westlake, Louisiana, just northwest of Lake Charles and the City of Lake Charles. The complex includes seven manufacturing units situated on approximately 400 acres. In late 2013, Sasol completed construction of the world's first commercial ethylene tetramerization unit at the complex. The plant is in operation and can produce more than 100,000 metric tons per year of combined 1-octene and 1-hexene.

Sasol announced plans to construct and operate an Ethane Cracker at the complex. The cracker will convert ethane contained in natural gas to ethylene, with a planned production rate of 1.5 million tons of ethylene per year. Construction would take place from late 2014through 2017, when project startup is anticipated. Sasol also announced plans to construct and operate a Natural Gas-to-Liquids Plant at the complex. The plant will produce more than 96,000 barrels per day of liquid fuels and chemicals. Construction is expected to begin in 2016 and continue for 4 years. The plant is expected to be in full operation in 2020.

Sasol stated that the two projects would have a peak construction workforce of 7,000 and a permanent workforce of 1,200.

4.13.1.4 Land Transportation Projects

The primary roadways in the vicinity of the proposed Project are LA-27 and I-10. According to representatives of Cameron, Calcasieu, and Beauregard Parishes, there are no new roadways planned in the foreseeable future, and the only roadway projects likely to occur are maintenance projects, including resurfacing. As a result, land transportation projects are not further considered.

4.13.1.5 Other Projects and Activities Considered

IFG Port Holdings, LLC Export Grain Terminal Expansion

IFG Port Holdings, LLC's export grain terminal at the Port of Lake Charles is about 13 miles upriver from the Terminal Expansion site. The grain terminal is currently undergoing an extensive expansion and renovation while continuing to operate. The facility will handle agricultural products such as rice, wheat, corn, soybeans, and dried distillers' grain for shipment to other countries. Construction began in 2012 and is expected to be completed in early 2014.

Ameristar Casinos/Golden Nugget Casino and Hotel

Ameristar Casinos, Inc. began construction of a dockside casino and hotel on Lake Charles with an 18-hole golf course and other sport facilities in 2012. In July 2013, Ameristar Casinos, Inc. announced the project would be sold to Golden Nugget. Construction of the facilities is expected to be completed by the end of 2014. The resort would be about 12 miles straight-line distance north-northeast of the Terminal Expansion site on a 242-acre site adjacent to the L'Auberge Lake Charles Casino Resort.

Chennault International Airport Expansion

AAR is opening an aircraft maintenance, repair, and overhaul facility at an existing hangar at the Chennault International Airport in Lake Charles, Louisiana and is currently constructing an additional 118,000 square feet of new hangar space. The airport is about 16 miles northeast of the Terminal Expansion. Construction is expected to be completed in 2017.

Dredging Projects

Several dredging projects near the Cameron LNG Terminal have been completed and several others are planned or associated with the construction of planned projects such as the Lake Charles CCS Project and the expanded IFG Port Holdings export grain terminal. In addition, every 2 years the COE conducts maintenance dredging in the portion of the Calcasieu Ship Channel adjacent to the terminal site, and Cameron LNG attempts to conduct concurrent periodic dredging of its LNG carrier berths at the existing Cameron LNG Terminal.

Non-Jurisdictional Electrical Lines

As discussed in section 1.4, a non-jurisdictional electrical distribution line is necessary to provide electrical power to the proposed Holbrook Compressor Station. Beauregard Electric would build the approximately 3.5-mile-long distribution line that would extend from a tie-in with an existing Beauregard Electric 230-kV electrical transmission line for the sole use of the proposed Holbrook Compressor Station. See section 1.4.4 for a description of the planned route. If Cameron Interstate receives a Certificate for the Pipeline Expansion, the distribution line would likely be constructed during 2015 and 2016, concurrent with construction of the pipeline and Holbrook Compressor Station.

To provide electrical power to the Terminal Expansion, Entergy would build an approximately 12-mile-long, double-circuit, 230-kV electrical transmission line in Calcasieu and Cameron Parishes (Entergy transmission line) and a new switch yard to replace the existing switch yard at the terminal. As described in section 1.4, this is a non-jurisdictional project which Entergy would construct and operate for the sole use of the proposed Terminal Expansion. See section 1.4.4 for a description of the planned facilities

It is likely that Entergy would construct the transmission facilities while the first liquefaction train is under construction to provide power for the planned startup of the expanded terminal in 2017.

4.13.2 Potential Cumulative Impacts by Resource

The following sections address the potential cumulative impacts from Cameron's Project and those of projects identified within the cumulative impact area defined for each resource. In the analysis below, the reference to "the Lake Charles projects" refers to the Lake Charles LNG Project, the Magnolia LNG Project, the Leucadia Projects, the IFG Port Holdings Export Terminal Expansion, the Ameristar Casinos/Golden Nugget Casino and Hotel, the Chennault International Airport Expansion, the Sasol Projects, and the G2X Energy Natural Gas-to-Gasoline Plant.

4.13.2.1 Geologic Conditions

The cumulative impact area for geologic resources and hazards was considered to be the area adjacent to proposed construction areas for the Terminal Expansion and the Pipeline Expansion.

At the proposed Terminal Expansion site, Cameron LNG would modify the existing topographic contours to accommodate its equipment and facilities and maintain adequate drainage from the site. This would result in contours similar to those of the adjacent existing Cameron LNG Terminal and would not differ substantially from the existing topography. The only projects in the cumulative impacts area for geologic conditions of the Terminal Expansion, other than the existing LNG Terminal, would be portions of the non-jurisdictional NGL pipeline and the Entergy transmission line near the site. Neither project is expected to result in noticeable changes in topography. The small change in topography at the proposed terminal site combined with the changes that resulted from these other projects would not result in significant cumulative impacts on geologic conditions.

Construction and operation of the Pipeline Expansion would occur largely within previously disturbed areas, and Cameron Interstate does not anticipate any blasting along the right-of-way. The Pipeline Expansion would have minimal impacts on geological resources because Cameron Interstate would restore topographic contours along the right-of-way to preconstruction conditions to the extent practicable. These contours would tie-in to the existing easements that Cameron Interstate would parallel. The non-jurisdictional electric distribution line is the only other project in the geologic cumulative impact area of the Pipeline Expansion. That project would not result in changes of topography. Therefore, the cumulative impact of the Pipeline Expansion on geologic resources would be minor.

In addition, the proposed Project would not have an impact on marketable mineral resources and therefore would not contribute to cumulative impacts on those resources.

4.13.2.2 Soils

The cumulative impact area for soils was considered to be the area adjacent to the proposed construction areas for the Terminal Expansion and the Pipeline Expansion. Past impacts on soils resources in the vicinity of the proposed Project have resulted from agricultural and commercial forestry processes and construction and maintenance of existing roads, railroads, natural gas and oil pipelines, utility lines, and electrical transmission line rights-of-way. Clearing and grading associated with construction of the Terminal Expansion and the Pipeline Expansion could result in soil loss due to erosion, which could reduce soil fertility and impair revegetation. However, Cameron would implement Project-specific mitigation plans and procedures to minimize erosion as a result of water and wind and aid in the reestablishment of vegetation after construction. In addition, Cameron Interstate would construct about 74 percent of its Pipeline Expansion adjacent to and overlapping existing rights-of-way, minimizing impacts on previously undisturbed areas to the extent practicable.

A portion of the planned non-jurisdictional NGL pipeline would be constructed adjacent to the proposed terminal site, primarily through wetlands and coastal marsh, as would a portion of the Entergy transmission line. The Beauregard Electric transmission line would be parallel and adjacent to the pipeline construction right-of-way. The construction procedures of these projects would include measures to minimize soil erosion and restore the construction right-of-way soon after construction is complete. As a result, those projects in combination with the proposed Project would not contribute significantly to a cumulative impact on soils.

4.13.2.3 Water Resources

The cumulative impact area established for groundwater resources was limited to the aquifers from which the proposed Project would withdraw water. The cumulative impact area associated with surface water resources extends about two miles upstream and downstream of (1) the Terminal Expansion site boundaries, and (2) the pipeline stream crossings. This distance was selected as the distance within which suspended sediments would be expected to settle out from the water column and be re-deposited, and is considered a conservative estimate based on the relatively low flow rates of the affected waterbodies. Very few, if any, of the barges used for construction of the proposed Project would have ballast systems, and Cameron LNG did not request an increase in the number of LNG carriers currently authorized to use the existing terminal. Therefore, we believe that the proposed Project would not contribute to cumulative impacts associated with ballast water discharge in the Calcasieu Channel or Gulf Intracoastal Waterway.

Cameron LNG would obtain water for construction of the Terminal Expansion from an existing onsite well, including water required for hydrostatic testing of the new LNG storage tank and facility piping. This would require about 30 million gallons, obtained at a rate of about 1,280 gpm over a period of about 5 weeks. The existing well draws from the Chicot Aquifer, which is also a source of water for public water supply, industry, irrigation, and other users. The nearest offsite well drawing from that aquifer is more than 150 feet from the site. Use of the well during construction of the Terminal Expansion would have a temporary and minor impact on the aquifer and would end after water withdrawal for hydrostatic testing is complete. As a result, the cumulative impact of use of this water during construction along with other withdrawals would not be significant.

During operation, the proposed Project would use substantially less water than during construction, with water obtained from the City of Hackberry municipal supply. In addition, there are no other projects listed in table 4.13.1-1 that would require the use of large amounts of water from the Hackberry municipal water supply system. As a result, there would not be significant cumulative impacts on the municipal water system.

Construction of the proposed work dock would include dredging about 205,000 cubic yards of material from 9.4 acres adjacent to the shoreline. Cameron LNG would place the dredged material in its approved beneficial use area at an elevation sufficient to create tidal marsh. Cameron LNG would also conduct maintenance dredging at the work dock during operation of the Project. Impacts associated with dredging would be minor and temporary due to the methods used to minimize sediment suspension in the water column, the high ambient levels of turbidity in the channel, and the relatively rapid deposit of the suspended sediments.

Dredging projects and projects listed in table 4.13.1-1 that potentially require dredging include the previously completed Cameron Loop and East Fork dredging, the water-related projects in the Lake Charles area, the Gasfin and Waller Point Projects, maintenance in the channel by the COE, and maintenance of the berthing area of the existing Cameron LNG Terminal. However, all but the latter two projects are outside of the cumulative impact area for the proposed Project because dredge sediments would likely drop out before reaching a point about 2 miles from the terminal due primarily to the relatively low flow of the channel. Therefore, these facilities were not included in the cumulative impact analysis for water resources.

The COE conducts maintenance dredging of the channel every 2 years, including dredging in the vicinity of the proposed work dock. Impacts associated with that dredging are minor and temporary for the same reasons as described above for dredging of the work dock. Similarly, Cameron LNG conducts periodic maintenance dredging at the LNG carrier berths that are adjacent to the channel and the proposed work dock. The impacts of that dredging are also minor and temporary, as described in our previous EIS and 2006 EA for the existing terminal.[51] Cameron LNG intends to conduct maintenance dredging of the berthing area and the work dock at the same time as the COE maintenance dredging of the channel. If those dredging activities occur at the same time, there would be a cumulative impact that would cause temporary and minor impacts on water quality of the channel. Because water quality would return to pre-dredging conditions shortly after dredging is completed, we do not believe this cumulative impact would be significant.

[51] Hackberry EIS (Docket No. CP02-374) and Cameron LNG Terminal Expansion EA (Docket No. CP06-422).

We are not aware of any other substantial construction projects within the cumulative impact area for surface water runoff. As a result, there would not be a significant cumulative impact on surface water due to construction and operation of the Terminal Expansion.

Shoreline erosion is a concern along the Gulf Intracoastal Waterway and the Calcasieu Ship Cannel. Erosion may be caused by ship traffic or by engineered structures, such as levees along beaches or rivers. Natural processes, such as tide-induced currents, sea level changes, wind waves, and hurricanes or other extreme storms, also contribute to shoreline erosion.

There would likely be several years of concurrent construction and associated barge traffic for the proposed Terminal Expansion and the Lake Charles and Magnolia LNG Liquefaction Projects, assuming all receive the necessary authorizations and permits. In addition, construction of the Lake Charles projects would likely require barges to deliver equipment and materials to the construction sites and may overlap with construction of the proposed Project for several years. All of the above projects would also likely increase barge traffic in the Gulf Intracoastal Waterway between Port Arthur and the confluence of the waterway and the Calcasieu Ship Channel, and in the channel between its confluence with the waterway up to the Port of Port Charles. The Gasfin and Waller Point Projects at the south end of the channel would also likely use barges during construction, and it is likely that many of the barges for those projects would transport equipment and materials from Port Arthur to the construction sites via the Gulf of Mexico and the southern end of the Calcasieu Ship Channel. If there is barge traffic along the Gulf Intracoastal Waterway and the channel to the Gasfin and Waller Point construction sites, they would also contribute to cumulative impacts on shoreline erosion.

Construction of the Terminal Expansion would increase barge traffic on the waterway and the channel between Port Arthur and the work dock. The primary increase in barge traffic during construction of the Terminal Expansion would occur during the first 14 months of construction and would decrease from a high of about 9 barges per day up through month 7 of construction, to about 4 barges per day in months 11 through 14, then 1 barge every 3 days through the end of construction. If the Terminal Expansion and other projects discussed above were constructed during the same time period, there could be a substantial increase in barge traffic. The additional barge traffic could create shoreline erosion, but it is not expected to be significant.

Cameron LNG has not proposed to increase LNG carrier traffic beyond that previously authorized and would therefore not contribute to cumulative impacts beyond those previously assessed. Impacts associated with LNG carrier traffic were addressed in the previous FERC environmental reviews.[52]

The Pipeline Expansion would require 29 waterbody crossings. Impacts on water quality due to open-cut waterbody crossings can include sedimentation and turbidity, alteration or removal of in-stream and stream bank cover, and introduction of water pollutants from inadvertent equipment spills or leaks, or entrainment of small organisms during hydrostatic testing. However, the short duration of pipeline construction through waterbodies would

[52] Hackberry EIS (Docket No. CP02-374), Cameron LNG Terminal Expansion EA (Docket No. CP06-422) and Environmental Assessment, Cameron LNG Export Project (Docket No. CP10-496).

generally result in temporary impacts on the water quality and flow. Cameron Interstate's Plan would limit vegetation maintenance within a 25-foot-wide riparian strip and includes erosion control measures to avoid or reduce runoff from construction activities. The use of the HDD crossing method would avoid direct impacts on nine waterbodies, including all major waterbodies. Although impacts on surface waters could occur during the HDD installation process (e.g., through an inadvertent release of drilling fluid), Cameron Interstate would reduce the likelihood and potential damage associated with such events by the implementation of its HDD Contingency Plan.

Although runoff from construction activities near waterbodies upstream or downstream of the proposed construction right-of-way could also result in impacts, we are not aware of any substantial construction projects that would affect surface water quality within two miles of Cameron Interstate's proposed waterbody crossings. Previously constructed pipeline crossings may have created changes in stream flow and channel configuration, although there is no evidence indicating any such changes have resulted in substantial alterations to the channels. As a result, the cumulative impact on surface water resources due to runoff and open-cut waterbody crossings would be minor.

We did not identify any other projects that would contribute to the cumulative impacts from hydrostatic test water withdrawal and discharge on water resources in the cumulative impact area for the Pipeline Expansion. Therefore, we believe the cumulative impacts due to the Pipeline Expansion's withdrawal and discharge of hydrostatic test water would be temporary and minor.

4.13.2.4 Wetlands

The cumulative impact area for wetlands was considered to be the area adjacent to the proposed Project construction areas.

Construction of the Terminal Expansion would result in the loss of wetlands on the proposed terminal site. However, compensatory mitigation for wetland loss would be required by the COE, the LDNR Office of Coastal Management, and LDEQ that would result in no net loss of wetland function and could improve regional coastal marsh resources. Cameron LNG proposed to create tidal fresh/intermediate marsh wetland west of the Project at a ratio of 1.3 acres for each acre of COE-jurisdictional wetland impacted by the proposed Terminal Expansion. This would create about 129 acres of marsh habitat using dredged materials from construction of the work dock. Although the non-jurisdictional NGL pipeline would be near the Terminal Expansion site and extend through wetlands and coastal marsh, LA-27 is between the proposed terminal site and those wetlands. The planned NGL pipeline route would extend through areas consisting of about 75 percent shallow open water and 25 percent broken marsh wetland. Construction of the NGL pipeline would temporarily impact about 23 acres of marsh wetlands, which we would expect to reestablish within one growing season. The marsh areas would not be maintained by mowing, and the impacts due to establishment of a permanent right-of-way would be minor. As a result, construction and operation of the NGL pipeline would have a minor, temporary impact on wetlands. The proponent would have to obtain a Section 404 Permit from the COE and a CUP from the LEDQ which may require compensatory mitigation if there is a loss of wetlands.

A portion of the non-jurisdictional Entergy transmission line would extend along the west side of LA-27 in the vicinity of the Terminal Expansion site. Construction of the transmission line, including pole placement and stringing along portions of the 150-foot-wide right-of-way would result in a minor and short-term impact on approximately 91 acres of existing emergent wetland vegetation communities and habitat structure. Permanent impacts would occur along the right-of-way on approximately 20 acres of forested wetlands that Entergy would permanently convert to an emergent or scrub/shrub state. Entergy must obtain a Section 404 Permit from the COE and a CUP from the LEDQ which may require compensatory mitigation for the conversion of wetlands.

Due to the isolated nature of impacts on wetlands, which would be on the opposite side of LA-27 from the Terminal Expansion for the NGL pipeline and the Entergy transmission line, and proposed mitigation, we do not anticipate that construction and operation of the Terminal Expansion in combination with the NGL pipeline and Entergy transmission line would result in a significant cumulative impact on wetlands.

Past impacts on wetland resources in the vicinity of the proposed Pipeline Expansion route have resulted from agricultural and commercial forestry processes and construction and maintenance of existing roads, railroads, natural gas and oil pipelines, utility lines, and electrical transmission line rights-of-way. Construction of the proposed pipeline would result in the loss of some wetlands, including forested wetlands. To mitigate the permanent loss of those wetlands along the proposed pipeline right-of-way, Cameron Interstate would purchase mitigation credits from a COE-approved mitigation bank; details regarding the number and type(s) of credits would be decided by the COE upon review of the Cameron Interstate Section 404 Permit application. Because Cameron Interstate would compensate for wetland impacts, construction of the Pipeline Expansion would not contribute to a cumulative loss of wetlands. The only other project in the cumulative impact area for the Pipeline Expansion that has not yet been constructed is the electrical distribution line for the Holbrook Compressor Station. This project may temporarily impact wetlands during construction. In addition, if wetlands cannot be avoided during placement of the power poles, there could be minimal permanent impact on wetlands that may also require mitigation.

Cumulative impacts on wetlands during project operation would occur where the Pipeline Expansion is collocated with the permanent rights-of-way of other pipelines crossing the same wetland, and the wetlands are maintained by periodic mowing and tree removal. However, these wetlands were previously disturbed during construction of the other pipelines, and the impacts were likely mitigated in accordance with COE and LDNR requirements during or shortly after construction. Most wetlands would be maintained in an herbaceous state; therefore, the primary cumulative impact would be conversion rather than a loss of wetland acreage, and when added to compensatory mitigation, we believe the cumulative impact on wetlands would not be significant.

4.13.2.5 Vegetation and Wildlife

The cumulative impact area for vegetation and wildlife was considered to be the area adjacent to and near the proposed Project construction areas.

The existing Cameron LNG Terminal is adjacent to the proposed Terminal Expansion site. Construction and operation of the existing terminal resulted in the loss of all vegetation (about 116 acres) and wildlife habitat on that site, as did construction and operation of adjacent LA-27. Construction of the Terminal Expansion would remove 371.9 acres of vegetation from the Terminal Expansion site north of the existing terminal, and 52.9 acres of vegetation from the existing terminal, a total of 424.7 acres. The affected vegetative communities have low species diversity and are not productive as agricultural land, grazing land, or high-quality wildlife habitat. Therefore, we believe the cumulative impact on wildlife would not be significant.

Cameron LNG proposes to create tidal fresh/intermediate marsh wetland habitat adjacent to the Project (west of LA-27) as compensatory mitigation at a ratio of 1.3 acres for each acre of COE-jurisdictional wetland impacted by the proposed terminal expansion. A total of about 129 acres of marsh habitat would be created using dredge spoil from construction of the work dock. The mitigation area would be adjacent to 220 acres of marsh habitat created during construction of the existing Cameron LNG Terminal, thus contributing to a larger area of contiguous marsh habitat and would be beneficial to wildlife. Created marsh habitat would vegetate naturally and be monitored for quality and functionality for a period of 20 years. In addition to the proposed marsh creation area, Cameron LNG proposes to create another marsh area for beneficial use of maintenance dredge material as part of its current CUP.

Although the northern portion of the non-jurisdictional NGL pipeline would be installed near the proposed terminal site, construction of the pipeline would likely affect only wetlands that would reestablish relatively quickly (see section 1.4). The non-jurisdictional Entergy transmission line would affect vegetation along the west side of LA-27 in the vicinity of the Terminal Expansion site. Vegetation clearing for construction along the 150-foot-wide right-of-way would result in a minor and short-term impact on wetlands as discussed above. Pole placement could result in a minor, permanent impact on wetlands.

It is anticipated that Entergy would implement best management practices during construction to minimize impacts on wetlands. Due to these best management practices and Cameron LNG's proposed wetland mitigation, we do not believe there would be a significant cumulative impact on vegetation and wildlife.

Past impacts on vegetation in the vicinity of the proposed Pipeline Expansion route have resulted from agricultural and commercial forestry processes and construction and maintenance of existing roads, railroads, natural gas and oil pipelines, utility lines, and electrical transmission line rights-of-way. Clearing and grading of the Cameron Interstate Pipeline Expansion would result in the removal of vegetation, alteration of wildlife habitat, and displacement of wildlife. The proposed route is adjacent and parallel to existing rights-of-way, and construction would increase the width along a portion of that corridor. The proposed Pipeline Expansion would not create an additional corridor or cause additional fragmentation. Most of the temporary construction rights-of-way and ATWS areas adjacent to the proposed route were allowed to revegetate to a vegetative state similar to pre-construction conditions, including forested areas. During construction, mobile wildlife species would relocate to adjacent habitats and we expect most displaced individuals would return to the habitats of the Pipeline Expansion right-of-way after restoration.

The Lake Charles CCS Project includes a CO_2 pipeline that would extend northwest of that facility. However, the terminus of the pipeline would be its interconnection with the existing Denbury Green Pipeline, about 1.4 miles southeast of the proposed Pipeline Expansion route and would not be within the cumulative impact area for vegetation and wildlife. The only new project in table 4.13.1-1 that has the potential for contributing to cumulative impacts on vegetation and wildlife along the pipeline corridor is the portion of the non-jurisdictional electrical distribution line that would extend from Holbrook Park Road to the Holbrook Compressor Station. Construction of the electric line would affect a small area of vegetation, and it would likely incorporate best management practices to reduce potential impacts on vegetation and wildlife. We believe that the incorporation of standard best management practices during construction, restoration, and maintenance would minimize the degree and duration of the cumulative impacts on vegetation and terrestrial wildlife from these projects. As a result, we conclude that construction and operation of the Terminal Expansion would not contribute to a significant impact on vegetation and wildlife in the cumulative impact area.

4.13.2.6 Aquatic Resources

We considered the cumulative impact area for aquatic resources to be the same as for water resources (2 miles upstream and downstream of the Terminal Expansion site boundaries and pipeline stream crossings). Dredging would impact bottom dwelling marine organisms and the bottom habitat, including EFH, within the dredged area and would result in conversion of subtidal habitat to deep water habitat for the duration of the Project. This would be an incremental addition to similar existing, converted habitat at the adjacent berthing area of the existing Cameron LNG Terminal, which is maintained as deep water habitat by dredging. The adjacent Calcasieu Ship Channel is also maintained by dredging every 2 years by the COE. Due to the substantial amount of subtidal habitat in the cumulative impact area, we believe the Project would have a minor cumulative impact on aquatic species.

The water-related Lake Charles projects are about 5.5 to 11 miles (straight-line distance) from the proposed work dock. Sediments would likely drop out of the waters of the Calcasieu Ship Channel before those waters reach the vicinity of the Terminal Expansion site. Therefore, we believe those projects would not contribute to cumulative impacts on aquatic resources in the cumulative impact area for the Terminal Expansion.

The impact of increases in turbidity due to dredging at the work dock would be temporary and localized to the dredged area and directly adjacent areas and relatively short downstream distances due to the slow-moving nature of the channel (see section 4.13.2.3). As a result, marine species would experience localized effects. If dredging at the work dock takes place at the same time as maintenance dredging of the existing Cameron LNG Terminal berthing areas and the maintenance dredging of the channel, the geographic extent of temporary impacts would increase beyond the area affected by dredging for the work dock. The impact area would be smaller if the dredging projects were not concurrent, but the total duration of impacts within the cumulative impact area would increase. In either case, we believe the impact in the cumulative impact area would not be significant because these impacts would be temporary and localized and we believe turbidity would return to pre-dredging levels soon after dredging is completed.

Potential impacts on fisheries resources resulting from construction of the proposed Pipeline Expansion include sedimentation and turbidity, alteration or removal of in-stream and stream bank cover, water withdrawal during hydrostatic testing, and introduction of pollutants from inadvertent equipment spills or leaks. The construction impacts of the adjacent pipelines occurred during and shortly after construction. These areas have been restored and would not contribute to cumulative impacts during construction of the pipeline extension. Water withdrawal for hydrostatic testing of the proposed Pipeline Expansion would be in compliance with the screening requirements and withdrawal rates of the permit from LDNR, which includes input from LDFW, to reduce impacts on aquatic species. As a result, cumulative impacts on aquatic resources from construction or operation of the proposed Pipeline Expansion would not be significant.

4.13.2.7 Threatened and Endangered Species

Ten species listed by FWS as threatened or endangered potentially occur near the proposed Project facilities. The Terminal Expansion would have no effect on six species and would not contribute to cumulative impacts on those species. We have not addressed species in the "no effect" category in this cumulative impact analysis. We conclude the Terminal Expansion is not likely to affect three species: the federally endangered Kemp's ridley sea turtle, the federally endangered West Indian manatee, and the federally threatened piping plover. The cumulative impact area for the turtle and the manatee is the Calcasieu Ship Channel. The cumulative impact area for the piping plover is the shoreline along the channel within about 2 miles of the proposed terminal site. We conclude that the Pipeline Expansion is not likely to adversely affect one federally endangered species, the red-cockaded woodpecker. The cumulative impact area for the red cockaded woodpecker is the pipeline construction right-of-way and the area within about 0.5 mile of the right-of-way and within 0.5 mile of the Holbrook Compressor Station site. We are currently consulting with FWS and NMFS on our determinations.

As noted in section 4.7, no Kemp's ridley sea turtles have been known to nest in Louisiana. Potential foraging and transit habitat for the species exists near the site of the proposed work dock; however, the high level of industrial activity adjacent to the Calcasieu Ship Channel and the usage of the channel by ship traffic make it unlikely that this species would use the habitat at the work dock. All of the projects within the Calcasieu Ship Channel must also complete Section 7 of the ESA consultation. As a result, it is not likely that the Terminal Expansion, the other liquefaction projects along the channel, or the water-related Lake Charles projects would have significant cumulative impacts on the Kemp's ridley sea turtle.

The West Indian manatee is present in marine, estuarine, and freshwater environments. Manatees have been spotted in the Calcasieu River Basin; however, given the level of industrial activity in the area, their presence near the Terminal Expansion project area is unlikely, as noted in section 4.7. The LNHP database includes a historical sighting near the Terminal Expansion area in 1929, but none since then. In addition, there is a minimal amount of appropriate habitat in the channel for this species. As a result, it is not likely that the Terminal Expansion, the other liquefaction projects along the channel, or the water-related Lake Charles projects would contribute to cumulative impacts on the West Indian manatee.

The piping plover is a migratory species that winters in Atlantic and Gulf coastal regions of the United States and several Caribbean islands, and breeds in the northern United States and Canada (see section 4.7). However, preferred shoreline types are not currently present along the Terminal Expansion site and it is not likely that the species would use that area or areas adjacent to the terminal site due to the level of industrial activity in the vicinity. As a result, it is not likely that the Terminal Expansion would contribute to cumulative impacts on the piping plover.

The red-cockaded woodpecker is known to occur in both Beauregard and Calcasieu Parishes. It is generally a non-migratory species that requires mature pine forests. On January 24, 2013, Cameron Interstate and FWS personnel conducted surveys of the species. No red-cockaded woodpeckers or nest clusters were identified within the survey area. Therefore, due to the small amount of available habitat and the lack of observations of individuals or nest cavities, we believe the proposed Pipeline Expansion would not likely have significant cumulative impacts on the red-cockaded woodpecker.

The only projects identified near the Terminal Expansion site are the non-jurisdictional NGL pipeline and the non-jurisdictional Entergy transmission line. The NGL pipeline would only impact marsh wetlands. Based on FWS correspondence, this project would have no effect on federally-listed threatened or endangered species[53]. Additionally, the Entergy transmission line would traverse the same habitats and would likely not impact threatened or endangered species. As a result, there would not be cumulative impacts on threatened or endangered species due to construction and operation of the proposed Terminal Expansion.

The only project in the threatened or endangered species cumulative impact area for the Pipeline Expansion is the electric distribution line. Construction of the project would have a minimal impact on habitat. Operation of the project is not expected to increase impacts on wildlife, and there would not be an increase in the width of the existing corridors that the distribution line would parallel. Therefore, we believe that cumulative impacts on threatened or endangered species due to construction and operation of the Pipeline Expansion would not be significant.

4.13.2.8 Land Use, Visual Resources, and Recreation

Land Use

The cumulative impact area for land use was considered to be the area adjacent to and in the vicinity of the proposed Project.

The existing Cameron LNG Terminal site is dedicated to industrial use. Construction of the Terminal Expansion would impact existing industrial, wetland, forest, and open water land uses and convert them to industrial use. The proposed Terminal Expansion along with the existing LNG Terminal, the NGL pipeline, the Entergy transmission line, LA-27, and the many small oil and gas projects in the vicinity of the Terminal Expansion would result in a cumulative increase in the conversion of a variety of land uses to industrial and transportation use in the cumulative impact area. However, the COE and LDEQ would require compensatory mitigation for wetland loss for the Terminal Expansion and the NGL pipeline and may require

[53] Provided in Docket Number CP13-25 in Appendix D.1 of Cameron LNG's April 26, 2013 Response to FERC's Environmental and Engineering Data Request dated April 3, 2013 (Accession Number 20130429-5029).

compensatory mitigation for the Entergy transmission line. Because there are many areas of wetlands, forest, and open water adjacent to the site, we believe that the Terminal Expansion would not result in a significant cumulative impact on land use.

Construction of the Pipeline Expansion would impact wetlands, agriculture, forested, industrial, and open water land uses. Only a short segment of the planned electrical distribution line to the Holbrook Compressor Station would be in the cumulative impact area for the Pipeline Expansion. The distribution line would parallel Holbrook Park Road east of the proposed pipeline corridor, and between Holbrook Park Road and the compressor station it would parallel the pipeline right-of way. Construction of the distribution line within the cumulative impact area is not expected to require additional tree removal, and ground disturbance would be minimal for pole placement.

As a result, we believe the cumulative impact on land use would not be significant.

Visual Resources

The cumulative impact area for visual resources was considered to be the area within the viewsheds of the proposed Project facilities. Because of the height of the structures at the expanded terminal, the viewshed of the terminal would extend for several miles in all directions. The viewshed for the proposed Pipeline Expansion is about 0.5 mile from the pipeline corridor and the aboveground facilities.

The Terminal Expansion would be consistent with the visual character of the adjacent Cameron LNG terminal, the ongoing industrial facilities and activities along the Calcasieu Ship Channel, and the many small oil and gas facilities near the Terminal Expansion site. The visual character of the Terminal Expansion would be similar to that of the adjacent Cameron LNG Terminal. To minimize impacts of the 20-foot-high vapor fence, we have recommended that Cameron LNG install and maintain a vegetative screen between LA-27 and the vapor fence that would extend along the western property boundary of the Terminal Expansion site. With this recommended mitigation measure, we do not believe there would be a significant cumulative visual impact.

The non-jurisdictional NGL pipeline would be buried from the Terminal Expansion site to its southern terminus and would not affect the visual character of the area after construction is complete. The southern terminus of the NGL pipeline is expected to be at storage facilities about 4 miles west-southwest of the Terminal Expansion site and would not affect visual quality. Entergy would install self-supporting single-circuit steel poles for each circuit and single-circuit H-frame structures for long span and high clearance crossings. The transmission lines and the structures supporting the lines would alter the visual quality of that viewshed and expand the industrial character of the area to the west side of LA-27. However, the visual quality would be consistent with the industrial character of the area in the vicinity of the existing Cameron LNG Terminal and consistent with electrical transmission lines that parallel many roadways in the area.

We did not identify any other proposed major projects within the same viewshed as the expanded terminal. As a result, we believe that the cumulative impact on visual resources would not be significant.

The proposed Pipeline Expansion route is adjacent and parallel to existing pipeline and utility corridors, which would minimize changes to the viewshed. This would result in a minor widening of the rights-of-way, a change of visual character that would likely not be noticeable outside of forested areas. Only a short segment of the planned electrical distribution line to the Holbrook Compressor Station would be within the cumulative impact area of the Pipeline Expansion for visual resources. That would consist of about 0.5 mile along Holbrook Park Road leading up to the Pipeline Expansion right-of-way, and a distance of about 0.25 mile adjacent to the Pipeline Expansion right-of-way between Holbrook Road and the compressor station. Although the poles and wires of the distribution line would alter the visual character of that area, the width of the existing corridors that the distribution line would parallel would not change, and we conclude that the cumulative impact on visual resources would not be significant.

Aboveground facilities, such as the Holbrook Compressor Station and interconnections, would have additional visual impacts; however, these interconnections would be installed adjacent to existing aboveground natural gas facilities, and the Holbrook Compressor Station would not be in the viewshed of many observers. Therefore, there would not be a significant cumulative impact on visual resources associated with the proposed Pipeline Expansion and other past, present, and reasonably foreseeable projects in the visual resources cumulative impact area for the Pipeline Expansion.

Recreation

For the proposed Terminal Expansion, the cumulative impact area for recreational-use vessels was considered to be the Calcasieu Ship Channel to its confluence with the Gulf Intracoastal Waterway, and the Gulf Intracoastal Waterway from its confluence with the channel to the Port Arthur area. The cumulative impact area for recreational facilities for both the Terminal Expansion and the Pipeline Expansion was considered to be Cameron, Calcasieu, and Beauregard Parishes.

In the initial phases of construction of the Terminal Expansion, the increase in barge traffic may affect some recreational and commercial users of the channel and the waterway, resulting in a moderate, short-term impact that would last about 14 months.

During construction of the Lake Charles projects, supply ship and barge traffic would likely increase in the Calcasieu Ship Channel and the Gulf Intracoastal Waterway, from Port Arthur to the Port of Port Charles. That would represent a cumulative impact with the proposed Project on the Gulf Intracoastal Waterway. However, recreational vessels currently encounter supply ship and barge traffic on the waterway. Further, the cumulative impact of Project vessel traffic in the waterway during construction would be short-term. Therefore, we believe cumulative impacts on boat traffic would not be significant.

Barge traffic during operation of the Project would be minimal and would not contribute to impacts on the waterway. Cameron LNG has not proposed to change its authorized LNG carrier traffic. Therefore, we believe operation of the Project would not contribute to cumulative impacts on recreational vessel traffic in the Calcasieu Ship Channel or nearby waterways.

The portion of LA-27 from Sulphur to its intersection with the Gulf Beach Highway is a part of the Creole Trail, including LA-27 in the vicinity of the proposed Terminal Expansion site.

During the construction period for the Terminal Expansion, Cameron LNG would increase traffic on LA-27 between Sulphur and the Terminal Expansion site. Construction of the non-jurisdictional NGL Pipeline would add traffic to LA-27 in the vicinity of the Terminal Expansion for about 1 year during the construction period of the Terminal Expansion. Workers commuting to construction sites for the Entergy transmission line and Liberty Gas Storage Expansion Project would also add to traffic on LA-27 between Sulphur and the Terminal Expansion site, and activities associated with construction of the transmission line adjacent to LA-27 may result in temporary disruptions of traffic flow. In addition, during the latter stages of Terminal Expansion construction, the Gasfin and Waller Point LNG Projects may add to the construction worker traffic on LA-27, if those projects are authorized and constructed. As with the Terminal Expansion, most of the traffic associated with construction of those projects would likely be associated with commuting construction workers during the early morning and evening hours.

Concurrent construction of the projects discussed above could substantially increase traffic on LA-27 from Sulphur to the turnoffs to the construction sites. The increase would not be during the time of day most recreational users of the Creole Trail would be affected. We have recommended mitigation measures to reduce the impact of construction-related traffic near the Terminal Expansion site, including uniformed traffic control at the access driveways of the Terminal Expansion site during construction commuting times, development of a plan to provide mass transportation to and from the Terminal Expansion site for construction workers, and conducting a traffic study during construction to assess the LOS at that time and developing additional mitigation measures if the roadway experiences an LOS of D or worse. We believe that our recommended mitigation would reduce the potential cumulative impact on LA-27 to less than significant levels during construction commuting times. Operation of the expanded terminal would contribute a minor amount of traffic to the roadway and there would not be a significant cumulative impact.

Because the Creole Trail does not extend north of Sulphur, it is not likely that construction-related traffic for the pipeline would contribute to cumulative impacts on the trail. Although pipeline construction workers and their families may use the Creole Trail at times, we do not expect the impact to be significant.

As described in section 4.9, most of the Terminal Expansion workers from out of the area are expected to reside in Cameron and Calcasieu Parishes, as would workers on the projects in southwestern Cameron Parish listed in table 4.13.1-1. Some of the workers may bring their families. As described in section 4.13.2.9, construction workers for the Lake Charles projects would reside primarily in Cameron, Calcasieu, Beauregard, and Jefferson Davis Parishes, with some workers possibly housed in Allen Parish. When not working, construction workers and the families of some workers may use LA-27 and other portions of the Creole Trail. This would increase traffic on LA-27 and other roadways that are part of the Creole Trail. However, outside of commuting times, we do not believe the increase in traffic along LA-27 and other portions of the Creole Trail would substantially increase, and we do not believe the cumulative impact on recreational use of the Creole Trail would be significant.

The construction period for Cameron's Project would likely be concurrent with those of several of the major Lake Charles projects and the three non-jurisdictional projects (the NGL pipeline, the Entergy transmission line, and the electrical distribution line for the Pipeline Expansion). Construction of the Gasfin and Waller Point LNG Projects may also be concurrent with construction of the proposed Project. Under those conditions, based on the sizes of some of the projects and the large number of construction workers required, the local labor force of qualified construction workers would likely be fully absorbed. This would result in a greater number of non-local workers than typically anticipated for construction projects in the area and a substantial increase in workers from out of the area. It is likely that many of those workers, and in some cases their families, would use the recreational facilities and other recreational opportunities available in Cameron, Calcasieu, Beauregard, and Jefferson Davis Parishes. Although this may stress some individual recreational facilities, we do not expect the overall impact to be significant due to the large geographic area in which the workers would be housed and the number of recreational opportunities within that area.

During operation, Cameron would employ an additional 135 workers. Although many of these workers and their families would likely use the recreational facilities of the cumulative impact area, the impact on the facilities and other users of those facilities would be minor and the cumulative impact on recreation would not be significant. The total number of permanent employees for the new projects listed in table 4.13.1-1 would be substantially lower than the number of construction workers required. As with the construction workers, the permanent employees would be housed throughout Cameron, Calcasieu, and Beauregard Parishes, and there are many recreational opportunities within that area. Therefore, the combined permanent workforce of the projects in table 4.13.1-1 that are under construction, planned, or reasonably foreseeable is not expected to have a significant impact on recreational facilities in the area.

After the Pipeline Expansion is constructed, the recreational activities currently taking place along the pipeline route and adjacent utility corridors could continue. There are no known recreational activities taking place on the proposed site of the Holbrook Compressor Station, although some hunting may occasionally occur there. As a result, there would be, at most, a minor cumulative impact on recreation due to the Pipeline Expansion.

4.13.2.9 Socioeconomics

Socioeconomic Conditions

We considered the cumulative impact area for socioeconomics to include Cameron, Calcasieu, and Beauregard Parishes, where Cameron would construct its facilities and workers would reside during construction and operation of its Project.

Construction of Cameron’s Project would generate a substantial number of jobs for a period of about 4 years starting in 2014. Construction of many other projects listed in table 4.13.1-1 would also occur during portions of that time period, including the major projects in the Lake Charles area and possibly the Golden Pass Liquefaction Project and the Waller Point and Gasfin LNG Projects. Simultaneous construction of those projects would require a large number of workers from the local labor pool. The cumulative effect would be a substantial reduction in unemployment in the area. However, that reduction in unemployment would also require the import of more construction workers than typically required for any single project.

The influx of non-local workers would impact transient housing in Cameron, Calcasieu, and Beauregard Parishes. As described in section 4.9.5, there is an adequate amount of vacant transient housing in Cameron, Calcasieu, and Beauregard Parishes to house workers on the

Cameron Project. However, with concurrent construction of many other major projects noted above, it is likely that there would not be any transient housing available in Cameron, Calcasieu, and Beauregard Parishes, and non-local workers unable to find acceptable housing in any of those three parishes could likely reside in adjacent Jefferson Davis and Allen Parishes. If peak construction workforce periods of many of the projects coincide, it is possible there may not be sufficient transient housing in the five parishes to accommodate all of the non-local workers. For example, if the peak workforce of the proposed Project occurs during the same time period as the peak workforce of the two Sasol projects, there would be about 10,500 workers in the area for just those three projects. That would benefit the transient housing, market but would adversely affect those seeking transient housing. Some members of the workforce and others seeking transient housing may be forced to commute long distances to obtain housing in parishes more distant than the five parishes nearest the projects.

The Sabine Pass Liquefaction Project is currently under construction, and most of the non-local workers are likely housed in the Port Arthur, Texas area. It is likely that most of the non-local workers that would be involved in construction of the Golden Pass Liquefaction Project would reside in the Port Arthur area. As a result, neither Sabine Pass nor Golden Pass Liquefaction Project is expected to cumulatively affect housing in the socioeconomic cumulative impact area of the proposed Project.

The combined construction workforces of projects would increase the need for some public services, such as police, medical services, and schools. The need for those services would generally be spread throughout the parishes that house the workforce, but because the majority of construction would take place in Cameron and Calcasieu Parishes, there may be an increased need for medical and emergency services at or near the sites of the projects. Cameron LNG would construct and staff a medical facility on the Terminal Expansion site to address most injuries and illnesses. As a result, the Project's contribution to the cumulative impact on medical and emergency services in Cameron and Calcasieu Parishes during construction would likely be occasional and minor. However, because the construction periods of the proposed Project and many other projects could overlap, there is a potential for a significant cumulative impact on such services in Calcasieu Parish, and likely some impact in the surrounding parishes. If the medical and emergency services, or other public services, are adversely affected during construction, the project sponsors may mitigate the impact by providing funding for temporarily increasing the staff and equipment of the public services affected.

With construction of some of the major projects listed in table 4.13.1-1 lasting several years, it is likely that some construction workers would bring their families, including school-age children. That would increase the population in some schools in the parishes housing the workers with families. However, it is likely that those families would be housed throughout many school districts in the five parishes and the increases in school populations would be distributed through many schools. As a result, it is not likely that the cumulative impact on schools during the concurrent construction periods would be significant.

A large workforce for the simultaneously constructed projects would have a beneficial impact on revenues for the state and for Cameron, Calcasieu, and Beauregard Parishes due to expenditures for services and materials for the projects, increased expenditures by local workers, and expenditures by the non-local workforce and any family members accompanying the non-local workers. The parishes would also receive a substantial increase in property taxes from these projects.

Marine Transportation

The cumulative impact area for marine transportation associated with the proposed Terminal Expansion was considered to be the Calcasieu Ship Channel up to its confluence with the Gulf Intracoastal Waterway, and the Gulf Intracoastal Waterway from that point to the Port Arthur area.

As previously described, construction of the major Lake Charles projects would increase barge and support vessel traffic in the Gulf Intracoastal Waterway from Port Arthur to the channel, and in the channel to the Port of Port Charles. Construction of those projects is not expected to affect marine transportation on the channel south of its confluence with the waterway. Concurrent construction of those projects and the Terminal Expansion would likely result in a cumulative impact on vessel traffic in the waterway, primarily by increasing vessel travel times from congestion. However, the major vessel traffic increase from the Project would be during the first 7 months and is not expected to result in a significant cumulative impact on vessel traffic in the waterway.

The Gasfin and Waller Point export terminal projects are proposed near the mouth of the Calcasieu Ship Channel, which would have minor effect on vessel travel in the Terminal Expansion's cumulative impact area. However, if barges are brought from Port Arthur through the Gulf Intracoastal Waterway and down the channel to the proposed sites, there would be additional barge traffic. The Port of Lake Charles would dictate the movement of these barges to minimize disruption. Therefore, we believe this cumulative impact would not be significant.

Land Transportation

We considered the cumulative impact area for land transportation to include the three parishes that would house the Project facilities and the construction workers for the proposed Project: Cameron, Calcasieu, and Beauregard Parishes.

During construction of the Project and the Lake Charles projects, roadways in the area from west of Sulphur to the eastern portion of Calcasieu Parish would experience a substantial increase in daily vehicle trips. If workers require housing in Jefferson Davis or Allen Parishes, roadways from the Lake Charles area to some portions of those parishes would also experience increases in traffic during commuting periods for construction workers. Increases would result from workers commuting to and from the construction sites; deliveries of equipment, materials, and supplies to the sites; and removal of materials from the sites. There may be a substantial decrease in the level of service on surface streets between Sulfur and Lake Charles, and perhaps along I-10, particularly during commuting periods, and possibly in the area east of Lake Charles. During commuting times, impacts would be greatest in the vicinity of the major projects, and mitigation measures may have to be implemented by the proponents of those projects to reduce the impacts.

Construction workers for the projects in the Lake Charles area would not travel along LA-27 south of the I-10 bridge; therefore, these projects would not contribute to cumulative impacts due to construction-related traffic along LA-27 in that area. It is not likely that other construction-related traffic for the Lake Charles projects would use that route. However, construction of the non-jurisdictional NGL pipeline, the non-jurisdictional Entergy transmission line, and the Liberty Storage Expansion Project would contribute to cumulative impacts on traffic along that portion of LA-27, primarily at the beginning and end of each construction shift. Construction of both the NGL pipeline and the Entergy transmission line may also result in temporary disruptions to traffic flow along LA-27 in the vicinity of the Terminal Expansion site. In addition, if the Gasfin LNG Project and the Waller Point LNG Project are authorized and under construction at the same time, construction traffic from those projects would contribute to the cumulative impact on traffic along LA-27 in that area. As noted above, we recommended mitigation measures to reduce the impact of construction-related traffic near the Terminal Expansion site. We believe that implementation of these mitigation measures would reduce the potential cumulative impact of the Terminal Expansion on traffic along LA-27 between the Terminal Expansion site and Sulphur. However, if the times of shifts for each of the projects discussed above are similar, the overall impact on traffic along LA-27 due to construction worker traffic may result in long delays on portions of the highway and it may be appropriate for the proponents of the projects to implement additional mitigation measures to reduce the impacts.

4.13.2.10 Cultural Resources

The cumulative impact area for cultural resources was considered to be the area adjacent to and near the proposed Project. No cultural resources were identified as a result of surveys completed for the Project. Therefore, the Project and other projects in the area would not add to cumulative impacts on cultural resources.

4.13.2.11 Air Quality and Noise

Air Quality

The cumulative impact area for air quality during construction of the expanded terminal is the area adjacent to and near the border of the terminal site. The cumulative impact area for air quality during operation of the proposed Project was established based on the expanded terminal’s PSD Area of Impact of 6.2 miles (10 kilometers [km]) plus 31.1miles (50 km), for a total distance from the Terminal Expansion of about 37.3 miles (60 km). This area encompasses the Lake Charles projects; the planned Gasfin and Waller Point LNG Projects; and the compressor stations for other natural gas pipelines systems. The existing Golden Pass LNG Terminal, the planned Golden Pass Export Project, the Sabine Pass LNG Terminal, and the Sabine Pass Liquefaction Project (currently under construction) are outside of this area and are not expected to contribute to cumulative impacts on air quality in combination with the proposed Project. Because the Terminal Expansion and the Pipeline Expansion are located over a large geographic area, the cumulative air quality impacts of each project would be minimal; therefore, the discussion below focuses on the cumulative air quality impacts of each project separately.

Construction of the Terminal Expansion would temporarily impact air quality due to emissions from the combustion engines used to power construction equipment and from fugitive dust resulting from equipment movement on dirt roads and earth-disturbing activities. The future projects in the vicinity of the Terminal Expansion that would be constructed in a similar timeframe as the proposed Terminal Expansion are the non-jurisdictional NGL pipeline, the non-jurisdictional Entergy transmission line, and the Liberty Gas Storage Project. The construction-related impacts of those projects would be temporary and the project proponents for those projects would minimize fugitive dust to the extent practicable. Because construction of the NGL pipeline and the Entergy transmission line would be linear and move quickly, air emissions associated with these projects would be intermittent. The construction of the Liberty Gas Storage Project would be localized to the storage field about 5.3 miles from the Terminal Expansion. Based on the intermittent and short-term nature of construction of those projects, we believe that construction of the Terminal Expansion would not contribute to a significant cumulative impact on air quality.

Although the region in the vicinity of the proposed Project is currently in attainment with air quality standards, increases in industrial point sources could affect local and regional air quality. Under LDEQ regulations, the expanded terminal would be considered a major emissions source and would contribute to cumulative impacts on air quality within the cumulative impact area.

The cumulative modeling analysis in section 4.11.1 was performed to quantitatively demonstrate that the Terminal Expansion operational impacts, in addition to existing major sources of air emissions in the area of impact (37.3 miles), would not have a significant impact on air quality. While the Terminal Expansion would contribute to a cumulative impact on air quality in the PSD area of impact, as shown in the modeling analysis, this impact would not exceed the NAAQS, which were established to protect public health (including sensitive populations) and public welfare. Projects that would potentially be constructed in the future, and are considered to be major sources of air emissions, would be required to conduct a similar PSD analysis. Should operation of a new project result in a significant impact on air quality, the LDEQ would enforce operational limitations or require emissions controls that ensure the facility’s compliance with the SIP and attainment with the NAAQS. In addition, Cameron LNG would be required to comply with permit conditions during operation of the facility and incorporate the required controls to limit the emission of certain criteria pollutants, HAPs, and/or GHGs. Based on the cumulative modeling analysis and the required emission controls, we conclude that there would be no significant cumulative impact on air quality as a result of the Terminal Expansion.

In addition to operation of the expanded terminal and the projects listed above, air emissions from LNG marine traffic and other project-related vessels, considered mobile sources of air emissions, would occur along the entire waterway from the boundary of territorial waters to the vessel berths. Due to the transitory nature of these mobile sources and the large area covered, we believe the associated emissions would not have a significant cumulative impact on air quality along the waterway. Cameron LNG has not requested an increase in the currently authorized number of LNG carriers; therefore, operation of the carriers and any associated mobile sources would not contribute to a cumulative impact on the air quality of the area beyond that previously assessed. While there would not be an increase in the currently authorized number of LNG carriers or the previously assessed vessel emissions, we evaluated emissions for total vessel operations as part of the cumulative impact analysis for the proposed Terminal Expansion. Mobile source emissions were calculated for the LNG carriers while loading and while berthed at dockside without loading (a condition termed “hoteling”), for the LNG carriers while in transit, and for the tug assist vessels, both within and outside of the moored safety zone (see table 4.13.2-1). These mobile source emissions are not considered for permitting purposes by either EPA or LDEQ.

In addition, air quality dispersion modeling was conducted for CO, SO_2, NO_2, and stationary sources proposed for the Terminal Expansion, combined with mobile sources within the moored safety zone. Table 4.13.2-2 lists the highest levels for each pollutant per averaging period. The modeling was performed using the AERMOD version 12060, AERMAP (version 11103), the terrain preprocessor, AERMET (version 11059), the meteorological preprocessor, and AERSURFACE (version 08009), which estimate surface characteristics required for input to AERMET. Meteorological data from 2007 to 2011 was used as input to the models.

TABLE 4.13.2-1

Summary Of Existing Mobile Source Emissions From Marine Vessel Activities

Activity	Emissions (tons per year)				
	CO	**SO_2**	**NO_x**	**PM**	**VOC**
Operation While Berthing or at Berth					
Maneuvering in/out Berth	1.6	0.2	7.0	0.1	0.4
LNG Carrier Loading	40.4	5.9	148.6	2.7	3.9
LNG Carrier Hoteling	17.4	2.6	67.1	1.1	1.7
Tug Assist and Stand-by during Berthing/ Loading/Hoteling	12.0	3.1	46.3	4.5	4.3
Total	**71.4**	**11.8**	**269.0**	**8.4**	**10.3**
Outside Moored Safety Zone					
LNG Carrier Transit	42.3	3.4	165.6	2.1	14.1
Assist Tug Maneuvering/ Transit	2.2	0.7	53.9	0.9	0.8
Total	**44.5**	**4.1**	**219.5**	**3.0**	**14.9**

The CO and SO_2 screening levels were below the SILs, therefore, further refined modeling was not required.

The NO_2 screening resulted in levels greater than the SILs; therefore, refined modeling was conducted for NO_2 (see table 4.13.2-3). Cameron LNG obtained the off-site sources for the refined NO_2 analysis from the LDEQ website. Major sources within the area of impact were modeled for the NO_2 annual average NAAQS run. For the NO_2 background concentration, the Westlake monitoring station was used. An NO_2 concentration of 15 ug/m^3 was used as background for the annual average NAAQS model based on the highest annual average of the 5 years of Westlake monitoring data. The results of refined modeling indicated that NO_2 would not exceed any of the applicable NAAQS.

TABLE 4.13.2-2 Summary of Screening Results for Stationary and Mobile Source Emissions			
Pollutant and Averaging Period	**Year of Highest Level**	**Modeled Concentration (ug/m^3)**	**Significant Impact Level (ug/m^3)**
CO 1-hour	2007	166	2,000
CO 8-hour	2010	51.58	500
SO_2 3-hour	2008	9.24	25
SO_2 24-hour	2010	2.53	5
SO_2 Annual	2011	0.16	1
NO_2 Annual	2011	4.13	1

TABLE 4.13.2-3 Summary of Refined Modeling Results and Incremental Consumption for Stationary- and Mobile-Source NO_2 Emissions					
Refined Modeling			**Increment Consumption**		
Year of Highest Level	**Total Concentration (ug/m^3) [Modeled+ Background]**	**NAAQS**	**Year of Highest Level**	**Project Contribution to Modeled Maximum Concentration (ug/m^3)**	**Significant Impact Level (ug/m^3)**
2007	87	100	2007	0.14	1

A PSD increment consumption analysis was also conducted. The increment-consuming sources within the area of impact obtained from the LDEQ were included for this analysis. That analysis indicated that NO_2 levels would be greater than Class II allowable levels, requiring further analysis to determine if the Project impact on PSD increment consumption, including mobile sources, would be significant. The analysis indicated that the Project, including mobile sources, did not exceed the SILs at any of the receptors above the increment consumption standard, and therefore would not contribute significantly to consumption of the PSD Class II increment, and has also demonstrated compliance with the standard.

Based on the modeling analysis, we conclude that the cumulative impact of the Terminal Expansion with the existing mobile sources at the Cameron LNG Terminal would not have a significant impact on air quality in the cumulative impact area.

The cumulative impact area for air quality during construction of the Pipeline Expansion is the area adjacent to and near the edge of the construction right-of-way. The cumulative impact area for operation of the Pipeline Expansion is also 37.3 miles from the site, (6.2 miles (10 km) plus 31.1 miles (50 km), for a total distance from the Pipeline Expansion of about 37.3 miles (60 km). During construction of the Pipeline Expansion, combustion engines and fugitive dust would create temporary and minor impacts on air quality. The electrical distribution line is the only other project in table 4.13.1-1 that would be in the vicinity of the proposed Pipeline Expansion. We expect construction emissions of the electrical distribution line would be similar, but less than those of the Pipeline Expansion. Further, Cameron would use certain measures such as watering the right-of-way to minimize construction-related emissions. Therefore, we believe that the cumulative impact of construction on the local air quality would not be significant.

The cumulative modeling analysis in section 4.11.1 was performed to quantitatively demonstrate that the Holbrook Compressor Station operational impacts, in addition to existing major sources of air emissions in the area of impact (37.3 miles), would not have a significant impact on air quality. While the new compressor station would contribute to a cumulative impact on air quality in the PSD area of impact, as shown in the modeling analysis, this impact would not exceed the NAAQS, which were established to protect public health (including sensitive populations) and public welfare. Projects that would potentially be constructed in the future, and are considered to be major sources of air emissions, would be required to conduct a similar PSD analysis. Should operation of a new project result in a significant impact on air quality, the LDEQ would enforce operational limitations or require emissions controls that ensure the facility's compliance with the SIP and attainment with the NAAQS. In addition, Cameron would be required to comply with permit conditions during operation of the facility and incorporate the required controls to limit the emission of certain criteria pollutants, HAPs, and/or GHGs. Normal operation of the Cameron pipeline would not result in measurable air quality impacts that would contribute cumulatively to the local air quality. Based on the cumulative modeling analysis and the required emission controls, we conclude that there would be no significant cumulative impact on air quality as a result of the Pipeline Expansion.

Climate Change

The cumulative impact analysis described below does not focus on a specific cumulative impact area because climate change is a global phenomenon. Climate change is the change in climate over time, whether due to natural variability or as a result of human activity, and cannot be represented by single annual events or individual anomalies. As an example, a single large flood event or particularly hot summer may not be an indication of climate change, but a series of floods or high temperatures that statistically change the average precipitation or temperature over years or decades may indicate climate change.

The Intergovernmental Panel on Climate Change (IPCC) is the leading international, multi-governmental scientific body for the assessment of climate change. The United States is a member of the IPCC and participates in the IPCC working groups to develop reports. The leading United States scientific body on climate change is the U.S. Global Change Research Program (USGCRP).

Thirteen federal departments and agencies participate in the USGCRP, which began as a presidential initiative in 1989 and was mandated by Congress in the Global Change Research Act of 1990. The IPCC and USGCRP have recognized the following:

- globally, GHGs have been accumulating in the atmosphere since the beginning of the industrial era (circa 1750);
- combustion of fossil fuels (coal, petroleum, and natural gas), combined with agriculture and clearing of forests is primarily responsible for the accumulation of GHG;

- anthropogenic GHG emissions are the primary contributing factor to climate change; and
- impacts extend beyond atmospheric climate change alone, and include changes to water resources, transportation, agriculture, ecosystems, and human health.

The USGCRP issued a report (*Global Climate Change Impacts in the United States*) in June 2009 summarizing the impacts of climate change on the United States and the projected impacts of climate change in the future. The report includes a description of overall impacts by resource and impacts for various regions of the United States.

Although climate change is a global concern, this cumulative impact analysis focuses on the cumulative impacts of climate change in the general area of the proposed Project. The USGCRP (2009) report notes the following impacts in the continental Southeast and Coastal regions:

- average temperatures have risen about 2° F since 1970 and are projected to increase another 4.5 to 9°F during this century;
- increases in illness and death due to greater summer heat stress;
- the destructive potential of Atlantic hurricanes increased since 1970 and the intensity (with higher peak wind speeds, rainfall intensity, and storm surge height and strength) is likely to increase during this century;
- within the past century in the United States, relative sea level changes ranged from falling several inches to rising about 2 feet and are projected to increase another 3 to 4 feet this century;
- sea level rise and human alterations have caused 1,900 square miles of coastal wetland loss in Louisiana during the past century, reducing the capacity of those wetlands to protect against storm surge, and projected sea level rise is anticipated to result in the loss of a large portion of the nation’s remaining coastal wetlands;
- declines in dissolved oxygen in streams and lakes have caused fish kills and loss of aquatic species diversity;
- moderate to severe spring and summer drought areas have increased 12 to 14 percent (with frequency, duration and intensity also increasing and projected to increase);
- longer periods of time between rainfall events may lead to declines in recharge of groundwater and decreased water availability;
- responses to decreased water availability, such as increased groundwater pumping, may lead to stress or depletion of aquifers and a strain on surface water sources;
- increases in evaporation and plant water loss rates may alter the balance of runoff and groundwater recharge, which would likely to lead to saltwater intrusion into shallow aquifers;

- coastal waters temperature rose about 2°F in several regions and are likely to continue to warm as much as 4 to 8°F this century; and
- coastal water warming may lead to the transport of invasive species through ballast water exchange during ship transit.

The GHG emissions associated with construction and operation of the Project are identified in section 4.11. Those emissions would not have any direct impacts on the environment in the general area of the Project, but may contribute incrementally to impacts in other areas. Cameron LNG and Cameron Interstate would incorporate GHG BACT analyses as part of the air permit applications to LDEQ. Potential controls for these emissions include preventing the GHG formation, or the emissions, such as, monitoring piping components to prevent GHG emissions, as well as (1) carbon capture and storage, (2) use of the most thermally efficient equipment, (3) use of low carbon fuels, (4) use of renewable energy sources [solar and wind], (5) Solid Oxide Fuel Cell Technology, and (6) good combustion/operating practices.

BACT for GHG Emissions

CCS has three main components: CO_2 capture and/or compression, transport, and storage. Approximately 90 percent of the CO_2 emissions from the proposed equipment would originate from the natural gas-fired compressor turbines, and CO_2 could theoretically be captured by scrubbing the exhaust stream with solvents such as amines and ammonia. However, separating CO_2 from this flue gas is challenging. For example, a high volume of gas must be treated because the CO_2 is dilute (3 to 4 percent by volume in natural gas-fired systems), trace impurities (such as particulate matter, sulfur oxides, and nitrogen oxides) can degrade the CO_2 capture materials, and compressing captured CO_2 from near atmospheric pressure to pipeline pressure requires a large auxiliary power load. EPA has also identified "a low purity CO_2 stream" as a "significant and overwhelming technical" issue.

There are no known installations of successful post-combustion capture of CO_2 on gas-fired turbines or compressors. EPA stated, "an applicant is generally not required to undergo extensive delays and expense to research and test unproven technologies as part of the BACT process." Further, the agency stated that "technologies in the pilot scale testing stages of development would not be considered available for BACT review." Therefore, LDEQ finds CO_2 capture to be technically infeasible. In addition, Cameron LNG indicated that CCS technology is not at the licensing and commercial stages, and as an emerging technology it has limited success for gas-fired internal combustion engines. We agree that controls have not been demonstrated on sources similar to those proposed, nor has technology been demonstrated applicable to the Project.

The proposed Project is in a region that does not have any geological formations that support sequestration; therefore, local storage of CO_2 is not an option, and transport from the expanded terminal to a distant storage facility would be required. In its GHG BACT analysis, Cameron LNG indicated that it could not commit to CCS because no CO_2 pipeline currently exists near the proposed LNG Terminal. The Denbury Resources CO_2 pipeline extends through Calcasieu Parish, Orange County, Texas, and Jefferson County, Texas, areas which border Cameron Parish. However, for the Terminal Expansion to connect to this CO_2 pipeline, Cameron LNG would have to secure the necessary rights-of-way (or perhaps purchase additional property) and construct a pipeline in excess of 20 miles. Alternatively, Cameron LNG could have subscribed to the proposed CO_2 pipeline that would extend from the Lake Charles CCS Project to the Denbury pipeline, which would require a shorter pipeline. However, the Lake Charles CCS Project appears to be fully subscribed with CO_2 from the Lake Charles CCS Project.

As a result, of these considerations, we eliminated CCS from further consideration as BACT for GHG emissions.

To prevent freezing of CO_2 in natural gas during the liquefaction process, the CO_2 is removed and vented to the atmosphere through thermal oxidizers. There are no controls available to eliminate these emissions. The flares are designed to convert any flare gas to CO_2. There is no additional control for the GHG emissions from the flares. Proper plant operations to minimize flare gas are determined as BACT for GHG emissions.

With CCS considered infeasible, there is no known applicability of solar thermal technology or solid oxide fuel cell technology to any facilities that are similar to those of the expanded terminal. The remaining control options consist of using the most efficient turbines, low carbon fuels, and good combustion/operating practices. Prevention of GHG emissions is the best control option for fugitive sources. Implementing a leak detection and repair program to minimize methane emissions is determined as BACT for GHG fugitive emissions.

Cameron LNG proposes to install six refrigeration turbines. These are high thermal efficiency turbine models, fired with natural gas, a low-carbon fuel. Good combustion/operating practices would increase thermal efficiency. Good combustion/operating practices may not reduce CO_2 emissions, but would reduce emissions of methane, which is a GHG component. Nitrous oxide emissions would be minimal, and controlling those emissions would potentially increase other criteria pollutants, such as NO_X; therefore, additional N_2O control is not practical. Use of natural gas-fired high thermal efficiency turbines in combination with good combustion and operating practices is determined as BACT for GHG emissions from the turbines. Cameron LNG would incorporate this BACT into operation of the expanded terminal.

Cameron LNG proposes to install several diesel-fired emergency generator engines and water pump engines to support plant operations if the main power source is not operating. Each engine would operate less than 100 hours per year. Selection of an engine with the highest fuel efficiency and good combustion and operating practices are the only feasible control options for diesel fuel GHG emissions and have been determined as BACT.

Cameron Interstate would use good operation and maintenance practices to reduce GHGs from natural gas-fired compressor engines, which has been determined as BACT. An optical gas imaging instrument would be used for equipment leak detection to reduce methane fugitive emissions, which has been determined as BACT.

There is no standard methodology to determine how the Project's incremental contribution to GHGs would translate into physical effects on the global environment. However, the emissions would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources, and contribute incrementally to climate change that produces the impacts previously described. Because we cannot determine the Project's incremental physical impacts due to climate change on the environment, we cannot determine whether or not the Project's contribution to cumulative impacts on climate change would be significant.

Noise

The cumulative impact area for noise is within about 1.5 miles of the Terminal Expansion, 1 mile of the pipeline route, and a 1-mile radius of the Holbrook Compressor Station.

The only NSA in the vicinity of the terminal expansion site is a rural residence about 1.2 miles northwest of the site boundary. Based on the distance to the NSA, sound levels from construction equipment could reach 48 dBA, which is less than our noise criteria of an L_{dn} of 55 dBA, and would not be expected to result in adverse impacts on the NSA. Sheet and pile driving could contribute sound levels of 53 dBA, which is also less than our noise criteria, and would also not be expected to result in significant impacts on the NSA. The only projects in the cumulative impact area that may be constructed at the same time as the Terminal Expansion are the non-jurisdictional NGL pipeline and the non-jurisdictional Entergy transmission line. The majority of the construction of the NGL pipeline would be south of the Terminal Expansion site, more distant from the terminal's nearest NSA, and would not be expected to increase noise levels at the NSA. Construction of the Entergy transmission line is not expected to result in significant impacts on the NSA closest to the terminal. As a result, we believe that construction of the Terminal Expansion along with the non-jurisdictional projects would not result in a significant noise impact on the nearest NSA.

The estimated operational noise level of the expanded terminal at the nearest NSA (about 1.2 miles to the northwest) is 43.8 dBA L_{dn}, which is 2.9 dBA greater than the estimated ambient noise levels. The threshold of perception of change in sound levels for human hearing is about 3dB; therefore, the increase would be unnoticeable or barely noticeable at the nearest NSA. Therefore, operational noise from the Terminal Expansion would result in minor impacts on the NSA. We did not identify any other projects that would contribute to operational noise impacts in the terminal's cumulative impact area for noise.

Construction of the Pipeline Expansion, including aboveground facilities, would affect ambient noise levels at some nearby residences. Those noise impacts would attenuate quickly as the distance from the noise source increases, and construction proceeds along the pipeline right-of-way. The duration of construction activities, and therefore noise impacts, at any one location would be temporary. The only project within the Pipeline Expansion's cumulative impact area for noise is the electrical distribution line for the Holbrook Compressor Station. The noise generated during construction of that project would be temporary and also attenuate quickly as the distance from the noise source increases. Therefore, we believe cumulative noise impacts from construction of the Pipeline Expansion would not be significant.

Two NSAs are within the cumulative impact area for the Holbrook Compressor Station. We did not identify any other projects that would contribute to operational noise impacts in the cumulative impact area for the Holbrook Compressor Station.

4.13.2.12 Safety

For the proposed Terminal Expansion, we considered the cumulative impact area for marine vessel traffic to include the Calcasieu Ship Channel from the coast of the Gulf of Mexico to its confluence with the Gulf Intracoastal Waterway, and from the latter's confluence with the channel to the Port Arthur area. The cumulative impact area for the expanded terminal itself is the area adjacent to and in the vicinity of the terminal site, and the cumulative impact area for the pipeline was considered to be within about 660 yards of the pipeline centerline. The cumulative impact area for emergency services includes the area in the general vicinity of the proposed Terminal Expansion (which includes the two non-jurisdictional projects, the NGL pipeline and the Entergy transmission line), the Lake Charles projects, the Gasfin and Waller Point LNG Projects, and the Pipeline Expansion.

Cameron would mitigate impacts on public safety through the implementation of applicable federal, state, and local rules and regulations for the proposed Project as described in section 4.12. Those rules and regulations would ensure that the applicable design and engineering standards are implemented to protect the public and avoid or minimize the potential for accidents and failures.

Because Cameron LNG has not requested an increase in the number of LNG carriers calling on the terminal, the Terminal Expansion would not add to the current risk assessment of public safety on the Calcasieu Ship Channel or of an intentional attack on an LNG carrier at berth or in transit in the channel.

As noted in section 4.12.8, the risk associated with the Pipeline Expansion would be small. In addition, the proposed Pipeline Expansion route is parallel and adjacent to several pipelines and crosses several other pipelines. Although operation of the proposed Pipeline Expansion would increase the risk of a pipeline accident, we believe the increase in risk would be small. As a result, we believe that the cumulative impact on risk for the Pipeline Expansion would not be significant.

Emergency response time is a key aspect of public health and safety. Key emergency services are provided by the existing Cameron and Lake Charles LNG terminals in Cameron and Calcasieu Parishes, and those services would expand to include the associated proposed liquefaction projects. In accordance with our regulations, Cameron LNG would prepare a comprehensive plan that identifies the cost sharing mechanisms for funding these emergency response costs. Therefore, we believe that the cumulative impact of each project's comprehensive plans would not result in a significant impact on public safety.

If any or all of the stand-alone liquefaction projects (the Magnolia, Gasfin, and Waller Point LNG Projects) are authorized, constructed, and operated, each would also have to prepare and implement a similar comprehensive plan to provide emergency services. In addition, we anticipate that the other major projects in the Lake Charles area (the LCCE Gasification Project, the Lake Charles CCS Project, the IFG Port Holdings export terminal expansion, the Sasol Projects, and the G2X Energy Natural Gas-to-Gasoline Plant) would include emergency services within their facilities, as well as emergency response plans developed with the appropriate agencies. Emergency responses at any of those facilities may temporarily stress emergency services in the area, but we would not expect them to result in a long-term significant impact on those services. In the unlikely event of major emergencies at several of the facilities at the same time, there could be a short-term but significant cumulative impact on emergency services within Cameron and Calcasieu Parishes. That impact could be mitigated by assistance from emergency service providers from surrounding parishes.