4.0 ENVIRONMENTAL ANALYSIS

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

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

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

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

This section of the EIS is organized by environmental resource. For most resources, the scope of our analysis includes the construction and operation of the proposed facilities, which are limited to onshore facilities at the proposed Creole Trail LNG terminal, the proposed pipelines, and aboveground facilities associated with the pipelines. For some resources within the Gulf of Mexico and the Calcasieu Ship Channel, we also include analysis of potential impacts that would result from LNG ship deliveries to the proposed LNG terminal. The EIS also includes detailed discussion of LNG and natural gas pipeline reliability and safety (see section 4.12).

4.1 GEOLOGIC RESOURCES

4.1.1 Geologic Setting

The proposed Creole Trail Project is located within the West Gulf Coastal Plain physiographic province of southern Louisiana (Encarta, 2004). Regional geology in the province is characterized by southerly dipping and thickening deposits of interbedded sands and clays to depths of thousands of feet below the present day land surface. The strata are disrupted by diapiric salt structures and regional systems of relatively shallow growth faults that trend for considerable distances, generally parallel to the coast line (Stevenson and McCulloh, 2001). Seismicity and faulting are discussed in sections 4.1.3.1 and 4.1.3.2, respectively. The surficial geology within the project area consists of alluvial, coastal marsh, and terrace deposits that resulted from fluvial, tidal, littoral (beach or shoreline), and deltaic processes during the Pleistocene and Holocene epochs (Louisiana Geological Survey (LGS), 2001a).

Soil borings installed at the proposed LNG terminal site encountered the following deposits in descending order:

- One to 12 feet of dredge spoil material consisting of unconsolidated soft clay, silt, sand and organic materials;
- Thirty-five to 45 feet of littoral and marine sediments consisting of clays and shell hash. These littoral deposits can accumulate biogenic gas (discussed in section 4.1.3.8);
- Twenty-five to 30 feet of Chenier Plain Saline Marsh deposits composed of soft organic clays and silts with frequent deposits of peat;
- Twenty-five to 30 feet of Deweyville Terrace deposits composed largely of sand and gravel;
- Approximately 105 to 115 feet of clays, sandy clays, sands, and silts of the Prairie Formation; and
- Sands, sandy clays, gravel, and clay of the Lissie Formation (LGS, 1984 and Toulanay-Wong Engineering, Inc. (TWEI), 2005a).

Similar Holocene- and Pleistocene-age geologic deposits described above and Intermediate Terrace deposits consisting of clay, sandy clay, and silt with local deposits of sand and gravel are found along the proposed pipeline routes (LGS, 1984). Because of the thick sequence of unconsolidated deposits in the region, blasting would not be necessary for construction of the proposed LNG terminal or pipelines.

4.1.2 Mineral Resources

LNG Terminal

Mineral resources within the project vicinity include salt (brine), sulfur, aggregate (construction sand and gravel), and oil and gas. There are no active salt, sulfur, or aggregate operations within 0.25 mile of the LNG site. The nearest potential salt or sulfur deposit to the LNG terminal site is the Calcasieu Lake Salt Dome approximately 6.5 miles north. Due to this distance, construction and operation of the LNG terminal would not affect potential salt or sulfur production at the Calcasieu Lake Salt Dome.

Construction of the LNG terminal would require approximately 610,000 yd^3 of imported clay, 310,000 yd^3 of imported sand, and 125,000 yd^3 of imported gravel and crushed stone to raise and finish areas of the site and to construct the LNG tank impoundment dikes. Clay and sand are readily available from nearby suppliers, and gravel and crushed stone surfacing materials are routinely imported into the Lake Charles and Cameron areas. Creole Trail would utilize these existing sources to obtain the construction materials. Construction and operation of the proposed terminal would not be expected to affect other sand and gravel resources that may exist in the area.

The proposed LNG terminal site is within the Cameron Oil Field and is north of the Calcasieu Pass and Block 5 Oil Fields (TWEI, 2005A). There are no known producing gas and oil wells within 0.25 mile of the LNG terminal property. However, there are 17 wells within 0.25 mile of the LNG terminal property that are reported as either dry and/or plugged and abandoned. Fourteen of these wells are within the property to be leased for the LNG terminal and the remaining three wells are outside of the property boundary. Natural gas and condensate were produced from one of the on-site wells.

Specifically, well P 4A RA SUA; WT Burton IND et al., No. 001 (LNDNR 202548) produced 2.6 Bcf of natural gas and 22,499 barrels of condensate from March 1986 to April 1999 prior to being abandoned. Table 4.1.2-1 identifies the oil and gas wells located on or near the LNG site (SONRIS, 2005).

Because all of the former oil and gas wells on and near the LNG terminal site were either dry holes or have been plugged and abandoned, it is unlikely that economic oil and gas reserves are present beneath the site. In addition, if economic oil and gas reserves exist directly beneath the LNG terminal site, they could likely be recovered after the LNG terminal ceases operation. Therefore, construction and operation of the proposed LNG terminal should not affect oil and gas production in the area.

TABLE 4.1.2-1

Oil and Gas Wells Within 0.25 Mile of the Proposed Creole Trail LNG Terminal Property

Field	Well Name/Well Number	Distance from Property Boundary (feet)	Status	Operator
Wildcat-So LA LK Charles Dist	Abel West Heirs No. 002, LDNR 36168	1,145	Dry and Plugged	Inactive Operator
Wildcat-So LA LK Charles Dist	J A Davis No. 001, LDNR 40699	635	Dry and Plugged	Inactive Operator
Cameron	P5 RA SUA; Vincent Heirs No. 001, LDNR 138173	Onsite	Plugged and Abandoned	Natomas-McCormick-Coastal
Cameron	P2 RC SUA; Vincent Heirs No. 001-D, LDNR 138760	Onsite	Plugged and Abandoned	Natomas-McCormick-Coastal
Cameron	P3 RC SUA; Reily No. 001, LDNR 138914	Onsite	Plugged and Abandoned	Apache Corporation
Cameron	P4 B RA SUA; Vincent Heirs No. 002, LDNR 139232	Onsite	Plugged and Abandoned	Apache Corporation
Cameron	P 2 RC SUA; Reily No. 001-D, LDNR 139799	Onsite	Plugged and Abandoned	Apache Corporation
Cameron	P1 A RA SUA; Reily No. 002, LDNR 139811	Onsite	Plugged and Abandoned	Apache Corporation
Cameron	P1 D RA SUA; Reily No. 002-D, LDNR 142123	Onsite	Plugged and Abandoned	Apache Corporation
Cameron	Vincent Heirs No. 004, LDNR 154976	245	Dry and Plugged	Apache Corporation
Cameron	P 1C RA SUA; Vincent Heirs No. 003, LDNR 159515	Onsite	Plugged and Abandoned	Apache Corporation
Cameron	P 4C RB SUA; Vincent Heirs No. 003-D, LDNR 160478	Onsite	Plugged and Abandoned	Apache Corporation
Cameron	P 4A RA SUA; WT Burton IND, et al., No. 001, LDNR 202548	Onsite	Plugged and Abandoned	Delta/Seaboard Well Serv. Inc
Cameron	Reily No. 001, LDNR 205137	Onsite	Dry and Plugged	C.J. Wofford
Cameron	Reily No. 001, LDNR 205922	Onsite	Dry and Plugged	Terra Resources
Cameron	W Boatner Reilly III, et al. No. 001, LDNR 209072	Onsite	Plugged and Abandoned	Great Southern Oil & Gas Co. Inc.
Cameron	SL 5788 No. 001, LDNR 215840	Onsite	Dry and Plugged	Goldking Production Co.

Pipeline Facilities

There are 26 oil and gas fields with a total of 215 oil and gas wells identified within about 0.25 mile of the proposed pipeline facilities (SONRIS, 2005). All of the identified wells are reported as either plugged or abandoned. Because database location information for oil and gas wells is only approximate, Creole Trail would solicit additional information from landowners regarding all wells that appear to be within 150 feet of the pipeline right-of-way. All wells and associated gathering lines would then be field verified prior to construction. Twenty-two wells identified within 150 feet of the proposed pipelines are listed in table 4.1.2-2.

TABLE 4.1.2-2

Oil and Gas Wells Within 150 feet of the Proposed Creole Trail Pipelines

Segment/Milepost	Feature [a]	Name	Oil and Gas Field	Distance from Proposed Pipeline Centerline (feet) [b]	Bearing (degrees)
Segment 2					
0.4	Oil-Gas Well	Gulf Land Co 001	Cameron	109.4	350.1
15.6	Oil-Gas Well	WH NF Cam D SU; SL 42 081	Hackberry, East	131.6	86.0
16.7	Oil-Gas Well	SL 42 107	Hackberry, East	4.1	266.0
Segment 3					
8.7	Oil-Gas Well	Fee 978	Sulphur Mines	110.3	90.6
8.9	Oil-Gas Well	Fee 886	Sulphur Mines	7.0	269.9
12.3	Oil-Gas Well	Gulf Land Co 001	Buhler, West	75.3	100.7
12.8	Oil-Gas Well	Gulf Land Co 001	Buhler, West	48.6	100.7
19.0	Oil-Gas Well	School Lands 002	Dunn Ferry	32.0	303.7
20.5	Oil-Gas Well	Gulf Land Co 001	Beckwith Creek	97.1	134.2
20.5	Oil-Gas Well	Gulf Land Co 001	Beckwith Creek	97.1	134.2
39.7	Oil-Gas Well	Gulf Land Co 001	Wildcat-SO LA LK Charles DIST	123.0	326.4
62.0	Oil-Gas Well	Gulf Land Co 001	Rogers Gully	19.5	173.2
71.3	Oil-Gas Well	Gulf Land Co 001	Tepetate, North	64.2	355.7
76.0	Oil-Gas Well	Gulf Land Co 001	Richie	101.8	232.0
76.1	Oil-Gas Well	School Land 004	Richie	56.6	65.8
76.4	Oil-Gas Well	Gulf Land Co 001	Wildcat-SO LA Lafayette DIST	116.2	206.2
76.5	Oil-Gas Well	Gulf Land Co 001	Richie	119.8	26.2
76.8	Oil-Gas Well	Robert Ellender 002-B	Richie	141.2	23.5
76.8	Oil-Gas Well	Robert Ellender 002-B	Richie	141.2	23.5
78.1	Oil-Gas Well	Gulf Land Co 001	Tepetate	143.4	43.8
78.2	Oil-Gas Well	State Land 003	Tepetate	11.7	45.6
81.6	Oil-Gas Well	Gulf Land Co 001	Grand Coulee	19.8	21.9

[a] All oil-gas wells are plugged and abandoned.

[b] Measurements for Segments 2 and 3 are taken from Line 1. Due to the distance between the pipeline and the edge of the construction right-of-way, this list does not necessarily represent all oil and gas wells within 150 feet of the construction right-of-way.

Source: Banks Information Solutions, Inc. 2005. Oil and Gas Well Electronic Data. Accessed from Louisiana Department of Natural Resources Strategic Online Natural Resource Information System (SONRIS) Database.

Creole Trail has stated that it has selected a pipeline route that avoids all known oil and gas wells. However, if a well or gathering line is found to be within or near the trench line, Creole Trail would contact the FERC to request a variance, as appropriate, to adjust the pipeline centerline to avoid impact on the well or gathering line. It is anticipated that any such adjustment would be minor (generally a 10-foot

centerline offset) and that all disturbance would be limited to the previously identified right-of-way. In the event of the discovery of a non-reported abandoned gas or oil well during construction, Creole Trail has developed a response protocol that includes immediate work stoppage, notification of the EIs and Chief Inspector, spill control and cleanup as necessary, barricading and placing warning signs around the area, and notification of the LADEQ, the well owner, and the FERC. By field-verifying oil and gas wells and gathering lines within the pipeline right-of-way, and by implementing the procedures outlined above to address unexpected wells or gathering lines, construction and operation of the proposed pipelines should not be affected by the oil and gas wells and gathering lines in the area. Similarly, construction and operation of the proposed pipelines would not significantly affect current and future recovery of oil and gas in the region, as the pipeline project would be limited to near-surface disturbance over a relatively small area when compared to the lateral extent of underground oil and gas reservoirs which typically occur at depths of more than 1,000 feet.

An abandoned aboveground petroleum storage tank battery is present within the proposed LNG terminal footprint. The tank battery is associated with well P 4A RA SUA; WT Burton IND et al, No. 001 (LNDNR 202548), which was plugged and abandoned in 1999. Creole Trail would remove and dispose of the tank battery in accordance with applicable federal and state regulations. See section 4.8.1.1 for further discussion of facilities to be removed or abandoned at the LNG terminal site.

A sulfur mine parallels Segment 3 from MP 8.0 to MP 9.6. According to the USGS (2000a), sulfur is no longer being produced in the state and the deposit near Segment 3 is mapped as “exhausted” (Heinrich and Mculloh, 1999). Therefore, construction and operation of the proposed Creole Trail Project would not affect sulfur mining in the area.

Potentially exploitable sand and gravel have been documented at two general locations along the proposed pipeline route (Heinrich and Mculloh, 1999). A sand body occurs along Segment 3 between MPs 13 and 14; however, no sand mining operations are noted in the area. Gravel resources are also present along Segment 3 between MPs 42 and 45. One gravel pit is present near MP 43.9 about 1.1 miles south of the pipeline route. Based on this distance, construction and operation of the proposed Creole Trail pipelines would not affect the existing gravel operation.

4.1.3 Geologic Hazards

Potential geologic hazards in the project area consist of seismic-related hazards (seismicity, faulting, and soil liquefaction), subsidence, flooding (including storm surge), and shoreline erosion. Slope instability and inadequate load-bearing capacity of soils could also pose a hazard at the proposed LNG terminal. Conditions necessary for the development of other geologic hazards, including karst terrain, landslides, avalanches, and volcanism, are not present in the project area.

4.1.3.1 Seismicity

The Gulf Coast region of the United States, including the project area, is tectonically stable and, therefore, not subject to strong earthquakes. The low seismic risk of the region is reflected in the Uniform Building Code’s Seismic Risk Map (International Conference of Building Officials, 1997) which depicts the Gulf Coast in Seismic Zone 0, the lowest seismic hazard category in the lower 48 states.

Earthquakes are characterized by their magnitude, a measure of the amount of energy released during the event, and/or their intensity, a measure of the effects of the event at the land surface. Although Louisiana is not seismically active, low-magnitude earthquakes have occurred in the state and the state has been affected by more significant, distant earthquakes. The October 19, 1930 Donaldson earthquake, centered about 150 miles east of the proposed Creole Trail LNG terminal site, is the largest earthquake to

have occurred in Louisiana, with a Modified Mercalli Intensity (MMI) greater than V but less than VI. For reference, a MMI VI earthquake is felt by all persons in the area and damage is slight, such as fallen plaster and damaged chimneys. The largest instrument-recorded earthquake to occur in the Gulf of Mexico was a magnitude 5.0 event on July 24, 1978. This earthquake was centered approximately 250 miles south of New Orleans and produced no onshore damage. The LGS (2001) also describes the October 16, 1983 Lake Charles earthquake which was centered approximately 20 miles north of the proposed Creole Trail LNG terminal. The Lake Charles Earthquake was a magnitude 3.8 event that occurred at an estimated depth of more than 8 miles. Of earthquakes that occurred outside of Louisiana, the three New Madrid, Missouri earthquakes of 1811-12 had the greatest affect in the project area. These earthquakes had estimated magnitudes on the order of 7.5 – 8.0 and affected most of the eastern United States. Damage in Baton Rouge, Louisiana, from the largest of the New Madrid earthquakes was reported to be MMI V, which would have included broken dishes and windows, a few instances of cracked plaster, and disturbance of trees and utility poles (Hough, et al., 2000).

Future seismic risk can be quantified by estimating the likelihood of various degrees of shaking to occur. The shaking experienced by the ground surface or structures during a given earthquake is usually expressed in terms of the acceleration due to gravity (g). In general, small earthquakes recur more frequently than larger, more damaging earthquakes. Creole Trail conducted a detailed study to evaluate the seismic risk to the proposed LNG terminal (ABS, 2005). The study was conducted in accordance with NFPA 59A (2001), which specifies two different design levels of earthquakes for LNG terminals: the Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). In general, the OBE represents the level of shaking through which a well-constructed facility should be able to operate and continue operating after its occurrence, with perhaps a brief shutdown for a safety inspection to confirm that no damage occurred. The OBE is defined by NFPA 59A (2001) as that level of shaking with a mean recurrence interval of 475 years, or having a 10 percent probability of occurring within a 50-year period (the approximate operating life of the proposed project). The larger SSE event represents the level of shaking that should not damage the vital, safety-related components of a facility to the extent that they could not function. The SSE is defined by NFPA 59A (2001) as that level of shaking with a mean recurrence interval of 4,975 years, or having a 1 percent probability of occurring within a 50-year period.

For the proposed LNG terminal site, the geoseismic study determined the 5 percent damped horizontal peak ground accelerations (PGAs) associated with the OBE and SSE to be 0.0532 g and 0.1045 g, respectively. For reference, a PGA of 0.1 g is the approximate threshold for damage to older structures or structures not made to resist earthquakes (USGS, 2004). Based on the low historic seismicity in the Gulf Coast region and the results of the NFPA 59A (2001) seismic hazard analysis for the LNG terminal site, the potential for an earthquake to occur which would damage the LNG terminal is very low. Therefore, the earthquake hazard was not considered a controlling factor in the design of the LNG terminal.

Previous studies (e.g., O'Rourke and Palmer, 1994) have concluded that modern arc-welded gas pipelines in good repair are generally highly resistant to traveling ground waves. Therefore, the low levels of ground motion predicted for the project area would not be expected to damage the proposed pipeline or associated surface facilities.

4.1.3.2 Faulting

The thick sequence of sedimentary units along the Texas Coastal Plain is characterized by growth faults which generally trend parallel to the coastline. Growth faults are listric (or shovel-shaped) faults that become less steeply inclined with depth and are restricted to low-strength sedimentary rock units and unconsolidated sediment. Movement along these faults is by a gradual process referred to as "creep," in

contrast to the sudden breaking of harder rocks associated with earthquakes. No earthquake that has occurred in Louisiana has been definitively attributed to growth faults (LGS, 2001).

Faulting can also result from the natural movement of salt deposits in the subsurface environment and from human activities including fluid removal during petroleum production, salt brine mining, and groundwater pumping. The proposed LNG terminal site is approximately 2 to 3 miles southeast of the Calcasieu Lake collapse-fault system, a circular fault system created by the natural movement of deep salt deposits beneath Calcasieu Lake (TWEI, 2005). Due to its distance, the Calcasieu Lake collapse-fault system would not affect the proposed LNG terminal site.

A reconnaissance of the proposed LNG terminal found no indications of surface faulting at or adjacent to the site (Fugro South, Inc., 2004a) and site-specific geotechnical testing verified that the site is not impacted by faults (TWEI, 2005).

Segment 2 of the proposed pipeline route would cross two defined surface faults in Calcasieu Lake. The southern boundaries of the faults are at approximate MPs 1 and 3 of Segment 2, and the northern boundaries are at approximate MPs 14 and 15 of Segment 2. Along Segment 2, an additional regional surface fault may extend below Calcasieu Lake near MPs 10 and 11. Creole Trail has completed mapping and seismic surveys of the bottom of Calcasieu Lake. These studies have not indicated the presence of active surface faults along the proposed pipeline route through Calcasieu Lake.

Two additional regional surface faults have been mapped within the proposed pipeline routes. These faults are located south and southwest of Sulphur, Louisiana between MP 24 of Segment 2 and MP 1 of Segment 3, and between MPs 61 and 71 of Segment 3. Visual observations and review of aerial photography has not indicated evidence of surface faulting in these areas. While the surface traces of growth faults in Louisiana can cause minor damage to sidewalks and buildings, the proposed Creole Trail pipelines would be constructed of modern arc-welded steel, which would be able to resist the very small amount of gradual movement that could occur along any growth fault crossed by the pipelines during their operating lives. In addition, Creole Trail would install isolation valves on Segment 2 near MP 0.0 and upon exiting Calcasieu Lake near MP 21.7. Further, Creole Trail would incorporate surface fault detection into the pipeline Operations and Maintenance Plan, Integrity Management Plan, and aerial patrol process. With these measures, faulting in the project area does not pose a significant risk to the proposed pipelines or associated aboveground facilities.

4.1.3.3 Soil Liquefaction

Soil liquefaction is a physical process in which saturated, cohesionless soils temporarily lose their load-bearing strength when subjected to strong and prolonged shaking experienced during earthquakes. Liquefaction is generally restricted to environments where the granular materials are relatively young and where groundwater is within 30 feet of the ground surface.

Water-saturated granular layers are present in the near-surface environment at the proposed LNG terminal site and along the proposed pipeline routes. However, due to the low levels of ground shaking predicted for the area, the potential for liquefaction to occur is very low. In addition, the proposed LNG storage tanks and other heavy load structures at the LNG terminal would be constructed on deep driven piles which would reduce or eliminate the effects of soil liquefaction should it occur.

4.1.3.4 Subsidence

Land subsidence is a gradual settling of the earth's surface owing to subsurface movement of earth materials. More than 80 percent of the identified subsidence in the United States is a consequence

of groundwater withdrawal accompanied by aquifer compaction (USGS, 2000b). Other major causes of subsidence are oil and gas extraction and solution of mining of salt. As a result of these activities, subsidence occurs throughout southwest Louisiana; however, the rate is not considered significant at a reported average of approximately 0.02 inches per year on a state-wide basis (Morton and Purcell, 2001).

At the proposed LNG terminal site, subsidence due to groundwater withdrawal is not considered a significant risk because:

- There are no private water supply wells or public water supply wells identified within 200 feet and 400 feet, respectively, of the construction work area;
- The public water supply wells for Cameron Parish Water Works, District 10 are located more than 10 miles from the LNG terminal site; and
- There is no active oil and gas production or salt solution mining in proximity to the LNG terminal site; therefore the risk of subsidence due to these activities is low.

Creole Trail proposes to install wick drains to de-water soils beneath the LNG tanks and containment berms, which could result in localized subsidence or settlement. However, Creole Trail would construct the LNG tanks and other heavy load structures on deep driven piles which would prevent settling of the structures. Creole Trail would also monitor the LNG tank area for signs of settling/subsidence. By implementing these measures, the potential impact of subsidence due to de-watering soils at the LNG site would be largely eliminated.

As discussed in sections 4.1.2 and 4.3.1, respectively, the proposed pipelines cross areas where active oil and gas and groundwater withdrawals are occurring. Although the potential exists for subsidence to occur in the pipeline project area due to these activities, as noted above the overall rate of subsidence in southwest Louisiana is low and should not affect the Creole Trail pipeline facilities.

4.1.3.5 Flooding

The Louisiana Gulf Coast experiences hurricanes and tropical weather systems that produce storm surge, high rainfall amounts and flooding, shoreline erosion, and high winds. In low-lying areas the most significant damage is typically associated with storm surge.

Hurricane Audrey, historically viewed as the most destructive storm to strike southwestern Louisiana, was a fast-moving Category 4 storm that produced a maximum storm surge of 12.4 feet at Cameron, Louisiana (Rothe, 2003). Hurricane Audrey is the only Category 4 storm to strike within 40 miles of the proposed Creole Trail LNG terminal since 1865 (NOAA, 2005). Hurricane Rita, a fast-moving Category 3 storm that struck southwestern Louisiana on September 24, 2005, is being compared by local residents to Hurricane Audrey. Hurricane Rita is the second Category 3 storm to strike within 40 miles of the Creole Trail LNG terminal site since 1865; the first was an unnamed storm which occurred in 1886 (NOAA, 2005). The communities of Cameron, Hackberry, and Holly Beach were essentially destroyed by Hurricane Rita. Official storm surge values from Hurricane Rita are pending, but preliminary reports indicate that the surge was similar to, if not greater than, that observed from Hurricane Audrey. For example, high water marks from Hurricane Rita at Cameron slightly exceeded those from Audrey, indicating a surge magnitude of approximately 13 feet.

On October 6, 2005, representatives from Creole Trail visited the LNG terminal site to assess damage from Hurricane Rita and reported that the entire site appeared to have been inundated by an estimated 15- to 25-foot storm surge. Creole Trail reported that the flood waters had receded and that the

vegetated cover did not appear to be affected except for several trees along the eastern edge of the site that had been uprooted or destroyed. About 0.5 to 0.75 inch of fine silt and loamy material was deposited across the site as a result of the hurricane, but did not significantly affect the site elevation or topography. Miscellaneous debris including boats, cars, and chemical containers had been transported to the site by the storm. Creole Trail did not observe any evidence of environmental concerns from the debris and is arranging for its removal from the site.

To further assess potential effects of hurricanes on the LNG terminal, Creole Trail commissioned a formal hurricane effects study by Shiner Moseley and Associates, Inc., (Shiner Moseley). The Shiner Moseley study evaluated available data pertaining to historic and recent hurricanes and summarized previous storm surge modeling and wave analyses.

In the draft EIS, we recommended that Creole Trail re-evaluate the potential for damage to the LNG terminal and jetty from wind, storm surge, flooding, and wave action based on the results of the Shiner Mosely hurricane effects study and file a report including the results and recommendations of the study. We also recommended that Creole Trail file all new measures or design changes to the LNG storage tanks and critical equipment resulting from the study for review and written approval by the Director of OEP.

Creole Trail subsequently re-evaluated the effects of recent hurricanes at the LNG terminal site and the potential for future hurricanes to affect the site based on the results of the Shiner Moseley study. As part of this assessment, representatives from Creole Trail and AMEC-Zachry, an engineering firm involved in the design of the LNG terminal, visited the site and area on December 9, 2005. The results of the site visit and Shiner Moseley study were filed in Creole Trail's comments on the draft EIS and are summarized as follows:

- FEMA, the COE, and NOAA have applied techniques to estimate the extent and elevation of storm surge impacts throughout the Gulf of Mexico. The results of this work are primarily available through FEMA Flood Insurance Rate Maps (FIRM), FEMA Flood Insurance Studies, and Hurricane Evacuation Studies (HES). The FEMA information is most helpful in determining the storm surge associated with a particular return period (i.e., the 100-year flood elevation). The FEMA FIRM map for Cameron Parish indicates that the 100-year base flood elevation for the LNG terminal site ranges from 9.8 to 10.8 feet MLG.

- The HES information is typically derived from the Sea, Lake, Overland Surges from Hurricanes (SLOSH) model, which provides an estimate of storm surge inundation for emergency planning and evacuation purposes. SLOSH modeling by NOAA for the Sabine Lake Basin, which includes the Creole Trail project area, suggests that surge elevations at the LNG terminal site are not expected to exceed 15 feet MLG for Category 3 hurricanes.

- As previously noted, Hurricane Audrey is the only Category 4 hurricane to make landfall within 40 miles of the Creole Trail LNG terminal site in the last 140 years, and Hurricane Rita was the second Category 3 hurricane to make landfall within 40 miles of the site during the same time period. Based on the recorded history of hurricanes in the Gulf of Mexico, the estimated return period for a Category 3 hurricane such as Hurricane Rita to make landfall in proximity to the project area ranges from 32 years at Port Arthur, Texas, to 53 years at Lafayette, Louisiana (NOAA, 2005).

- Wave analyses indicate that wind-driven waves generated near the Creole Trail LNG terminal site during a Category 3 hurricane could be as high as 8.4 feet depending on the direction of the wind and other site factors. Creole Trail notes, however, that it is probable that waves would actually

be much smaller at the LNG terminal site due to conservatism within the wave models. According to the FEMA FIRM map for Cameron Parish, the LNG terminal site is classified as a AE-Zone, in which waves are not expected to exceed 3 feet during the 100-year event.

Based on the results of the Shiner Moseley study and its site visit, Creole Trail does not intend to change its proposed design basis. As proposed, critical infrastructure components such as process equipment, piping, power generators, utilities, electrical equipment, the control room, and electrical cable runs would be installed on piled platforms. The formed concrete bottoms of the platforms would be at an elevation of 14 feet MLG, and the platforms would be approximately 2 feet in height. The equipment skids, pipe sleepers, and building base dimensions range in height from 1 to 2 feet. In total, the bottom of installed facilities and buildings would be approximately 17 to 18 feet MLG, or approximately 6 to 7 feet above the FEMA 100-year base flood elevation for the site. The LNG tank containment dikes would have a top elevation of 21 feet MLG (approximately 10 feet above the 100-year flood elevation) and the marine jetties would have an elevation of approximately 27 feet MLG (about 16 feet above the 100-year flood elevation).

Along the 116.8 miles of pipeline route, about 44.2 miles of the pipeline (38 percent) would be within the 100-year floodplain and considered wet. Therefore, because the pipeline alignment is already inundated with water, the pipeline would not be susceptible to damage from flooding.

Flooding could increase the buoyancy of the pipelines, causing them to rise toward the land surface where they may be exposed. Flooding could also increase the potential for stream scour to occur, again potentially exposing the pipelines in stream crossings. These risks would be reduced by implementing normal construction techniques including the use of concrete-coated pipe or other means to weight the pipe in wet areas and installing pipelines beneath major streams by the HDD method. In information filed after the recent hurricanes, Creole Trail stated that the proposed pipeline buoyancy control measures would be adequate for the level of flooding sustained during the hurricanes. Creole Trail would operate and maintain their facilities in accordance with the DOT requirements outlined in 49 CFR Part 192. Maintenance of the pipelines would include regular visual inspection of the entire right-of-way to identify any soil erosion, exposed pipe or other flood-related damage, and terrace repair and backfill replacement.

4.1.3.6 Shoreline Erosion

Louisiana is experiencing the highest rates of coastal erosion and wetland loss in the United States (Ruple, 1993). Rates of coastal land loss in Louisiana have increased from approximately 4 to more than 40 square miles per year over the past century. Average coastal erosion rates are approximately 16 feet per year in Louisiana and 6 feet per year along the northern Gulf of Mexico shoreline. However, the most serious erosion and land loss are occurring in the eastern part of the coastal area, east of Atchafalaya Basin (USGS, 2003). Erosion and land loss have also been documented in the Calcasieu Lake area and interior marsh water bodies, where erosion-related breaching of the shorelines and levees can expose the fragile interior marshes to increased water exchange and saltwater intrusion, and result in the loss of surface layers of organic material (National Wetlands Research Center, 2005).

At the proposed LNG terminal site, the potential for shoreline erosion to occur would be minimized in the areas of the tugboat slip and marine berth by utilizing articulated concrete block mats, bulkheads, and/or geotextile materials. Creole Trail would utilize one or more of the following methods to monitor areas of the shoreline for erosion and, based on the monitoring results, implement corrective actions, if necessary, to prevent significant shoreline erosion:

- Environmental Inspectors would evaluate the shoreline areas for active and potential erosion during construction and make recommendations to stabilize areas of concern;

- If shoreline erosion is suspected or observed, aerial surveys and aerial photographs would be taken to document and monitor possible erosion areas and the rate of erosion. Aerial photography would be compared to pre-construction aerial photography to compare and determine the amount of erosion occurring;

- Topographic surveys of the shoreline would be completed prior to and following construction; and

- During construction and operation of the facility, Creole Trail anticipates hiring coastal engineers or surveyors to monitor and evaluate the site for erosion.

The banks of the Calcasieu Ship Channel that border the project area also experience erosion from the wakes of ships that regularly use the channel. While ship traffic can contribute to shoreline erosion, it is not always possible to distinguish between shoreline erosional effects caused by ships and those caused by natural processes. LNG ships calling on the Creole Trail LNG terminal would be among the largest vessels to use the Calcasieu Ship Channel. Larger size generally equates to greater bank erosion potential. However, LNG ships are restricted to lower speeds that tend to lessen erosional effects. By operating the LNG ships at specified lower speeds shoreline erosion due to passage of the LNG ships would be minimized. In addition, the pipeline approaches to Calcasieu Lake and the crossings of the Calcasieu Ship Channel would be accomplished by the HDD method, thereby avoiding disturbance of shorelines and minimizing direct construction-related erosion in these areas.

During its October 2005 site visit to assess impacts of recent hurricanes on the LNG terminal site, Creole Trail did not observe major erosion of the shoreline or changes in shoreline characteristics. A post-hurricane topographic survey conducted by Creole Trail did not identify significant changes in the shoreline gradient.

4.1.3.7 Slope Stability and Load-Bearing Capacity

Pre-existing natural and man-made slopes would be encountered during construction of the proposed project. The project area is characterized by low slopes and soils that are not conducive to slope instability (Natural Resources Conservation Service (NRCS), 1967, 1980, 1988, 1995, 2002 and 2003; USGS, 1978). Therefore, instability of pre-existing slopes would not be expected to affect the proposed project.

Significant slopes would be created at the LNG terminal that would consist of the banks of the marine berth and the LNG tank impoundment dikes. Instability within these slopes could negatively affect the construction and operation of the proposed project. The load-bearing capacity of soils at the LNG terminal site is a critical element to the safe construction and operation of the facility.

Geotechnical studies were conducted at the proposed LNG terminal site (TWEI, 2005a, 2005b, 2005c). These studies included collecting about 200 soil borings to depths ranging from 20 to 300 feet, excavating 16 test pits to depths of 18 feet, conducting numerous cone penetrometer tests, installing piezometers to monitor groundwater levels, and conducting various field and laboratory analyses to characterize site soil conditions. Preliminary engineering analysis concluded that slopes on the order of 3.5:1 in the marine berth would provide adequate slope stability under static conditions and if the site were to experience the OBE (475-year recurrence interval); but, under the SSE (4,975-year recurrence interval), slope stability factors were near or slightly below 1.0 (TWEI, 2005b). Preliminary engineering

analysis also concluded that the LNG tank impoundment dikes would be stable under all conditions, including the SSE, if constructed with slopes on the order of 2:1 (TWEI, 2005c). However, TWEI (2005b, 2005c) recommended that detailed slope stability studies be conducted in the final engineering stages of the proposed project to confirm that slopes at the LNG terminal site would remain stable under anticipated static and dynamic conditions. **We recommend that:**

- **Creole Trail file with the Secretary the results of the final, detailed slope stability analysis to confirm the stability of the proposed final slopes at the LNG terminal under static and dynamic conditions as recommended by TWEI. Creole Trail should also file any plans developed to implement the recommendations indicated by this study for review and written approval by the Director of OEP <u>prior to beginning construction of the LNG terminal</u>.**

The geotechnical studies also determined that the soft sediments in the upper 65 feet of the LNG site would be unable to support the LNG tanks and other heavy load structures without soil improvement or engineered foundations, and that fill materials placed at the site would undergo primary and secondary settlement.

To address this issue, Creole Trail proposes substantial filling at the LNG terminal site. In the LNG tank area, about 765,000 yd^3 of existing soils (10 to 12 feet deep) would be improved by mixing the soils with lime and fly ash. About 160,000 yd^3 of this material would then be utilized to construct the LNG tank impoundment dikes. Other fill materials would be imported to the site as described in section 4.1.2. Soil that would be removed from above the groundwater level in the berth area would also be utilized as fill, primarily in the process equipment area. Engineering calculations by Creole Trail estimate that as much as 40 inches of primary settlement would be expected during construction of the LNG tank impoundment dikes and approximately 17 inches of settlement would occur in the process area. Secondary settlement would also occur in these areas over a period of 30 to 50 years. Primary settlements would be addressed by increasing the amount of fill during construction to accommodate for the primary settlement. A settlement monitoring system would be installed to measure and record any movement of the LNG tank foundations slabs during construction, hydrostatic testing of the tanks, and operating life of the facility. During operation, tank foundation settlement monitoring would be performed quarterly, or more frequently if observations were to indicate an abnormal change in position.

Due to the soft soil conditions at the site, each LNG storage tank would be constructed on an elevated cap supported by approximately 1,440 deep driven piles. Other components of the LNG terminal, such as the process area, marine berth structures, and most buildings, would also be constructed on deep driven pile foundations.

The geotechnical reports for the site (TWEI, 2005b, 2005c) recommend detailed analysis of the proposed pile foundations as the designs of project components are finalized, and implementation of a field testing program to ensure that the final foundation designs would meet the stringent stability requirements of the LNG tanks and other heavy load structures at the site. To implement these recommendations, Creole Trail would establish the types of piles and the penetration depths during the detailed design phase of the project based on the geotechnical engineering reports and final design criteria. During construction, Creole Trail would implement testing to verify that the pilings, as installed, would safely support the structures. The testing procedures would include test pile installation and pile load testing, observation during production pile installation, and testing of the production piles after installation to confirm the adequacy of the foundations.

By constructing the proposed LNG terminal in accordance with carefully engineered plans that meet all applicable regulatory requirements, and upon FERC review of final slope stability analysis and

foundation designs, the potential for slope instability, settlement, or geotechnically unsuitable soils to significantly affect the proposed terminal would be low.

4.1.3.8 Biogenic Gas

Biogenic gas is typically defined as a combination of methane, nitrous oxide, and dimethyl sulfide (Amouroux et al., 2002). It is produced by bacterial decomposition of organic matter in shallow sediments and may be trapped in place in the underlying geologic formation. When released to the atmosphere, these gases may accumulate in low areas and can be an explosive hazard in poorly ventilated or confined spaces (Swistock and Sharpe, 2004).

Biogenic gas was not found during geotechnical investigations completed at the LNG facility (TWEI, 2005b and 2005c). However, Holocene soils above the Deweyville Terrace contain organics which could possibly produce biogenic gas (TWEI, 2005a). The biogenic gas can be transmitted through shell and shell hash in the upper sediments and could potentially accumulate in buildings at the LNG terminal site. To address the potential for biogenic gas accumulation to occur, Creole Trail would install positive ventilation beneath enclosed buildings and structures that would be occupied and would be located at ground level. Buildings that are elevated would have an air gap between the building foundation and the ground to provide for ventilation. The positive ventilation systems for building at ground level would include an air gap supplied by a granular layer and perforated pipe beneath the ground floor slab to convey any biogenic gas to a suitable atmospheric vent.

Due to the shallow depths of excavations required to construct and operate the pipeline, any biogenic gas present would typically vent to the atmosphere; therefore, no steps would be necessary to reduce this risk during construction.

4.1.4 Paleontological Resources

Paleontological resources have been discovered in southwest Louisiana in the form of Late Pleistocene megafauna (Heinrich, 2001). However, the proposed project area does not contain any known sensitive paleontological resources.

4.2 SOILS

We reviewed information provided by Creole Trail and other published data to evaluate likely project-related impacts on soils within the LNG terminal site as well as along the proposed pipeline routes and associated aboveground facilities. Soils within the proposed Creole Trail Project would be disturbed by grading, excavation, heavy equipment traffic, and the construction and operation of aboveground structures. Issues to be addressed include disturbance of areas considered to be prime farmland, soil compaction, erosion and sediment control, and revegetation concerns.

To address potential impacts on soil resources in the project area, Creole Trail would implement our Plan and Procedures. Some of the relevant mitigation measures specified in our Plan and Procedures include requirements to:

- segregate a maximum of 12 inches of topsoil in all actively cultivated or rotated croplands, pastures, residential areas, hayfields, and at other areas at the request of the landowner or land management agency;
- provide temporary erosion and sediment control measures such as silt fence, straw bales, slope breakers, seeding, mulch, and erosion control fabric to minimize any impacts related to soil erosion and sedimentation that may result from precipitation runoff;
- mitigate soil compaction following construction and right-of-way restoration activities;
- ensure revegetation of all areas disturbed by project-related activities. Disturbed upland areas would be seeded in accordance with written recommendations from local conservation authorities or as requested by the landowner;
- provide post-construction monitoring of mitigation practices to ensure their success; and
- utilize EIs to ensure implementation of the practices outlined above.

Our Plan states that the construction right-of-way width in upland areas should not exceed 75 feet or the width described in the FERC application. The Plan also allows for up to an additional 25 feet of right-of-way width where required for topsoil segregation or where required by site-specific soil or topographic conditions. Creole Trail has proposed a 135-foot-wide construction right-of-way for Segments 2 and 3 to accommodate construction of the dual pipelines, and a 150-foot-wide right-of-way where topsoil segregation would be conducted. We agree that the wider construction right-of-way for the dual 42-inch pipelines in uplands would accommodate the dual-pipeline design, the diameter of the pipelines, workspace requirements, and safety considerations for construction personnel. As discussed in section 4.2.1.6, the majority of the soils affected by Segments 2 and 3 are considered to have good revegetation potential, and the implementation of our Plan, which includes measures to ensure successful revegetation, would minimize potential impacts associated with the use of the wider construction right-of-way.

In addition to the wider construction right-of-way, Creole Trail has requested variances to two items in our Plan. Item V.A.1 of the Plan requires that cleanup operations immediately follow backfill, and states that final grading, topsoil replacement, and installation of permanent erosion control structures must be completed within 20 days after backfilling the trench. Item V.D.3.d requires that seeding of disturbed soils be conducted within 6 working days of final grading. Creole Trail has requested variances to these two items to allow for the sequential construction approach proposed for the dual pipelines (see section 2.3.2.1). Using this approach, Creole Trail would first clear and grade the entire construction right-of-way in a given spread in preparation for the construction of the first pipeline, and install erosion

and sedimentation control measures as specified in our Plan and Procedures. Creole Trail would construct the first of the dual pipelines within a given spread through backfill and rough cleanup, then equipment and crews would return to the beginning of the spread to construct the second pipeline.

Because the right-of-way would be disturbed a second time for construction of the second pipeline, Creole Trail proposes to maintain temporary erosion control measures installed for the first pipeline during construction of the second pipeline, and to conduct final cleanup, stabilization, and seeding within 6 days of backfilling the second pipeline.

Creole Trail estimates that the average and maximum amount of time between backfilling the first and second pipelines within a given spread would be 45 and 60 days, respectively. To minimize the potential for erosion and sedimentation during this period, Creole Trail would stabilize the construction right-of-way until the second line is installed by applying a NRCS-approved seed mix within 10 days of backfilling the trench. Creole Trail would consult with the NRCS and other interested stakeholders (e.g., landowners, FWS) to identify appropriate seed mix(es) within the various habitat types along the pipeline corridor. Creole Trail committed to filing the results of these consultations with the Commission for review. Creole Trail would maintain all erosion and sedimentation control devices until the second line is installed and final restoration achieves at least 80 percent vegetation cover as compared to adjacent, undisturbed areas. We recognize that any permanent erosion controls installed or seeding conducted over the first pipeline immediately after backfill and grading would likely be disturbed and rendered ineffective during construction of the second pipeline. Therefore, we grant the requested variances for pipeline Segments 2 and 3.

4.2.1 Soil Resources

Soils are typically described in terms of their series, slope, and physical characteristics (e.g., drainage class, permeability, texture, etc.). Soils in the area of the proposed LNG terminal site and pipeline routes are described in the following sections.

Among the various soil characteristics discussed in these sections is the potential to encounter contaminated soils during construction of the proposed LNG terminal and pipelines. Although this potential is determined to be relatively low, mismanagement of contaminated materials encountered during construction could result in impacts on soils and other sensitive resources. To ensure that personnel working on the project are prepared to deal appropriately with an unanticipated encounter with contaminated soils, **we recommend that:**

- **Creole Trail prepare a Plan for the Discovery and Management of Contaminated Soils and Groundwater for the proposed Creole Trail Project. This plan should comply with applicable state and federal regulations and should include procedures for the identification and management of unknown contaminants if any are encountered during construction of the proposed LNG terminal and pipeline facilities. The plan should be filed with the Secretary for review and written approval by the Director of OEP <u>prior to construction</u>.**

LNG Terminal

The soils within the approximately 772-acre site that Creole Trail would lease for the LNG terminal consist of four different soil mapping units (Udifluvents, Aquents, Bancker, and Creole soils). Approximately 315.4 acres of soil within this larger site would be affected during construction of the LNG terminal. These soils consist of about 226.7 acres of Udifluvents and 88.7 acres of Aquents. Following construction, approximately 22.4 acres of Udifluvents and 101.3 acres of Aquents would be

encompassed within the footprint of the facility components (e.g., marine facilities, structures, process areas, roads, etc.).

According to the soil survey of Cameron Parish (U.S. Department of Agriculture (USDA), 1995), Udifluvents consist of sandy, loamy, and clayey soil materials that were dredged from coastal marshes during construction and maintenance of existing, nearby navigable waterways (e.g., Calcasieu Ship Channel). These soils are present on spoil banks of varying height and are generally 1 to 15 feet higher than surrounding soils in the marshes. Soils formed from these dredge spoils are stratified and are firm or friable throughout. Internal drainage and slope vary, and the land surface is generally uneven. Permeability is low to moderate and water runs off the surface at a slow to rapid rate, depending on slope. These soils are slightly to very slightly saline.

Similarly, Aquents consist of loamy and clayey soil materials that were dredged from coastal marshes during construction and maintenance of existing, nearby navigable waterways. Theses soils are found in marsh areas and are slightly higher than the surrounding soils. Aquents are frequently flooded and include areas of very fluid mineral soils with organic surface horizons. These soils have slopes that are generally less than 1 percent. The permeability of these soils is very slow and water runs off the surface at a very slow rate. Aquents in Cameron Parish are slightly to moderately saline.

Construction and operation of the LNG terminal site would permanently convert 315.4 acres of land to a commercial/industrial use, 123.7 acres of which would be occupied by the facility components and the remainder of which would be maintained in an herbaceous condition. Soil impacts, however, would be minor due to the fact that the soils are not designated as prime farmland and have already been affected by previous dredge disposal activities as well as by oil and gas exploration and production. The Aquents are not considered highly erodible land (HEL) or potentially highly erodible land (PHEL). The Udifluvents located along the edge of the Calcasieu Ship Channel, however, are considered PHEL. PHEL consists of those soils that have the potential to be highly erodible, but cannot be designated as highly erodible land without a field determination of slope percent and length. Erosion and sedimentation at the proposed terminal site would be controlled and mitigated through implementation of measures specified in our Plan and Procedures. These measures would include temporary and permanent erosion and sedimentation control measures to prevent the movement of sediment into the Calcasieu Ship Channel and other adjacent water bodies and sensitive wetland areas.

Based on the results of soil and sediment sampling and analysis conducted by Creole Trail in April 2005, the soils and sediments within the proposed dredging footprint for the LNG marine facilities are not contaminated. An abandoned aboveground petroleum storage tank battery would be removed from the construction footprint during construction of the proposed terminal. See section 4.8.1.1 for additional information regarding removal of this abandoned facility.

Pipeline Facilities

The proposed pipeline routes would cross the Southern Mississippi Valley Silty Uplands, Gulf Coast Prairies, Gulf Coast Marsh, and Western Gulf Coast Flatwoods Major Land Resource Areas (MLRAs). The dominant soils in the Southern Mississippi Valley Silty Uplands and Western Gulf Coast Flatwoods MLRA's are Udalfs. The dominant soils in the Gulf Coast Prairies MLRA are Uderts in the western and central portions and Aqualfs in the eastern portion. The dominant soils in the Gulf Coast Marsh MLRA are Aquolls, Saprists, Aquents, and Hemists. Seventy-eight percent of the soils that would be crossed by the pipelines are somewhat poorly drained or wetter. More well drained soils (about 22 percent of the pipeline routes) are limited to the area generally north of Calcasieu Lake along Segment 3. The percentages calculated for the drainage classes do not include soils classified as Udifluvents because they are not assigned a drainage class. These soils account for less than 1 percent of the soils crossed.

4.2.1.1 Soil Characteristics

Soils along the pipeline routes were evaluated for characteristics that could affect pipeline construction or increase the potential for construction-related soil impacts. Table 4.2.1-1 provides a summary of the significant soil characteristics that would be crossed by the pipeline routes in each parish. Individual soil characteristics are discussed separately below.

TABLE 4.2.1-1

Acreage of Soil Characteristics Affected by the Creole Trail Pipeline Right-of-Way [a]

Segment/ Parish	Total	Prime Farmland [b]	Hydric Soils [b]	Compaction Prone [c]	Highly Erodible Land [d]	Revegetation Concerns [e]
Segment 2						
Cameron	43.1	4.6	33.9	9.2	4.6	0.0
Calcasieu	70.8	52.3	26.2	52.3	1.5	0.0
ATWS	11.1	2.8	3.1	2.8	6.0	0.0
Segment 3						
Calcasieu	376.5	300.0	192.8	246.2	20.3	70.6
Beauregard	157.6	135.0	71.0	83.4	135.0	8.4
Allen	332.9	268.0	115.7	196.9	142.7	30.9
Jefferson Davis	226.9	202.4	33.6	210.4	57.6	0.0
Acadia	442.3	417.1	113.7	398.0	41.8	5.9
ATWS	65.2	56.4	22.5	50.6	20.8	2.6
Pipeline Total	1,726.4	1,438.6	612.5	1,249.8	430.3	118.4

[a] Acreage is based on a 135-foot-wide construction right-of-way for Segments 2 and 3, as well as ATWS. An additional 15-foot-wide construction right-of-way would be used in agricultural areas where top soil segregation is required. The area affected does not include access roads. Values within a row do not add up to the total listed in the total column because soils may occur in more than one characteristic class or may not occur in any class listed in the table.

[b] As designated by the NRCS.

[c] Includes soils in somewhat poor to very poor drainage classes with surface textures of sandy clay loam and finer.

[d] Includes soils with slopes greater than 8 percent and soils designated by NRCS as highly erodible and potentially highly erodible land.

[e] Includes soils that have a slope greater than 8 percent, are very strongly acid (pH less than 5.0), or have 15 percent (or greater) coarse fragments in the surface layers.

ATWS = additional temporary workspace.

Creole Trail has identified seven wareyards that would be used during the construction of the proposed project. These wareyards would affect a combined 222.0 acres of developed land (a total of 2.3 acres of wetlands are also present within two of the yards, but would be protected and avoided during use of the yards). This land has been previously developed so no additional impacts on the soils would be expected. Seventy-two percent of the soils within the wareyards are considered prime farmland. However, because these soils have been previously affected by development and none are actively cultivated, no additional impacts on prime farmland would be expected. Only 1 percent (2.9 acres) of the soils within the wareyards has revegetation concerns. Ninety-one percent of the soils within the wareyards are not considered to have a high potential for erosion by water and none of the soils are considered susceptible to wind erosion. Nevertheless, erosion control procedures and restoration of vegetation would be implemented where appropriate, thereby further minimizing potential impacts on soils and adjacent resources.

4.2.1.2 Prime Farmland

The USDA defines prime farmland as "land that is best suited to food, feed, fiber, and oilseed crops" (USDA, 1993). This designation includes cultivated land, pasture, woodland, or other lands that are either used for food or fiber crops or are available for these uses. Urbanized land and open water are excluded from prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., artificial drainage).

Forty-eight percent (59.7 acres) of the soils that would be crossed by Segment 2 are considered to be prime farmland. Eighty-six percent (1,378.9 acres) of the soils that would be crossed by Segment 3 are considered prime farmland. None of the prime farmland soils that would be crossed by Segment 2 are actively cultivated. However, about 655.4 acres of the prime farmland that would be affected by construction of Segment 3 are actively cultivated for rice and crawfish production.

Impacts on prime farmland from construction of the proposed pipelines could include interference with agricultural drainage (if present), mixing of topsoil and subsoil, and compacting and rutting. These impacts would result primarily from trench excavating and backfilling, and vehicular traffic along the construction right-of-way. With proper mitigation, these impacts would be temporary and would not result in permanent conversion of prime farmland to non-agricultural uses.

Creole Trail would minimize impacts on prime farmland by constructing the pipelines in accordance with our Plan and Procedures. Mitigation measures employed to minimize impacts on prime farmland would include topsoil segregation, compaction relief, removal of excess rock, and restoration of agricultural drainage systems. Any drain tiles, culverts, or other items damaged during construction would be repaired or replaced to preconstruction conditions. Adherence to these measures would minimize impacts on prime farmland and other agricultural land and would promote the long-term productivity of the soil.

4.2.1.3 Hydric Soils

Hydric soils are defined as "soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (Federal Register, July 13, 1994). Soils that are artificially drained or protected from flooding (e.g., by levees) are still considered hydric if the soil in its undisturbed state would meet the definition of a hydric soil. Hydric soils include very poorly, poorly, and some somewhat poorly drained soils. Fifty percent (63.2 acres) of Segment 2 and 34 percent (549.3 acres) of Segment 3 are underlain by hydric soils.

Due to extended periods of saturation, hydric soils can be prone to compaction and rutting as discussed below. In addition, high groundwater levels associated with hydric soils could create a buoyancy hazard for the pipeline. Creole Trail would minimize rutting of hydric soils by using construction mats where hydric soils cannot support equipment and/or employing low-ground-weight equipment according to our Procedures. Special construction methods such as concrete coating of pipe and other weighting methods would be used to overcome buoyancy hazards during operation of the pipeline.

4.2.1.4 Compaction Potential

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of soils. Construction equipment traveling over wet soils could disrupt the soil structure, reduce pore space,

increase runoff potential, and cause rutting. The degree of compaction depends on moisture content and soil texture. Fine-textured soils with poor internal drainage that are moist or saturated during construction are the most susceptible to compaction and rutting. The majority of the soils that would be affected by the proposed pipelines are prone to compaction (see table 4.2.1-1). Fifty-one percent (64.3 acres) of Segment 2 and 74 percent (1,185.5 acres) of Segment 3 are underlain by soils that are prone to compaction.

Creole Trail would minimize compaction and rutting impacts by using measures outlined in our Plan and Procedures (e.g., construction from timber mats, or low-ground-weight equipment) during construction in soft or saturated soils. In addition, EIs could recommend restricting construction activities during unfavorable conditions (e.g., wet weather) to further reduce compacting and rutting. Compaction impacts would be mitigated through the use of deep tillage operations during restoration activities using a paraplow or similar implement.

4.2.1.5 Erosion

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

All of the soils that would be crossed by Segment 2 have a wind erodibility group (WEG) classification of three or higher and are therefore not susceptible to wind erosion. Only about 1 percent (19.2 acres) of the soils affected by the construction of Segment 3 have a WEG of two or less. The mucks and mucky clays that would be crossed were not assigned a WEG classification by the NRCS because they are not considered susceptible to wind erosion due to the organic/hydric nature of the soil materials at the surface. None of the soils along the proposed pipeline routes are considered HEL. Only about 10 percent (12.1 acres) of the soils that would be affected by construction of Segment 2 are considered PHEL (see table 4.2.1-1). These soils are located in the dredge spoils (Udifluvents) along the Calcasieu Ship Channel. Twenty-six percent (418.2 acres) of the soils that would be affected during construction of Segment 3 of the proposed pipelines are considered PHEL.

Creole Trail would use prescribed erosion control devices (e.g., silt fence, hay bales) and construction practices as specified in our Plan and Procedures to minimize erosion during and after construction activities. Temporary erosion control devices would be installed immediately after initial ground disturbance and monitored as required throughout construction (e.g., daily in areas of active construction, weekly in areas with no active construction). Erosion and sedimentation controls on the pipeline right-of-way would be inspected and maintained as necessary until final stabilization was achieved. Creole Trail would also implement dust mitigation measures, including the use of water trucks to moisten the right-of-way, to reduce impacts from wind erosion.

4.2.1.6 Revegetation

Successful restoration and revegetation are important for maintaining soil productivity and protecting the underlying soil from potential damage, such as erosion. Soils that are highly acidic (pH less than 5), have a slope greater than 8 percent, and/or with greater than 15 percent coarse fragments (rocks and stones) in the surface layer would create revegetation concerns. Highly acidic soils create an

unfavorable environment for establishment of many plant species. Similarly, steep slopes and stony surfaces may make the establishment of vegetation difficult. There are no rocky/stony soils within approximately 5 feet of the surface that would create revegetation concerns. The NRCS does not provide chemical or physical data for the soils mapped as Udifluvents due to the fact that it is a broad classification. Based on aerial photography however, it is apparent that the areas within the project footprint mapped as Udifluvent can revegetate naturally. Based on the above criteria, none of the soils that would be affected by the construction of Segment 2 have revegetation concerns. Only 7 percent (118.4 acres) of Segment 3 is underlain by soils with potential revegetation concerns.

In accordance with our Plan and Procedures, Creole Trail would mitigate the effects of poor revegetation potential by applying fertilizer, pH modifiers, and using mulch (where appropriate) to create a favorable environment for the re-establishment of vegetation. Creole Trail would apply a seed mixture developed through consultation with the NRCS and in accordance with landowner agreements to reestablish vegetation following final grading.

4.2.1.7 Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination are typically minor because of the low frequency and volumes of spills and leaks. Creole Trail would develop a SPCC Plan prior to construction that specifies cleanup procedures in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents. Creole Trail would implement its SPCC Plan to prevent and contain, if necessary, accidental spills of any material that may contaminate soils, and to ensure that inadvertent spills of fuels, lubricants, or solvents are contained and cleaned up in an appropriate manner.

Creole Trail conducted a Hazardous Materials Data Base search (Environmental FirstSearch, 2004 and 2005) along the proposed pipeline routes. No potential sources of contamination were identified along Segment 2. However five Resource Conservation and Recovery (RCRA) Information System Large and Small Quantity generators were identified within 0.25 mile of the proposed construction work area along Segment 3. Although the potential to encounter contaminated soils during pipeline construction is relatively low, mismanagement of contaminated materials encountered during construction could result in serious impacts on soils and other sensitive resources. To ensure that project personnel are prepared to deal appropriately with an unanticipated encounter with contaminated soils, we have recommended that Creole Trail prepare a Plan for the Discovery and Management of Contaminated Soils and Groundwater for the proposed project (see section 4.2.1).

4.2.1.8 Aboveground Facilities

None of the proposed aboveground facilities would affect an area of 5 acres or greater. The Bridgeline/ANR M&R station, pigging facility, and MLV at MP 0.0 of Segment 2 would be within the LNG terminal site and would not represent an additional impact on soils. The remaining aboveground facilities would all be located in areas classified as prime farmland. Construction of the aboveground facilities would affect about 7.6 acres of prime farmland in addition to that affected by the pipeline construction rights-of-way; however, none of these temporary work areas are actively cultivated. Operation of the M&R stations would permanently affect about 10.6 acres of prime farmland outside of the permanent pipeline right-of-way (all on Segment 3), of which about 2.8 acres are actively cultivated. Operation of the five MLVs that are not associated with other aboveground facilities (one MLV on Segment 2 and four MLVs on Segment 3) would permanently affect prime farmland within the permanent pipeline right-of-way; however, only the MLV at MP 63.6 on Segment 3 would be located in an actively cultivated area. Prime farmland soils affected by the operation of aboveground facilities would be permanently converted to non-agricultural use and removed from future production. However, the impact

of the aboveground facilities on prime farmland soils would be minimal given that there are more than 2 million acres of soils designated as prime farmland in the six parishes crossed by the proposed pipeline routes. Most of the soils contained within the aboveground facilities are not susceptible to erosion, so adverse impacts on nearby sensitive resources from erosion and sedimentation would be expected to be minor. However, erosion control procedures and restoration of vegetation would be implemented where appropriate, thereby further minimizing potential impacts on soils and adjacent resources.

4.2.2 Subsurface Sediments

LNG Terminal

Construction of the LNG terminal would require dredging of sediment to create the proposed marine facilities. The marine basin would be dredged to an elevation of 45 feet below MLG, with up to an additional 2 feet of overdredge allowance. Dredging of the marine basin would require the removal of about 4,046,400 yd^3 of sediment (including the overdredge material) consisting of fine-textured clays and silts. In addition to the dredging, construction of the marine basin would require the removal of 51,100 yd^3 of surficial materials (located generally above the local water table) prior to initiation of dredging operations. This surface material, which consists of sandy, loamy, and clayey soil materials deposited at the site as part of dredged material disposal activities connected with routine maintenance of the Calcasieu Ship Channel, would be reused on the LNG terminal site as structural fill. The tugboat dock would be dredged to an elevation of 25 feet below MLG, with a 2-foot overdredge allowance. Construction of the tug boat dock would require removal of an additional 79,400 yd^3 of sediment (including the overdredge material). The total volume of dredged material would be about 4.1 million yd^3 of sediment.

The dredged material would be removed using a cutter head suction dredge. Studies by the COE indicate that cutter head dredging generally results in lower sediment resuspension than other forms of dredging (e.g., clamshell or hopper barge) (COE, 1986; COE, 1988). The dredged material generated from LNG terminal construction would need to be beneficially used in accordance with Louisiana law (Louisiana Revised Statute 49:214.32(F)(1)). As part of the mitigation that would be required, Creole Trail would prepare a beneficial use plan. The beneficial use plan will be included as part of Creole Trail's ARMP, which Creole Trail is currently developing in consultation with the COE and other appropriate agencies. See section 4.4.3 for further discussion of Creole Trail's ARMP. Creole Trail's draft ARMP is provided in Appendix E.

Creole Trail conducted limited sampling and analysis of a portion of the sediment contained within the proposed marine basin at the LNG terminal site (see figure 4.2.2-1). The sampling and analysis were conducted in accordance with methodology described in the EPA/COE Regional Implementation Plan (EPA/COE, 2003). These samples included eight surficial sediment samples in upland areas within the existing DMPA proposed for the marine facilities, and three samples of near-shore sediment at areas within and adjacent to the Calcasieu Ship Channel that would be deepened by the proposed dredging. Based on consultations with the COE, Creole Trail understands that existing soils within the site are composed of dredged material from historic routine dredging of the Calcasieu Ship Channel. For testing purposes, it was anticipated that the depth of the dredge material was no more than 5 feet, and that any sediment contamination would be observed within this horizon. Creole Trail's consultants confirmed that the maximum depth of fill was no more than 5 feet and characterized the lower soil horizon, or parent material, as a dark gray Beaumont Clay.

Based on the results of its analysis, Creole Trail concluded that the dredge material that would be associated with construction of the marine basin would be suitable for beneficial use (see below for further discussion of sampling results). However, during preparation of the draft EIS, the COE indicated

that dredged material to be used beneficially or disposed of in waters of the United States must also be evaluated under the protocol of the EPA/COE *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual* (Inland Testing Manual). Creole Trail stated that it was consulting with the LADEQ, EPA, and COE to verify its conclusions, and has committed to providing any additional consultations or clearances to the Commission upon receipt. As discussed below, the EPA subsequently filed comments on the draft EIS expressing concerns about the potential for the proposed dredging to adversely affect the aquatic environment and recommending additional evaluation for one of Creole Trail's sampling stations.

The former dredged materials contain generally low (i.e., less than 20 parts per million) to very low (i.e., less than 10 parts per million) concentrations of the 11 metals that were analyzed. Most of the samples returned results that were below the detection limits for all 13 polycyclic aromatic hydrocarbons (PAH) analyzed. Only one sample from a single core, sample CTL-04M, contained measurable concentrations of several PAHs.

In its comments on the draft EIS, the EPA stated that three of the PAHs present in elevated concentrations in sample CTL-04M are considered to be highly bioaccumulative. The concentrations of these PAHs ranged between the Effects Range Low and the Effects Range Medium sediment guidelines. The EPA stated that the sediment quality guidelines themselves do not indicate a direct relationship to toxicity, but that they provide evidence for concern and the need for further information. Therefore, the EPA recommended that Creole Trail conduct Tier III evaluation for stations CTL-04M as described in the Inland Testing Manual. Tier III testing involves both biological and chemical testing, which the EPA indicated would provide a more complete analysis of the dredge material and would help clarify the potential for the proposed dredging activities and beneficial use of the dredged material to adversely affect the aquatic environment. To further evaluate the potential environmental impacts associated with dredging and to address the concerns expressed by the EPA, **we recommend that:**

- **Creole Trail consult further with the EPA and the COE regarding the need to conduct a Tier III evaluation, as described in the Inland Testing Manual, for sampling station CTL-04M. Creole Trail should file copies of all associated communications with the COE and EPA, as well as the results of any additional testing or evaluation if applicable, with the Secretary <u>prior to dredging at the LNG terminal</u>.**

The sediment from the Calcasieu Ship Channel contains generally low concentrations of metals (most less than 20 parts per million) and no detectable PAHs. Elutriate testing performed to estimate the possible release of chemical constituents to the water column during dredging operations indicates that none of the identified metals would be released at concentrations that would exceed Louisiana state water quality standards or criteria. Thus, the near surface sediment from the margins of the existing ship channel would pose little if any risk to water quality as a result of dredging to construct the marine basin facilities.

Dredging operations to excavate the ship berth would suspend sediments and affect water quality. In general, dredging-related water quality impacts would include both the physical effects of suspended sediment and alterations of water chemistry due to the release of various chemical constituents associated with the sediment (see section 4.3 for further discussion of water quality impacts).

Non-Internet Public

ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED
CREOLE TRAIL LNG TERMINAL
AND PIPELINE PROJECT
Docket Nos. CP05-360-000, CP05-357-000,
CP05-358,000, CP05-359-000

Figure 4.2.2-1 Sediment Sampling Sites

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

Pipeline Construction

Pipeline construction across Calcasieu Lake would require the dredging and excavation of about 2,575,596 yd^3 of lake bottom sediment. Construction barges needed to install the pipeline across the lake require 6 to 7 feet of draft. In those areas of the lake with less than 8 feet of water depth, a floatation channel would need to be dredged to accommodate the construction barges. Sediments excavated to install the pipeline would be temporarily stored in the lake adjacent to the floatation channel and pipeline ditches. After the pipeline installation is complete, the pipe trench and floatation channels would be backfilled and the lake bottom contours returned to preconstruction conditions to the maximum extent practicable.

Dredging and excavation operations necessary to install the pipeline through Calcasieu Lake would suspend sediment and affect water quality and aquatic resources. In addition to the impacts resulting from initial dredging of the floatation channel and excavation of the pipe trenches, temporary storage of the dredged and excavated materials within the lake would also result in prolonged exposure of stock-piled sediments to wave and wind action. These lake processes could result in additional impacts on water quality and aquatic resources. These impacts are discussed further in sections 4.3.2 and 4.6.2 of this EIS.

4.3 WATER RESOURCES

4.3.1 Groundwater

4.3.1.1 Hydrogeologic Setting

The proposed project area is located above the Coastal Lowlands Aquifer System, which underlies most of the Gulf Coast from southern Texas to the Florida panhandle. The Coastal Lowlands Aquifer System is one of the most extensively used aquifer systems in the southern United States, yielding large quantities of water for agricultural, commercial, industrial, and public/domestic supplies (Renken, 1998).

The mapped hydrologic unit underlying the project area is the Chicot Aquifer, the principle sub-aquifer system of southwestern Louisiana (Lovelace et al, 2004). The Chicot Aquifer system underlies about 9,900 square miles of Louisiana, extending west from the Atchafalaya River into southern Texas and south to the Gulf of Mexico. The landward boundary of the aquifer consists of outcrop areas where the aquifer system feathers out at a point of contact with the underlying Vicksburg-Jackson confining unit (Lovelace et al., 2004). The Gulf-ward boundary is near the coastline where the water becomes increasingly saline and the upper boundary is the land surface (Ryder, 1996).

The Chicot Aquifer is the most heavily pumped aquifer system in southwestern Louisiana and provides approximately 800 million gallons of water per day for a variety of uses. The primary use is for agriculture (68 percent), in particular, rice irrigation. Other uses include public water supply (11 percent), industrial (9 percent), aquaculture (8 percent), power generation (2 percent), and other (2 percent) (LSU AgCenter, 2001).

The Chicot Aquifer ranges from 50 to 1,050 feet in thickness and is composed of Pleistocene interbedded sands, silt, gravel, and clay deposited in fluvial, deltaic, and near-shore marine environments. In Cameron, Beauregard, Jefferson Davis, and Acadia Parishes, east of Calcasieu Lake and to the north, the Chicot Aquifer is subdivided into three water-bearing sand units: the Atchafalaya Aquifer, the Upper Sand, and the Lower Sand. Water quality is highest in the Lower Sand unit in eastern Cameron and Vermillion Parishes and is suitable for domestic use. In Calcasieu and Cameron Parishes, west of Calcasieu Lake, the Chicot Aquifer is also subdivided into three water-bearing sand units, the “200-foot,” “500-foot,” and “700-foot” sands. Water quality is better in the “500-foot” and “700-foot” sands and is suitable for domestic use. However, in western Cameron Parish, all three sand layers are affected by saltwater intrusion (Nyman, 1989). In southwestern Louisiana, the Chicot Aquifer is designated as an EPA Sole Source Aquifer.

Within the proposed project area, the Chicot Aquifer is overlain by surficial groundwater resources within discontinuous, near-surface sand beds. At the proposed Creole Trail LNG terminal site, geotechnical soil borings encountered shallow groundwater at depths of approximately 5 to 10 feet below ground surface. Shallow groundwater would also be expected to occur along the majority of the proposed pipeline routes. The surficial water-bearing units are typically thin and not important as aquifers (LGS, 1960).

4.3.1.2 Water Wells and Springs

Creole Trail reviewed the Louisiana Department of Transportation and Development (LADOTD) well database and conducted field surveys to determine whether any water supply wells are present in the vicinity of the proposed LNG terminal or pipeline routes. No private or public water supply wells were identified within 200 feet or 400 feet, respectively, of the proposed LNG terminal construction work area.

Creole Trail has completed field verification surveys of approximately 94 percent of the lands within 150 feet of the pipeline rights-of-way to identify water wells that could be affected by construction of the proposed pipelines. Based on these surveys, no public water supply wells are located within 150 feet of the proposed construction rights-of-way. However, the following four private water supply wells were identified within 150 feet of the construction right-of-way along proposed pipeline Segment 3:

- MP 71.9, off-line tract, well located 125 feet north of temporary workspace across Parish Line Road;
- MP 84.6, tract LA-AC-107.000, well located 24 feet north of temporary workspace;
- MP 84.7, tract LA-AC-108.000, well located 60 feet south of temporary workspace; and
- MP 86.4, tract LA-AC-119.000, well located 96 feet north of temporary workspace.

Creole Trail has indicated that the remaining 6 percent of land (about 7.2 miles) would be surveyed for the presence of water supply wells once access to these properties is granted. Creole Trail has committed to filing the results of these surveys with the Commission.

The State of Louisiana Wellhead Protection and Source Water Protection Program designates Aquifer Protection Areas and establishes Wellhead Protection Areas around each public water supply well or well field in the state. No Aquifer Protection Areas would be affected by the proposed LNG terminal or pipeline routes, and no Wellhead Protection Areas would be affected by the LNG terminal. However, pipeline Segment 3 would cross nine Wellhead Protection Areas (see table 4.3.1-1). Based on correspondence with the LADEQ, there are no land use restrictions or special construction and operational procedures required within established Wellhead Protection Areas.

Due to the absence of consolidated bedrock near the surface of the project area, no blasting is anticipated for construction of the proposed facilities; therefore, no impact on area wells from blasting would occur.

To protect existing water supply wells in the vicinity of the proposed pipelines, Creole Trail would reduce the construction workspace as practicable to provide a buffer to those wells within 150 feet of the construction work area. Creole Trail would use mats or pads in those work areas where the route crosses water well piping to ensure the piping is not damaged during construction. Creole Trail has also proposed the following additional measures to protect existing water supply wells and to ensure no disruption of water supply to affected well users:

- For wells located within 150 feet of the construction right-of-way, Creole Trail would conduct pre- and post-construction monitoring, with the well owner's permission, to determine baseline water quality conditions and potential impacts on the well as a result of pipeline construction;
- Should any well or water supply be adversely affected, Creole Trail would provide users with a temporary source of water until the original water source has been reestablished; and
- As described in section 4.3.1.3, Creole Trail would implement a project specific SPCC Plan to prevent, minimize, or clean up any accidental or inadvertent spills of fuels, lubricants or hazardous materials during project construction.

TABLE 4.3.1-1

Wellhead Protection Areas Crossed by the Proposed Creole Trail Project Pipelines

Segment/ Facility/ LDOTD Well ID [a]	Owner Operator	MP 1	MP 2	Well Type	Depth	Aquifer System	Distance from construction Right-of-Way (feet)	Direction of Well from Right-of-Way [b]
Segment 3								
1121	Carlyss Recreational Center	0.9	2.5	PWS	222	Chicot	3,171	N
1236	CU WW District 9	3.2	4.6	PWS	554	Chicot	2,645	N
1237	CU WW District 9	3.6	5.1	PWS	546	Chicot	2,678	N
1076	Palermo Real Estate	3.3	5.1	PWS	190	Chicot	2,609	N
1077	Palermo Real Estate	3.6	5.2	PWS	190	Chicot	2,716	N
6164Z	Jeanet Mathis	28.8	30.7	PWS	260	Chicot	1,522	NNE
759	Acadia Fire District 4	77.5	79.2	PWS	180	Chicot	2,712	ENE
814	Daniel Fruge	81.8	83.5	PWS	205	Chicot	3,271	ENE
8290Z	El Paso	90.7	91.5	PWS	170	Chicot	1,889	ENE

[a] LADOTD water well data for the proposed project area derived from Public and Private Water Supply Wells, Banks Information Solutions, Inc (2005).

[b] N = North
NNE = North Northeast
ENE = East Northeast

We believe that implementation of the above measures would provide adequate protection to existing groundwater supply wells in the vicinity of the proposed project during pipeline construction.

Field surveys also identified three water irrigation outlets within the proposed permanent right-of-way along proposed Segment 3, and two additional water irrigation outlets within proposed temporary workspace along Segment 3. Creole Trail would relocate the irrigation outlets, if necessary, to ensure the continued operation of the irrigation systems.

No springs have been identified within 150 feet of the proposed project. Creole Trail would notify the FERC should any springs be identified as field surveys are completed.

4.3.1.3 Potential Effects of Project Construction

An accidental release of fuels, lubricants, or hazardous materials during the refueling of vehicles and storage of fuel, oil, and other fluids during construction could create a contamination hazard to groundwater resources. Additionally, soil contamination could continue to add pollutants to groundwater long after a spill has occurred.

To avoid and/or minimize the potential for spills or releases of hazardous substances, Creole Trail would implement its project-specific fuels and hazardous materials SPCC Plan in accordance with Item IV (Preconstruction Planning) of our Procedures. Creole Trail has committed to filing its SPCC Plan with the Commission as part of the project-specific Implementation Plan, which would be required to be filed

after the project is authorized and prior to construction. Creole Trail has requested certain variances to our Procedures with respect to the SPCC Plan as discussed in section 4.3.2. The SPCC Plan would:

- Incorporate preventative and mitigative measures that would be used to minimize the potential impacts of a fuel or hazardous materials spill during construction;
- Restrict the locations of fuel storage and fueling activities;
- Require equipment to be refueled by designated personnel in designated areas with specific training in refueling, spill containment, and cleanup; and
- Provide procedures, materials and a line of communication to facilitate prevention, containment, and cleanup of spills during construction activities.

We believe the implementation of Creole Trail's project-specific SPCC Plan would reduce the potential for project-related spills and release to occur, and minimize the effects of any accidental spills to low levels.

Construction activities at the proposed LNG terminal could more specifically affect shallow groundwater resources at the site. Dewatering activities (if required) and the addition of fill material and soil stabilizers during site development could alter groundwater chemistry and levels, as well as the permeability of shallow groundwater deposits. However, these effects would be limited to the site and would not affect groundwater users, as no such users were identified in close proximity to the site.

As described in section 4.1.3.7, Creole Trail proposes to construct the LNG storage tanks and most of the other major facilities at the LNG terminal site on deep driven pile foundations. Installation of the piles would laterally displace soils adjacent to the piles, thereby increasing compaction and reducing groundwater permeability. However, these effects would likely be limited to the immediate area of the LNG tanks and other pile-founded structures and, therefore, would not have a significant affect on groundwater resources. In addition, the potential for foundation piles to create migration pathways between shallow groundwater and deeper groundwater would be low because the piles would be driven rather than bored, thus forming a relatively tight seal between the piles and surrounding soils.

Construction and operation of the proposed pipelines and associated aboveground facilities could also affect groundwater resources, although the potential for significant impact is low. As described in section 4.3.1.1, the Chicot Aquifer underlies all of the proposed pipeline routes. However, where the proposed pipelines would be located, the Chicot Aquifer system dips and thickens as it extends towards the coast, and is overlain by a layer of clay that typically ranges from 50 to 100 feet thick (Lovelace et al., 2004). Because the depth of the trench excavations would be relatively shallow (generally ranging from about 4 to 9 feet depending on the pipeline diameter and depth of cover) as compared to the depth of the Chicot Aquifer, and given the presence of a thick clay layer over the aquifer within the project area and the implementation of the measures in the SPCC Plan, construction of the proposed project pipelines would be unlikely to affect the Chicot Aquifer.

Construction of the proposed pipelines and aboveground facilities could affect shallow groundwater resources that may exist within soil depths that would be affected during construction. In some areas with shallow groundwater, it may be necessary to dewater the trench prior to installing the pipelines. Creole Trail would conduct any dewatering in accordance with our Plan and Procedures. Dewatering would lower groundwater levels within a "zone of influence" near the point of dewatering. Trenching and other construction activities could also increase turbidity in shallow groundwater, and create preferential pathways for groundwater migration. All of these construction-related effects would

be localized to the immediate area of disturbance and, groundwater levels and clarity would be expected to return to their former condition.

4.3.1.4 Project Groundwater Requirements

No groundwater wells would be installed at the proposed LNG terminal. Potable water for the proposed facility would be obtained from the Cameron Parish Water District 10, which derives its water from Chicot Aquifer wells located more than 10 miles from the proposed LNG terminal site. To provide water to the proposed LNG terminal, the water district would construct a new nonjurisdictional 10-inch water line from the existing 10-inch water district waterline located south of the LNG terminal entrance. Construction of the LNG terminal would require an estimated 8,000 gallons per day from the water district, with an additional 13 gpm during on-site concrete production. During operations, the normal water usage rate would be about 40 gpm, with a maximum requirement of 240 gpm.

Approximately 30 million gallons of water would be necessary for hydrostatic testing of the LNG storage tanks. Creole Trail is considering three potential sources for this test water, including rainwater, purchased water, or water from the Calcasieu River (see section 4.3.2.2 for further description of these sources). Creole Trail proposes to obtain hydrostatic test water for the proposed pipelines from various surface water sources along the pipeline routes.

Our consultation with the Cameron Parish Water District 10 indicated that approval from the water district would be required prior to appropriation of the volume of water that is projected for use at the proposed LNG terminal site (Badon, 2005). The water district also indicated that its engineers would need to review the anticipated water demands for the project to determine whether those demands could be met by the water district without affecting public water availability. Based on our preliminary consultation with water district and to ensure that the necessary water resources would be available for construction and operation of the proposed LNG terminal, **we recommend that:**

- **Creole Trail should confirm with the Cameron Parish Water District 10 that the water demands of the proposed project would be met by the water district, and file documentation of this confirmation with the Secretary <u>prior to beginning construction of the LNG terminal</u>.**

4.3.1.5 Contaminated Groundwater

Groundwater resources at the proposed LNG terminal site and along the proposed pipeline routes are not known to be contaminated. However, due to land use activities in the project area, the potential exists for contaminated groundwater to occur in the area. A review of a regulatory database search completed for the project area identified 55 contaminated or potentially contaminated sites in the area, 5 of which occur within 0.25 mile of proposed pipeline Segment 3. In addition, contaminated groundwater could be associated with former oil and gas wells at the proposed LNG terminal site and along the proposed pipeline routes, the former aboveground storage tank battery at the LNG terminal site, and foreign pipeline facilities in the area. Because previously-existing contaminated groundwater could be encountered during pipeline trenching and other excavation activities, we have recommended that Creole Trail develop a Plan for the Discovery and Management of Contaminated Soil and Groundwater to address encounters with unanticipated groundwater and soil contamination during construction of the proposed LNG terminal and pipeline facilities (see section 4.2.1).

Implementation of the recommended Plan for the Discovery and Management of Contaminated Soil and Groundwater would ensure that any previously existing groundwater contamination that may be

encountered during construction would be managed in accordance with applicable regulatory requirements.

4.3.2 Surface Water

The Creole Trail Project would be within the Calcasieu and Mermentau River watersheds in southwestern Louisiana. The Calcasieu River watershed encompasses more than 3,900 square miles of drainage within Louisiana, and the Mermentau River watershed encompasses about 1,147 square miles. The LNG terminal and Segment 2 would be within the tidally influenced (i.e., estuarine waters) portion of the Calcasieu River watershed. Segment 3 would be within the freshwater region of the Calcasieu and Mermentau River watersheds.

Surface water resources within these watersheds consist of rivers, lakes, ponds, canals, and streams that provide habitat for fish and wildlife or are used by humans for dinking water, recreation, agriculture, and/or industrial purposes. The suitability of a water resource for a particular use is determined by water quality, which is defined by chemical, physical, biological, and aesthetic characteristics. The LADEQ administers surface water quality standards for the waters of the state as described in the Louisiana Administrative Code (LAC) Title 33, Part IX, Chapter 11. Water quality standards are developed to enhance or maintain water quality and to provide for, and fully protect, the designated uses of the waters of the state. These designations consist of primary contact recreation, secondary contact recreation, fish and wildlife propagation, drinking water supply, oyster propagation, agricultural, and outstanding natural resource waters.

No waters from the Calcasieu or the Mermentau River Basins are on the LADEQ 2004 303(d) list as containing contaminated sediments (LADEQ, 2004b). However, as discussed in section 4.3.2.1, 11 waterbodies crossed by the proposed pipeline routes are categorized by the LADEQ as impaired. No potable water intakes are located within 3 miles downstream of the proposed project waterbody crossings.

4.3.2.1 Construction Impacts

LNG Terminal

The Creole Trail LNG terminal would be immediately adjacent to the West Fork of Calcasieu Pass on the western shore of the Calcasieu Ship Channel. The main surface water resource in the region is Calcasieu Lake, a bay-estuary system, partly separated from the Gulf of Mexico and the inner shelf by a modern strandplain-chenier system. Tidal exchange between the Gulf of Mexico and Calcasieu Lake occurs through the Calcasieu Ship Channel which has been extensively modified for navigation purposes (e.g., the channel has been dredged to a depth of 45 feet). The tides in this bay-estuary system are uniformly small, approximately 2.1 feet at Calcasieu Pass (NOAA, 2005). The Calcasieu River, numerous bayous and smaller rivers, and the extensive surrounding marshlands discharge freshwater into Calcasieu Lake. Other sources of fresh water in the bay-estuary system include streams and stormwater runoff; municipal, industrial, and agricultural return flow; and direct precipitation. Waterbodies discharging into the Calcasieu River include Choupique Bayou, Houston River, Little River, Indian Bayou, Marsh Bayou, Barnes Creek, Cow Bayou, Gum Bayou and Nezpique Bayou. The Gulf Intracoastal Waterway enters the Calcasieu River west of Choupique Island.

Designated uses of the nearby portions of the Calcasieu River-Calcasieu Ship Channel include primary and secondary contact recreation, fish and wildlife propagation, and oyster propagation. The Calcasieu River-Calcasieu Ship Channel sub-segment watershed (030401) currently fully supports the listed designated uses (LADEQ, 2004a).

The primary impact of the project on water quality would result from the dredging of approximately 4.1 million yd^3 of material in or adjacent to the Calcasieu Ship Channel as part of construction of the marine facilities. Details of Creole Trail's proposed dredging for the marine facilities are provided in section 2.3.1.3. Dredging would result in a temporary increase in suspended solids in the water around the dredged area and the subsequent settling of the suspended particles, or sedimentation. However, Creole Trail anticipates that turbidity would be minimized by the types of materials to be dredged, which are primarily stiff clays with some silty deposits. Most of the sediment that would become suspended during dredging would settle within the dredging footprint. In addition, Creole Trail would use a hydraulic cutterhead dredge, which generally creates less turbidity than other types of dredges, and the cutter speed can be adjusted if excessive turbidity is detected, thus minimizing turbidity.

Dredging operations to excavate the ship berth would suspend sediments and affect water quality. In general, dredging-related water quality impacts would include both the physical effects of suspended sediment and alterations of water chemistry due to the release of various chemical constituents associated with the sediment. See section 4.2.2 for discussion of the water, sediment, and soil sampling conducted by Creole Trail. Based on elutriate testing, Creole Trail concluded that none of the identified metals would be released by dredging operations at concentrations that would exceed Louisiana state water quality standards or criteria. However, as discussed in section 4.2.2, we have recommended that Creole Trail consult further with the EPA regarding the EPA's recommendation that additional evaluation be conducted for one of Creole Trail's sampling stations to provide a more complete analysis of the dredge material and to help clarify the potential for the proposed dredging activities to adversely affect the aquatic environment.

Turbidity resulting from dredging could reduce light penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton in the slip area. The suspension of organic materials and sediments could cause an increase in biological and chemical oxygen demand in the vicinity of the marine basin. Reduced dissolved oxygen concentrations could cause a temporary displacement of motile organisms and could stress or kill sessile benthic organisms within the affected area. However, construction of the marine facilities would alter micro-environment in the area and hence result in short-term impacts on aquatic biota and habitat.

In order for a hydraulic dredge to move sediment, a large volume of water must be pumped with the sediments to make a slurry. The volume of water needed is typically 4 to 8 times the in-place volume of sediment removed. This means that about 800 to 1,600 gallons of water would be used for each cubic yard of sediment dredged. As such, dredging for the project could be expected to involve transferring about 3.3 to 6.6 billion gallons of water through a dredge slurry pipeline. Creole Trail would be required to obtain permits for dredging and dredge material management, including COE permits under section 404 of the CWA and section 10 of the Rivers and Harbor Act and water quality certification from the LADEQ. Creole Trail would beneficially reuse the dredged material, and is in the process of developing a beneficial reuse and mitigation plan in cooperation with COE, NOAA Fisheries, LADNR, and LADWF. Impacts associated with a dredge slurry pipeline would need to be addressed in this plan. In addition, the EPA has recommended that the dredged material be tested for suitability of disposal and has indicated that if sediment chemistry results are not clear cut, the most expeditious way to make such a determination is often to perform toxicity testing. See section 4.4.3 for further discussion.

Land disturbing activities associated with construction of the proposed LNG terminal would expose soils to potential erosion. To minimize impacts of erosion and sedimentation on surface waters, land disturbing and construction activities would be conducted in accordance with our Plan and Procedures and in compliance with the LAPDES permit for stormwater discharges during construction and operation.

Spills, leaks, or accidental releases of fuels, lubricants, or other hazardous substances during construction could also adversely affect water quality. To minimize the potential for accidental releases of hazardous materials to waterbodies and to ensure an appropriate response if such a release were to occur, Creole Trail would develop a project specific SPCC Plan to be filed prior to construction with the Construction Implementation Plan for review and written approval by the Director of OEP.

Pipelines

The proposed pipelines would cross 175 surface waterbodies, including 1 lake (Calcasieu Lake), 108 rivers, streams, creeks, ponds, or bayous and 66 ditches, canals, and stock ponds. Table C-1 in appendix C provides a list of the waterbodies crossed by the proposed pipelines including waterbody name, approximate milepost, stream type, crossing width, water quality classification and crossing method.

Portions of Segment 2 would be constructed within Calcasieu Lake. The lake entrance and exits would be constructed using the HDD method. In addition, Creole Trail would conduct 12 other HDD crossings that would encompass a total of 26 waterbodies. Eighty-one waterbodies would be crossed using conventional open-cut methods. Creole Trail has indicated that the 66 manmade ditches, canals, and stock ponds that it has identified as "nonjurisdictional" with respect to the COE would also be crossed by the open-cut method unless encompassed by an alternative crossing method (e.g., bore or HDD) being used to cross an adjacent feature. In the draft EIS, we noted that regardless of whether a waterbody is under COE jurisdiction, our Procedures define a waterbody as "…any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes." Creole Trail has confirmed that all waterbodies that meet our definition of a waterbody would be crossed in accordance with our Procedures. Further, the waterbodies that Creole Trail has identified as nonjurisdictional include minor, intermediate, and major waterbodies as defined by our Procedures. Our Procedures require that site-specific construction plans be filed with the Secretary for the review and written approval by the Director of OEP for all major waterbody crossings (i.e., greater than 100 feet wide). These plans must be filed prior to construction.

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

To minimize surface water impacts, Creole Trail would implement the construction and mitigation measures described in our Procedures. Our Procedures prescribe ATWS setbacks as well as in-stream construction duration constraints and sediment control procedures. As noted above, our Procedures also require preparation of site-specific crossing plans for waterbodies greater than 100 feet wide. Adherence to our Procedures would minimize short- and long-term impacts associated with crossing these waterbodies. Additionally, Creole Trail is proposing to use the HDD technique to cross several waterbodies, which preclude the need to disturb stream bottoms and banks.

The proposed pipelines would cross 11 waterbodies that are categorized by the LADEQ as impaired (LADEQ, 2004b; EPA, 2005) (see Appendix C for specific waterbodies and applicable categories based on the EPA's *Consolidated Assessment and Listing Methodology* guidelines). Six of these waterbodies are listed as containing mercury and/or other metals. The remaining five waterbodies are listed due to low dissolved oxygen or organic enrichment. Creole Trail proposes to cross all except two of the impaired waterbodies by HDD; therefore, no impacts on these waterbodies or their water quality are expected. Indian Bayou and Marsh Bayou are currently proposed to be open cut (see below for further discussion regarding the crossing method to be used at these waterbodies). These crossings are about 3 feet wide and 15 feet wide, respectively. Both of these waterbodies are listed as impaired due to low dissolved oxygen or organic enrichment; they are not listed as containing mercury or other metals. Impacts on these waterbodies would be minimized by the implementation of the measures specified in our Procedures which limit the amount of equipment that can operate within a waterbody to that needed to complete the crossing. In addition, our Procedures require that crossings of minor waterbodies (less than or equal to 10 feet wide) be completed within 24 hours, and crossings of intermediate waterbodies (10 to 100 feet wide) be completed within 48 hours.

Requested Variances to the FERC Procedures

Creole Trail has committed to comply with our Plan and Procedures during construction and operation of the proposed project. However, Creole Trail has requested variances to certain items of our Procedures, including items V.B.2.a and V.B.4.a. Item V.B.2.a requires that all extra work areas such as staging areas and ATWS be at least 50 feet from water's edge except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land. Item V.B.4.a requires that spoil from minor and intermediate waterbody crossings and upland spoil from major waterbody crossings be stored in the construction right-of-way at least 10 feet from the water's edge or in approved additional extra work areas.

Creole Trail's requested variances to item V.B.2.a are addressed in section 4.4.2. With respect to item V.B.4.a, Creole Trail has not provided site-specific justification for areas where it would need to store spoil within 10 feet of a waterbody, but has only indicated that such spoil placement might be necessary due to site-specific construction constraints such as the presence of wetlands between streams and work areas, unavoidable or constraining land features, or meandering streams or tributaries present in the crossing area. To the extent that we have approved Creole Trail's requests for ATWS within 50 feet of wetlands (see section 4.4.2), our Procedures would allow for spoil storage within those ATWS. In these cases, Creole Trail would implement protective measures such as the installation of silt fence and hay bales between the waterbody and the spoil, temporary stabilization between the construction periods for each pipeline within the dual pipeline segments, and final restoration and stabilization within 10 days of construction. Variances to item V.B.4.a at other locations are denied at this time due to lack of sufficient information. For any other location where Creole Trail believes it would be necessary to store spoil within 10 feet of a waterbody, Creole Trail would need to identify the specific location and file site-specific justification for its variance request.

Horizontal Directional Drill

Creole Trail proposes to conduct 14 HDD operations, some of which would encompass more than one waterbody. In total, the proposed HDDs would encompass 26 waterbodies as well as the entry and exit of Segment 2 from Calcasieu Lake. Two of the HDD installations would be associated with the crossing of Calcasieu Lake, including the construction of Segment 2 at the points where it enters and exits the lake (the HDD for the lake entry would also encompass a canal south of the lake). The HDD method would be used at 12 other locations to install the pipeline under 25 other waterbodies. Proposed HDD crossings are listed in table 4.3.2-1. The HDD construction method is described in section 2.3.2.2.

TABLE 4.3.2-1

Waterbodies Proposed to be Crossed Using the Horizontal Directional Drill Method Along the Creole Trail Pipeline

Directional Drill Number	Approximate Entry Milepost	Approximate Exit Milepost	Length of Drill (feet) [a]	Feature Crossed
Segment 2				
1	0.0	0.5	2,247	Calcasieu Ship Channel
2	2.6	3.4	4,000	Calcasieu Lake Shoreline (lake entry)
				Canal south of Calcasieu Lake
3	19.7	20.3	2,000	Calcasieu Lake Shoreline (lake exit)
4	20.4	21.2	3,943	Gulf Intracoastal Waterway
				Open Water Channel to Calcasieu Lake Bay System
Segment 3				
5	12.5	13.1	2,920	Houston River
6	16.5	16.9	2,162	Little River
				Tributary to Little River
				Tributary to Little River
				Tributary to Little River
7	20.2	20.8	3,023	West Fork Calcasieu River
				Tributary to West Fork Calcasieu River
				Tributary to West Fork Calcasieu River
				Tributary to West Fork Calcasieu River
8	38.8	39.1	1,375	Barnes Creek
9	41.9	42.7	3,932	Calcasieu River
10	54.9	55.1	1,294	Bayou Serpent
11	65.9	66.3	2,022	Bayou Nezpique
				Tributary to Bayou Nezpique
12	72.9	73.3	1,767	Bayou Des Cannes
13	78.0	78.6	2,961	Bayou Mallet
				Tributary to Bayou Mallet
				Tributary to Bayou Mallet
				Tributary to Bayou Mallet
				Tributary to Bayou Mallet
14	89.3	89.8	2,287	Bayou Plaquemine Brule
				Tributary to Bayou Plaquemine Brule

[a] Lengths of drill segment obtained by subtracting the engineering stationing number of the drill entry/exit point from the drill entry/exit point as indicated on the site-specific crossing plans filed by Creole Trail.

The use of the HDD method would eliminate or significantly reduce the potential for pipeline construction to affect these waterbodies because the HDD method avoids disturbance of the stream beds, banks, and associated riparian vegetation. Creole Trail is in the process of conducting a geotechnical evaluation to assess the suitability of soils and subsurface geological conditions in and surrounding the waterbodies proposed to be crossed by HDD. During interagency site visits, federal and state agency representatives indicated that in their experience, HDD construction of other pipelines in the project area have generally been successful. Nevertheless, HDDs sometimes fail. Therefore, to further analyze potential impacts associated with these crossings, **we recommend that:**

- **Creole Trail file with the Secretary a site-specific plan for the crossing of each waterbody proposed as a HDD crossing in the event that the HDD is unsuccessful. These site-specific plans should include scaled drawings identifying all areas that**

would be disturbed by construction. Creole Trail should file these plans for review and written approval by the Director of the OEP along with the COE permit <u>prior to construction across those waterbodies.</u>

In comments on the draft EIS, both the COE and the LADWF recommended that Indian Bayou (approximate 3-foot crossing width) and Marsh Bayou (approximate 15-foot crossing width), be crossed using the HDD method in order to avoid or minimize impacts on the adjacent riparian areas and associated forested wetlands. As currently proposed, Creole Trail would construct both of these crossings using the open-cut crossing method, which would affect approximately 1.25 and 1.24 acres of bottomland hardwood forest at Indian and Marsh Bayous, respectively. Creole Trail would be required to obtain COE authorization under section 404 (CWA) and LADEQ authorization under section 401 (CWA) for these crossings. Based on our site visit and review of aerial photo-based alignment sheets, it appears that use of the HDD method at these locations could potentially affect other resources such as upland forest, and may require realignment of the pipeline, particularly at Marsh Bayou. To allow us to further assess this issue, **we recommend that**:

- **Creole Trail evaluate the feasibility of using the HDD method to cross Indian and Marsh Bayous and develop a site-specific construction plan for each of these crossings in coordination with the COE and LADWF that clearly identifies all construction work areas including the laydown area for the pipe string if the HDD method is determined to be feasible. Creole Trail should file the results of its evaluation, the site-specific construction plans, and any agreed-upon mitigation measures to minimize impacts on riparian areas and the associated forested wetlands. Creole Trail should file the above information with the Secretary for review and written approval by the director of OEP <u>prior to construction of the proposed pipeline</u>.**

While the HDD method is often the preferred method for installing pipelines across sensitive resources, it is not without some environmental risk. An inadvertent release of drilling mud could enter the waterbody being crossed or the HDD installation could fail due to unfavorable geologic conditions and/or equipment failures.

The HDD method involves the circulation of a drilling mud to remove cuttings, stabilize the borehole, and cool and lubricate the drill bit. Drilling mud is composed primarily of freshwater, bentonite clay,[1] and a small percentage of other additives. During the drilling process, drilling mud can enter waterbodies through coarse unconsolidated formations, such as sand or gravel, or through fractured rock formations. When an inadvertent release of drilling mud returns to the surface or enters a waterbody, it is referred to as a "frac-out." Because drilling mud is composed of primarily freshwater, a small release would likely dissipate and would not be expected to adversely affect water quality beyond a temporary increase in turbidity. In larger quantities, the release of drilling fluid could negatively affect fisheries and/or vegetation, although impacts would generally be less than those associated with an open-cut crossing.

Creole Trail's geotechnical evaluation will provide information regarding the potential for a frac out to occur at the proposed HDD crossings. When this survey is completed, **we recommend that:**

[1] Bentonite is the commercial name for a mixture of non-toxic clays and rock particles consisting of about 85 percent montmorillonite clay, 10 percent quartz and feldspars, and 5 percent accessory materials, such as calcite and gypsum. Typical mixtures consist of 25 pounds of dry compound in 100 gallons of fresh water. In some cases, additional compounds are added as thickening agents.

- **Creole Trail develop and file a Drilling Mud Contingency Plan for each waterbody proposed to be crossed by the HDD method. Each plan should address how Creole Trail:**

  a. will handle any inadvertent release of drilling mud into the waterbody or areas adjacent to the waterbody, including procedures to contain inadvertent releases;

  b. will seal the abandoned drill hole; and

  c. will clean up any inadvertent releases.

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

Upon completion of installation of the HDD segment, the exit points would be backfilled and returned to their original contours.

The HDDs for the shore approaches to Calcasieu Lake are described in section 2.3.2.2. Temporary siltation and sedimentation would occur at the HDD entry and exit points in Calcasieu Lake, primarily from the drilling mud associated with the initial drilling of the pilot hole, the subsequent reaming, and the pulling of the pipeline through the hole. Drilling mud is typically non-toxic and would not be expected to chemically affect organisms in the lake; however, sessile organisms in the vicinity of the release could be smothered and killed. In its comments on the draft EIS, Creole Trail stated that its current plan is to conduct the HDD at the south end of Calcasieu Lake (the pipeline entry into the lake) as a lake-to-land operation, with the HDD entrance in the lake and the exit on land. At the north end of the lake (where the pipeline would exit the lake), the opposite configuration would be used, with the HDD entry point on land and the exit point in the lake. At the HDD entry point, drilling mud would be managed within a closed pumping and return system. Drilling mud would be more difficult to control at the exit point, which is not enclosed. Therefore, the greatest potential for drilling mud to be released into the lake would be at the north end of the lake where the HDD exit point would be located within the lake.

In the draft EIS, we recommended that Creole Trail file a report concerning the HDD exit and entry holes in Calcasieu Lake with turbidity plume modeling to estimate the length and duration of the turbidity plume, the thickness and distance of the drilling mud deposits on the lake bottom, and the mitigation measures Creole Trail would use to minimize and contain drilling fluids at the drill entry and exit holes. In response, Creole Trail filed additional information about the HDD process in Calcasieu Lake and how the potential for the release of drilling mud into the lake would be minimized. In its comments, Creole Trail explained that it did not conduct turbidity plume modeling because, based on consultations with experienced HDD contractors, it anticipates that the drilling fluid-cutting mixture would be contained with a collection pit and/or recovered through pumping as described further below.

The contractors with whom Creole Trail consulted anticipate that the HDD installations at both ends of Calcasieu Lake would require the excavation of exit or entrance pits that would be positioned at the transition point from the terminus of the HDD section to the pipeline in the lake. The pits would be excavated to accomplish two purposes; to provide a smooth transition between the HDD pipe string and the remainder of the pipeline in the lake bed; and to provide containment of the drilling fluids used for the HDD. Creole Trail indicated that these containment pits would range from 10 to 20 feet in depth. Based on studies conducted for other projects (URS, 2003 and PI Engineering, 2005) and consultation with recognized HDD contractors, Creole Trail estimates that about 10 percent of the drilling fluid could be

released into the containment pits during the HDD process. Creole Trail anticipates that a tank barge and pumping system would be used to maintain the level of any drilling mud released into the pit at a level that would limit the potential for drilling fluid to migrate beyond the containment pit. Additionally, the drilling fluid and cuttings mixture would be denser than the lake water, resulting in rapid settling of the material when it exits the drill hole.

Based on Creole Trail's analysis of the potential for drilling fluid migration during HDD installation of the pipeline in Calcasieu Lake, as well as the drilling fluid containment and recovery measures that are expected to be employed by Creole Trail during the HDD installations, we agree that turbidity plume modeling is not necessary. The construction methods that Creole Trail expects to use to install the HDD crossings in Calcasieu Lake would limit the potential for significant release of drilling fluid and therefore minimize the potential for impacts on benthic organisms resulting from drilling fluid sedimentation outside the containment pits. As discussed below, Creole Trail has committed to filing final, site-specific, detailed engineering alignment sheets and construction installation plans for the Calcasieu Lake crossing once it has retained an Engineering, Procurement, and Construction contractor, and we have recommended that these plans include detailed information about the locations and dimensions of the pits to be used for containing drilling mud for review and written approval by the Director of OEP.

Calcasieu Lake Crossing

About 17.1 miles of Segment 2 would be installed in Calcasieu Lake using a combination of HDD technology and open-cut construction from lay barges. As noted previously, the HDD method would be used to install the pipeline at the shoreline approaches of Calcasieu Lake beginning at MPs 3.0 and 20.1 of Segment 2. Creole Trail would use the HDD method at these locations to minimize impacts from trenching in shallow water and shoreline areas within Calcasieu Lake.

Open-cut construction would be used for the remainder of the Calcasieu Lake crossings. The proposed construction methods are described in section 2.3.2.2. As described in that section, Creole Trail proposes to use a 300-foot-wide construction right-of-way to allow for dredging of both the pipeline trench and the floatation channels that would be required for operation of the lay barges. Flotation channels would not be necessary in water depths greater than 8 feet.

Creole Trail selected its proposed construction methods after analyzing several alternative methods for constructing through Calcasieu Lake. Construction methods considered included the use of a standard shallow water lay barge, simultaneous dual lay operation from a single barge, push/pull, and jet trenching. Creole Trail's analysis considered seasonal timing and duration of construction activities in the lake, total extent of physical disturbance in the lake, and constructability under specific lake conditions. Creole Trail's objective was to identify a technically sound engineering/construction approach that would allow for construction in the more sensitive southern portion of the lake during the summer months and accommodate completion within 50 to 75 days (excluding the HDD shore approaches). These timing and duration parameters were identified in consideration of economic impacts on the lake users, impacts on fishery resources, public perception, and impacts on the lake.

The primary impacts on water quality associated with open-cut construction in the lake would be the resuspension of sediment into the water column. Sediments may be resuspended during trench excavation and from spoil pile erosion due to wind and wave forces. See section 4.3.2.2 for further discussion of potential resuspension of sediment from spoil piles.

Creole Trail would minimize water quality impacts in Calcasieu Lake by constructing the pipeline in the lake during the summer. Summer construction would take advantage of seasonally

reduced lake currents and higher salinities. These conditions would reduce the amount of siltation in the lake because, as the salinity increases, the dissolved solids in the water fall or settle to the bottom. Additionally, when the sediments are resuspended, they would fall from the water column faster, decreasing the sediment plume associated with the construction and minimizing the area affected. As discussed in section 2.3.2.2, the LADWF's comments on the draft EIS included several items regarding Creole Trail's proposed construction methods in Calcasieu Lake. Creole Trail has stated that it would develop final, site-specific, detailed engineering alignment sheets and construction installation plans for the Calcasieu Lake crossing once it has retained an Engineering, Procurement, and Construction contractor. Creole Trail stated that it would file these final plans with the Commission prior to construction. **We recommend that:**

- **Creole Trail develop its final plans for construction in Calcasieu Lake in coordination with the COE, LADNR Coastal Management Division, and LADWF. The plan should describe in detail the construction methods to be used in Calcasieu Lake and should include supporting alignment sheets; scaled drawings identifying all areas that would be disturbed by construction; and typical drawings to illustrate construction methods and workspace requirements. As warranted based on Creole Trail's discussions with the COE, LADNR, and LADWF, the plans should also address:**

  a. locations and dimensions of collection pits to be excavated in the lake for HDD operations;

  b. final locations and dimensions of land- and water-based workspaces required for HDD operations at the pipeline entrance and exit into and out of Calcasieu Lake;

  c. locations of turnaround areas;

  d. locations of turbidity curtains and associated supports (e.g., pilings);

  e. measures to be implemented to minimize suspension of sediments from stockpiled material excavated from the pipeline trenches; and

  f. measures to be implemented to ensure that the proper depth of cover is obtained.

  In addition to the detailed construction plans, Creole Trail should file at the same time copies of any related plans required by or developed in coordination with the COE, LADNR, or LADWF such as a lighting/signage plan, turbidity curtain monitoring plan, and/or survey monitoring plan for bottom contours. Creole Trail should file this information with the Commission for review and written approval by the Director of OEP prior to beginning pipeline construction.

Natural and Scenic Rivers

The proposed pipeline routes would cross two waterbodies along Segment 3, Barnes Creek (MP 38.5) and the Calcasieu River (MP 42.4), which are designated as Louisiana Natural and Scenic Rivers at the project crossing locations. See section 4.8.3.6 for further discussion of the Louisiana Natural and Scenic Rivers program. Creole Trail would cross both of these rivers using the HDD; therefore, no

project-related impacts on these waterbodies are expected. We have recommended earlier in this section that Creole Trail file site-specific plans that would be implemented in the event that an HDD is unsuccessful. These plans would need to be approved in writing by the Director of OEP. Other applicable federal and state permits would need to be obtained before Creole Trail could open cut either of these Natural and Scenic Rivers.

Open-Cut Waterbody Crossings

The impacts of the open-cut construction method on perennial and intermittent waterbodies along the pipeline route would generally be localized and short term. The degree of impact would depend, in part, on sediment loads, stream velocity, turbulence, waterbody bank composition, sediment particle size, and the extent of the disturbance to the channel. At perennial waterbodies, construction activities, such as clearing canopy vegetation, grading, and trenching could modify aquatic habitat, increase sedimentation, increase turbidity, increase water temperatures, decrease dissolved oxygen concentration, release chemical and nutrient pollutants from sediments, and introduce chemicals, such as fuel and lubricants. Turbidity resulting from the resuspended sediments could reduce light penetration and the corresponding photosynthetic oxygen production.

To minimize impacts on waterbodies, Creole Trail would adhere to the measures contained in our Procedures. Our Procedures were developed in response to past concerns raised by federal, state, and local agencies and provide the minimum level of protection for surface waterbodies crossed during natural gas pipeline construction. Our Procedures include requirements for preconstruction planning, environmental inspection, waterbody crossing methods, and restoration methods.

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

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

4.3.2.2 Hydrostatic Testing

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

LNG Terminal

LNG transfer lines would be pneumatically tested and therefore would not require hydrostatic test water. Hydrostatic testing of the tanks would involve filling the inner tanks with fresh water in accordance with the requirements of API 620, Q.8.3. Each tank would be tested as it is completed, requiring approximately 30 million gallons per tank, and the water subsequently discharged. As one tank test is completed, the water would be pumped to the next tank, therefore minimizing the total quantity of water required to conduct hydrostatic testing of all four tanks.

Creole Trail evaluated various water sources for hydrostatic testing of the LNG tanks, including construction of a shallow rainwater collection impoundment, use of aboveground storage tanks to collect rainwater, purchase of water from Cameron Parish Water Works, and use of water from the Calcasieu River. Creole Trail has eliminated the rainwater impoundment alternative based on a feasibility review at the LNG terminal site. At this time, Creole Trail believes that the obtaining water from the Calcasieu River is the most feasible alternative, but has not ruled out using one of the other two alternatives or a combination of alternatives. Creole Trail has stated it would implement the recommendations of our Procedures. This would include the recommendation to use screening on the intake hose to prevent entrainment of fish.

To ensure that water withdrawn from the Calcasieu River or from one of the other alternatives is suitable for conducting the hydrostatic tests, Creole Trail would use mobile water filtering equipment to clean the water and remove salinity. The units would be temporary and would be placed within the construction work area for the LNG terminal without the need for additional surface disturbance. No chemical additives would be used in the water during hydrostatic testing.

Following testing, the water would be tested to meet applicable regulatory requirements or standards and discharged to the Calcasieu River. Hydrostatic test water discharges would be conducted in accordance with Creole Trail's LAPDES Hydrostatic Water Discharge Permit.

Creole Trail would implement the measures in our Procedures to minimize erosion and bed scouring during discharge of the test water into the ship channel. Our Procedures recommend that the discharge rate be regulated, and that appropriate energy dissipation device(s) and sediment barriers be used, as necessary, to prevent erosion, scour, suspension of sediments, or excessive streamflow.

Pipelines

Prior to being placed in service, the pipelines must be hydrostatically tested to DOT standards, as listed in 49 CFR Part 192. A total of approximately 84,653,000 gallons of water would be required for this process. Creole Trail proposes to obtain water from the sources listed in table 4.3.2-2. Discharge locations have not yet been identified, but Creole Trail anticipates that in most cases test water would be discharged to the same source from which it was obtained. Creole Trail would be required to identify discharge locations during the LAPDES permitting process. In addition, our Procedures require that Creole Trail file a list identifying the locations of all waterbodies proposed for use as hydrostatic test water sources or discharge locations with the Secretary prior to construction. Creole Trail has not yet determined whether test water would be reused for more than one test section. HDD sections would be pre-tested prior to pullback.

Hydrostatic testing involves increasing pressure in the pipeline to a designated test pressure and maintaining that pressure for 8 hours. If any ruptures or leaks occur, they would be identified during this procedure and repaired. Then, the testing process would be repeated. After the hydrostatic test is successfully completed, the pipeline would be de-watered by pushing the water out with air. Creole Trail

would not add any chemicals to the hydrostatic test water, and the discharged water would be tested in accordance with the requirements of the LAPDES Hydrostatic Test Water Discharge Permit. With the exception of designated Natural and Scenic Rivers, water use permits are not required for surface water withdrawals in Louisiana.

TABLE 4.3.2-2

Hydrostatic Test Water Sources and Potential Discharge Locations for the Creole Trail Pipelines

Segment/Source	Milepost	Projected Gallons
Segment 2		
Calcasieu River	0.5	1,793,000
Land approach/Calcasieu Lake	2.9	12,120,000
Calcasieu River	19.4	574,000
Gulf Intracoastal Waterway	20.0	3,801,000
Segment 3		
Sabine Water Authority Canal	10.4	13,196,000
Houston River	12.6	574,000
Little River	16.7	574,000
West Fork of Calcasieu River	20.4	15,204,000
Barnes Creek [a]	38.5	574,000
Calcasieu River [a]	42.4	16,638,000
Bayou Nezpique	66.1	18,431,000
Bayou Mallet	78.3	574,000
Bayou Plaquemine	89.4	600,000
Hackberry Lateral		
Appropriate water volume to be transferred from Segment 2 then discharged separately.		

[a] Withdrawal of water from Barnes Creek or the Calcasieu River, both of which are Louisiana Natural and Scenic Rivers, would require a permit from the LADWF.

Creole Trail anticipates withdrawal and discharge rates for the hydrostatic test water to be 6,000 gpm. In addition to complying with the requirements of the LAPDES Hydrostatic Test Water Discharge Permit, Creole Trail would minimize the environmental impacts from withdrawal and discharge of hydrostatic test water by implementing the measures outlined in our Procedures which include: notifying state agencies prior to testing; screening intakes to avoid entrainment of fish; maintaining adequate stream flow rates to protect aquatic life and provide for all waterbody uses and downstream withdrawals of water by existing users; locating hydrostatic test manifolds outside of wetlands and riparian areas to the maximum extent practicable; regulating discharge rates; using energy dissipations devices; and installing sediment barriers as necessary to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.

4.3.2.3 Operational Impacts

LNG Terminal

Operational impacts of the LNG terminal would include resuspension of bottom sediments from occasional maintenance dredging, incidental propeller wash from LNG ships, the creation of additional impervious surfaces at the facility, discharge of sanitary wastewater, and discharge of water that would be generated during the LNG vaporization process. Dredging and incidental propeller wash would result in

temporary increases in turbidity in localized areas. Turbidity from propeller wash would be minor and short-term and would decrease as the berthings of LNG ships at the facility become routine. Turbidity caused by maintenance dredging would be short-term and localized. Based on expected shoaling rates of 25,000 to 40,000 yd^3 per year, Creole Trail anticipates that minimal maintenance dredging would be required.

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

Spills, leaks, or other releases of hazardous materials during operation of the LNG terminal facilities could adversely affect water quality. Hazardous materials entering nearby waterbodies as a result of spilled materials being flushed into waterbodies with storm water runoff or entering the Calcasieu Ship Channel directly from leaks or spills at the LNG unloading facilities could have an adverse impact on water quality and aquatic organisms. To minimize the potential for accidental releases of hazardous materials and to establish proper protocol concerning minimization, containment, remediation, and reporting of any releases that occur, Creole Trail would prepare a site-specific SPCC Plan for both the construction and operational phases of the project.

Following construction of the terminal facilities, the amount of impervious surface area at the site would be increased, which would result in an increased volume of stormwater runoff. A stormwater management system would be designed and constructed as described in section 2.1.1.7. Stormwater would be managed in accordance with LADEQ and EPA requirements. The jetty customs building and office areas would each have a self-contained sanitary treatment package for disposal of sanitary domestic wastes. The treated water would be discharged to the Calcasieu Ship Channel with the non-impoundment area stormwater runoff in accordance with conditions of the LAPDES permit.

The proposed LNG terminal facility would generate water from combustion of natural gas in the SCVs during the LNG vaporization process. Approximately 547,200 gallons per day (gpd) of condensate would be discharged during normal operation of 19 SCVs. Because this process water is slightly acidic, it would be buffered with sodium hydroxide to raise the pH prior to discharge. As proposed, the water would be discharged into the firewater pond and then released with the excess discharging into the Calcasieu Ship Channel. The volume of water that would be discharged into the Calcasieu Ship Channel would vary based on daily conditions. Creole Trail would request permits for the maximum anticipated discharge volume. In comments on the draft EIS, the COE and the LADWF indicated that the water generated by the SCVs could be discharged into adjacent wetlands and recommended that Creole Trail develop a beneficial use plan for this water. We do not object to the discharge of buffered condensate into wetlands if required and approved by the COE. In section 4.3.2.1, we have recommended that Creole Trail file a copy of its COE permit with the Commission prior to construction. In addition, as discussed in section 4.4.3, Creole Trail is developing a comprehensive, project-specific ARMP through consultation with the COE, LADWF, and other resource agencies that will specify wetland mitigation measures to be implemented for the project. We have recommended that Creole Trail file a copy of the final ARMP for review and written approval by the Director of OEP. Creole Trail has designed its LNG terminal to account for an accidental spill of LNG during operation of the facility, and to prevent the LNG from entering the Calcasieu Ship Channel (see section 2.7.1.1). The LNG tanks would be surrounded by individual impoundments and spill containment troughs would be provided for the LNG transfer pipelines to drain LNG into the impoundment basins. Impoundments would also be located around all process areas handling LNG. LNG impoundment basins would be designed to hold the volume of LNG that

could accidentally be released during a 10-minute spill from a single pipe rupture pursuant to federal requirements. In the unlikely event that LNG is spilled into the water, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water. Being less dense than water, LNG would float on the surface prior to vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water.

Ballast Water

As with other large cargo ships, LNG carriers would take on some ballast water to maintain stability and trim as they off-load their cargo, but they would not be fully loaded when departing the Creole Trail LNG terminal. The amount of ballast water required by each LNG carrier would vary according to its size and the weather conditions. Creole Trail anticipates that a typical 125,000 m^3 LNG carrier would require approximately 14.8 millions gallons of water, which would be obtained in the Calcasieu Ship Channel and transported out of the waterway. The larger 250,000 m^3 ships are expected to withdraw about 28.8 million gallons of water. This would constitute a minor but long-term impact to water resources of the Calcasieu Ship Channel.

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

Cooling Water Intake

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

Pipelines

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

4.4 WETLANDS

The proposed Creole Trail Project would be constructed in areas that support numerous wetlands. Wetlands are defined by the COE and the EPA as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of wetland vegetation typically adapted for life in saturated soil conditions (Environmental Laboratory, 1987). Creole Trail delineated wetlands within the project area in accordance with the 1987 *COE Wetland Delineation Manual* (Environmental Laboratory, 1987). Wetlands within the project area were classified according to the Cowardin et al. (1979) system which classifies wetlands based on specific shared characteristics. During its October 2005 site visit to assess the impacts of Hurricane Rita, Creole Trail determined that although about 0.5 to 0.75 inch of silt and loam had been deposited across the LNG terminal site, the hurricane did not result in changes to the locations, character, or extent of wetlands within the LNG terminal site or near Calcasieu Lake. Although Creole Trail did not visit all of the wetlands along the pipeline routes, it determined based on visual observations from roads and a review of satellite imagery that the hurricane did not result in wetland losses. Creole Trail concluded that its baseline wetland delineations remain representative of the wetlands in the project area.

Between January and April 2005, Creole Trail conducted field surveys of the proposed LNG terminal site, pipeline rights-of-way, ATWS, and aboveground facility locations to identify wetlands in the project area. Field surveys were conducted where access was allowed. FWS National Wetlands Inventory (NWI) maps were used to supplement field delineations where survey access permission was not granted by the landowner. Some of the common vegetation identified during the field surveys of the proposed LNG terminal site and pipeline facilities is presented in table 4.4-1.

4.4.1 Affected Wetlands

Table 4.4.1-1 (LNG terminal) and Appendix D (pipelines) list specific wetlands that would be affected by the project, including the wetland type and the anticipated impacts during construction and operation of the project. The acres of wetland impacts described in this final EIS differ from those listed in the draft EIS because they reflect the results of the COE's verification process, which was completed after the draft EIS was issued. The COE verification process resulted in a minor decrease in wetland impacts associated with construction and operation of the proposed pipelines. However, the COE determinations identified significantly higher wetland impacts than Creole Trail anticipated for construction and operation of the proposed LNG terminal. Specifically, anticipated construction impacts for the LNG terminal have increased from 8.46 acres to 102.89 acres, and anticipated operation impacts have increased from 2.48 acres to 34.47 acres.

The LADWF commented that it is not unusual for the COE verification process to result in a higher acreage of wetland impacts than those estimated by an applicant. However, because of the significant difference between the COE findings and Creole Trail's estimates, we requested additional information from the COE about this issue. The COE indicated that the difference between its findings and Creole Trail's was related to the interpretation of hydrology and hydric soils indicators in marsh areas at the site, possibly due to dry conditions at the time Creole Trail conducted its delineations. The COE noted that the wetlands that Creole Trail delineated were primarily marsh areas that are ponded or frequently flooded for very long duration. The additional wetlands identified by the COE meet the hydric soils criteria (NRCS, 1998), which include "a frequently occurring water table less than 1.5 feet from the surface for a significant period during the growing season." These areas also meet the criteria for wetland hydrology (NRCS, 1998), which include "inundated or saturated to the surface for at least 5 percent of the growing season in most years." The COE conducted two visits to the proposed LNG terminal site with representatives of Creole Trail's environmental consultant, PBS&J in May and November 2005, and took

soil samples during both visits. During the first site visit, dry weather conditions obscured primary wetland hydrology indicators; however, several secondary indicators were present. The COE also observed indicators of hydric soils. During the second site visit, the COE reconfirmed the presence of hydric soils and observed primary and secondary indicators of hydrology.

As verified by the COE, the development of the Creole Trail Project would affect a total of 209.6 acres of wetlands, including 47.8 acres of forested wetlands, 5.5 acres of scrub shrub wetlands, and 156.3 acres of emergent wetlands. Construction of the LNG terminal site would result in temporary impacts on 102.9 acres of wetlands. Permanent wetland impacts at the LNG terminal would include the permanent loss of 34.5 acres of emergent and scrub-shrub wetlands. Pipeline construction would temporarily affect 47.8, 4.7, and 54.3 acres of forested, scrub-shrub, and emergent wetlands, respectively. Operation of the proposed pipeline facilities would result in the permanent conversion of 25.4 acres of forested wetlands to emergent or scrub-shrub wetlands.

TABLE 4.4-1

Common Wetland Species Identified in Delineations within the Creole Trail Project Area

Common Name	Scientific Name	Common Name	Scientific Name
LNG TERMINAL SITE			
sand spikerush	*Eleocharis montevidensis*	chairmaker's bulrush	*Scirpus americanus*
largeleaf pennywort	*Hydrocotyle bonariensis*	poisenbean	*Sesbania drummondii*
Jesuit's bark	*Iva frutescens*	saltmeadow cordgrass	*Spartina patens*
common rush	*Juncus effusus*	gulf cordgrass	*Spartina spartinae*
small pondweed	*Potamogeton pusillus*		
PIPELINE FACILITIES			
Intermediate and Brackish Marsh			
saltmeadow cordgrass	*Spartina patens*	chairmaker's bulrush	*Scirpus americanus*
gulf cordgrass	*Spartina spartinae*	green flatsedge	*Cyperus virens*
inland saltgrass	*Distichlis spicata*	common reed	*Phragmites australis*
common rush	*Juncus effusus*		
Fresh Water Marsh			
common rush	*Juncus effusus*	alligatorweed	*Alternanthera philoxeroides*
slimpod rush	*Juncus diffusissimus*	longleaf pondweed	*Potamogeton nodosus*
green flatsedge	*Cyperus virens*	chairmaker's bulrush	*Scirpus americana*
andlestem beaksedge	*Rhynchospora caduca*	broadleaf cattail	*Typha latifolia*
sand spikerush	*Eleocharis montevidensis*	switchgrass	*Panicum virgatum*
dwarf spikerush	*Eleocharis parvula*	gaping grass	*Panicum hians*
swamp smartweed	*Polygonum hydropiperoides*	vasey grass	*Paspalum urvillei*
coastal plain yelloweyed grass	*Xyris ambigua*	common reed	*Phragmites australis*
Scrub-Shrub Wetlands			
Jesuit's bark	*Iva frutescens*	wax myrtle	*Myrica cerifera*
sand spikerush	*Eleocharis montevidenis*	eastern baccharis	*Baccharis halimifolia*
saltmeadow cordgrass	*Spartina patens*	switchgrass	*Panicum virgatum*
tallowtree	*Sapium sebiferum*	common reed	*Phragmites australis*
Forested Wetlands			
water oak	*Quercus nigra*	black willow	*Salix nigra*
laurel oak	*Quercus laurifolia*	Cherokee sedge	*Carex cherokeensis*
swamp chestnut oak	*Quercus michauxii*	giant cane	*Arundinaria gigantea*
tallow tree	*Sapium sebiferum*	dwarf palmetto	*Sabal minor*
bald cypress	*Taxodium distichum*	red maple	*Acer rubrum*
water tupelo	*Nyssa aquatica*		

TABLE 4.4.1-1

Wetlands Affected by Construction and Operation of the Proposed Creole Trail LNG Terminal

Wetland ID	Wetland Classification [a]	Temporary Construction Impact (acres) [b]	Permanent Operational Impact (acres) [c]
WET A1	PEM	1.20	0.01
WET A3	E2EM	0.20	0.00
WET A4	PEM	0.02	0.00
WET A8	PEM	0.21	0.00
WET A9	PEM	0.07	0.01
WET A10	PEM	0.17	0.00
WET B2	PEM	0.01	0.00
WET B3	PEM	0.09	0.06
WET B4	E2EM	1.94	0.58
WET B5	E2EM	0.96	0.96
WET B12	E2SS	0.30	0.05
WET B14	PEM	0.02	0.00
WET B15	PEM	0.01	0.00
WET B16	PEM	0.13	0.00
WET B17	PEM	0.25	0.00
WET B18	PEM	0.05	0.00
WET B19	PSS	0.51	0.00
USACE-1	PEM	61.15	14.18
USACE-2	PEM	35.60	18.63
	Total	**102.89**	**34.47**

[a] Cowardin Classification System:

E2EM = Estuarine intertidal emergent
E2SS = Estuarine intertidal scrub-shrub (included with scrub shrub wetland category)
PEM = Palustrine emergent
PSS = Palustrine scrub-shrub.

[b] Construction impacts include temporary disturbances related to construction of the LNG terminal and associated facilities.

[c] Operational impacts include the permanent loss of wetlands within the footprint of the facility.

The impacts of project-related construction and operation activities on wetlands would vary depending on the timing of construction, construction techniques used, the sensitivity of the resources disturbed, and the length of time required for wetlands to be restored. Soil disturbance and removal of wetland vegetation within the project area could temporarily affect the capacity of wetlands to buffer flood flows and could increase the potential for erosion. Removal of wetland vegetation could also deprive wildlife of a valuable habitat component and encourage the recruitment of less desirable invasive species. Failure to properly segregate topsoil over the pipeline trench could result in the mixing of topsoil with subsoil, which could affect the success of post-construction reestablishment and natural recruitment of native wetland vegetation. Rutting of soils from construction equipment could result in soil mixing and a disruption of surface water flow, which could also affect the success of post-construction right-of-way restoration. Uncontrolled surface runoff from adjacent disturbed upland areas could transfer sediment into off-right-of-way wetlands. Construction equipment fuel and lubricant leaks and spills could also result in wetland contamination and some loss of wetland values/functions as wildlife habitat could be diminished during pipeline construction.

4.4.1.1 LNG Terminal

Table 4.4.1-1 lists the wetland impacts associated with the construction and operation of the proposed LNG terminal. Construction of the LNG terminal facilities would temporarily affect approximately 102.9 acres of wetlands. Following construction, about 34.5 acres of wetlands would be permanently converted to commercial and industrial use. Emergent wetlands not permanently affected by operation of the LNG terminal facilities would be allowed to return to pre-construction conditions. Affected scrub-shrub wetlands would be permanently converted to emergent wetlands due to maintenance activities within the terminal site.

4.4.1.2 Pipeline

A detailed list of wetlands affected by the proposed pipeline facilities is provided in Appendix D. Table 4.4.1-2 summarizes the impacts associated with the construction and operation of the proposed pipeline facilities. Construction of the pipeline facilities would temporarily affect approximately 106.7 acres of wetlands. Operation of the pipeline facilities would permanently affect approximately 57.4 acres of wetlands. Operational impacts include the permanent conversion of 25.4 acres of forested wetlands and 2.8 acres of scrub-shrub wetlands to other wetland types as discussed in section 4.4.2. All of the emergent wetlands would be allowed to revert to pre-construction conditions following construction.

TABLE 4.4.1-2

Wetlands Affected by Construction and Operation of the Proposed Creole Trail Pipeline

	Emergent Wetland		Forested Wetland		Scrub-Shrub Wetland	
Project Component	Construction (acres) [a, b]	Operation (acres) [a, c]	Construction (acres) [a, b]	Operation (acres) [a, c]	Construction (acres) [a, b]	Operation (acres) [a, c]
Segment 2	35.82	18.69	0.00	0.00	0.07	0.00
Segment 3	18.47	10.48	47.77 [d]	25.42 [d]	4.60	2.76
Wareyards and Access Roads	0.00 [e]	0.05	0.01 [e]	0.00	0.00	0.00
Total	**54.29**	**29.17**	**47.78**	**25.42**	**4.67**	**2.76**

[a] Acreages shown take into account the avoidance of wetlands that would be crossed by the HDD construction method. These wetlands would not be affected by construction or operation of the proposed facilities.

[b] Construction impacts are based on the proposed 135-foot-wide construction right-of-way for Segments 2 and 3. Construction impacts also include additional temporary work spaces proposed to be located within wetlands for each pipeline segment.

[c] Permanent operations impact is based on a 75-foot-wide permanent right-of-way for Segments 2 and 3.

[d] Acreage includes impacts from the interconnecting pipeline associated with the TETCO meter and regulation facility at MP 32.7 of Segment 3.

[e] Approximately 2.33 acres of wetlands are located within the wareyards but would be protected and avoided; therefore, these wetlands would not be affected by the project.

Additional Temporary Work Space

Although our Procedures require that ATWS be located at least 50 feet from waterbodies and wetland boundaries, Creole Trail has identified 30 locations where ATWS is proposed to be located entirely or partially within wetlands. The use of these proposed ATWS during construction would temporarily affect 4.7 acres of emergent/estuarine wetland, 1.5 acres of forested wetland, and 0.1 acre of scrub-shrub wetland. The wetland impacts resulting from these workspaces are included in the acreage presented in table 4.4.1-2 and do not represent additional impacts. See section 4.4.2 for a discussion of Creole Trail's requested variances from our Procedures.

Aboveground Facilities

None of the aboveground facilities would be located in wetlands. However, the interconnecting pipeline associated with the TETCO M&R facility (MP 32.7 of Segment 3) would temporarily affect 0.42 acre of forested wetlands. Approximately 0.29 acre of this wetland would be permanently maintained as scrub-shrub and emergent wetland for the life of the pipeline. These impacts are reflected in table 4.4.1-2 and do not represent additional impacts.

Wareyards and Access Roads

Potential impacts associated with the wareyards and access roads are summarized in table 4.4.1-2 and detailed in Appendix D. Two of the proposed wareyards would contain within their boundaries a combined 2.04 acres of forested wetlands and 0.29 acre of emergent wetlands. Creole Trail has indicated that all of the wetlands within the wareyards would be avoided and protected throughout construction of the proposed pipeline and no impacts on these areas would occur. Therefore, use of the wareyards would not affect wetlands.

As initially proposed, two of the proposed access roads along Segment 3 would have affected wetland. Access road AR-AC-4 (approximate MP 78.1 on Segment 3) is an existing field road that would be used for temporary access to the construction right-of-way and would affect approximately 0.01 acre of forested wetland. Access road AR-CC-3D (approximate MP 9.5 on Segment 3) would be a new, permanent access road constructed to provide access to the Targa M&R facility that would have permanently affected 0.05 acre of wetland. In response to our recommendation in the draft EIS, Creole Trail changed the proposed location of AR-CC-3D to the east side of the permanent easement to avoid permanent impacts on wetland C-127.

Creole Trail has not yet determined which existing access roads, if any, would require improvement, but if improvements were necessary, they would require FERC approval prior to any disturbance.

4.4.2 Wetland Construction Procedures

Creole Trail would use wetland construction methods described in section 2.3.2.2 of this EIS and in accordance with our Procedures and applicable permit conditions.

To avoid or minimize impacts on wetlands, Creole Trail would implement measures outlined in our Procedures during the construction and operation of the proposed LNG terminal and pipeline facilities. Our Procedures include, but are not limited to, the following requirements:

- Construction equipment operating within the right-of-way would be limited to that equipment necessary for clearing, excavation, pipe installation, backfilling, and restoration activities. All nonessential equipment would use upland access roads to the maximum extent practicable.

- Equipment operating within saturated wetlands would be low-ground-weight equipment or would operate from prefabricated construction mats.

- Temporary erosion and sedimentation control measures would be installed immediately after the initial disturbance of wetland soils and would be inspected and maintained regularly until final stabilization.

- Sedimentation controls would be installed across the construction right-of-way, as needed, within wetlands to contain trench spoil.

- Grading and pulling of tree stumps would be limited to the area directly over the trenchline unless additional grading or stump removal is required for worker safety.

- In unsaturated wetlands, the uppermost 12 inches of topsoil along the pipeline trench would be segregated from the underlying subsoil.

- Project-specific restoration plans would be developed based on consultations with appropriate land management or state agencies. The wetland restoration plan should include measures for re-establishing herbaceous and/or woody species, controlling the invasion and spread of undesirable exotic species, and measures for monitoring the success of the revegetation and weed control efforts.

- Monitoring of wetlands would be conducted for a minimum of 3 years post-construction to ensure the success of wetland revegetation. If revegetation is not successful after 3 years, a remedial revegetation plan would be developed and implemented.

In comments provided to us during preparation of this EIS, NOAA Fisheries stated that best construction practices should be used while working on portions of the pipeline crossing banklines and wetlands to minimize the potential for adverse impacts in wetlands. Creole Trail would implement the measures in our Procedures when working in wetlands and waterbodies. Our Procedures are designed to minimize construction-related impacts on these resources and, as indicated above, include best construction practices such as those referenced by NOAA Fisheries. NOAA Fisheries also expressed concern that pipeline construction could result in lower surface elevations in wetlands, which could affect revegetation success, and recommended that additional fill be added to restore pre-construction contours in wetlands. We do not generally advocate importing fill for backfill in wetlands, and any such filling would need to be authorized by the COE. Creole Trail would conduct final grading to restore pre-construction contours. Further, as noted above, our Procedures require post-construction monitoring to ensure revegetation success in wetlands. If revegetation is not successful, our Procedures require remedial action and continuation of revegetation efforts until wetland revegetation is successful. If importation of fill is necessary to restore wetlands or for remediation based on monitoring results, Creole Trail would be required to coordinate with the COE to obtain the necessary authorization.

Creole Trail would cross numerous wetlands along the proposed pipeline rights-of-way using the HDD method (see table D-1 in Appendix D). Use of the HDD method would avoid the need to clear or otherwise disturb about 11.1 acres, 10.2 acres, and 0.09 acre of emergent, forested, and scrub-shrub wetlands, respectively. Absent unforeseen events such as inadvertent returns of drilling mud (see section 4.3.2.2), the only potential disturbance in these areas for each HDD would be limited, selective clearing of brush (typically done by hand along a path about 3 feet wide for each cable) if needed to allow for the temporary deployment of two HDD guidance (telemetry) cables. However, Creole Trail has stated that it does not intend to clear a line of sight in sensitive wetlands that would be crossed by HDD. To avoid wetland impacts at these locations during pipeline operation, Creole Trail would not maintain the right-of-way between the HDD entrance and exit locations.

Creole Trail has identified several locations along Segment 3 where it may use the push/pull construction method (see Appendix D). This construction method is generally used in large wetland areas with suitable hydrology and topography (i.e., flooded or saturated soils and minimal local relief). Push/pull construction generally requires a narrower right-of-way and minimizes the operation of construction equipment within wetlands. As such, this method offers environmental advantages over conventional wetland construction approaches. Because of the potential environmental advantages of the push/pull construction method, our Procedures require that this method be used where sufficient water is present in the trench and other site conditions allow. Creole Trail has not yet committed to using this

method to cross any wetlands due to the need to verify site-specific conditions at the time of construction (e.g., wetland conditions may preclude the push/pull method).

Requested Variances to Our Procedures

Creole Trail has requested variances to certain items of our Procedures. Some of these requests are discussed below and summarized in tables 4.4.2-1 and 4.4.2-2. Others are discussed in section 4.3.2.1.

Refueling and Storage of Hazardous Materials within 100 feet of Wetlands and Waterbodies

Item IV.A.1.d of our Procedures requires that all equipment be parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary unless the EI finds, in advance, no reasonable alternative and appropriate steps are taken to prevent and provide for prompt cleanup of spills. Item IV.A.1.e requires that hazardous materials (e.g., chemicals, fuels, lubricants) not be stored within 100 feet of a wetland or waterbody unless the location is designated for such use by a government authority. Creole Trail has requested variances from these requirements at 11 locations based on site-specific circumstances and proposed construction methods.

We are aware that there are certain instances where the 100-foot refueling and hazardous material storage buffer specified in our Procedures cannot be maintained due to site-specific conditions, special construction methods, or safety considerations. Under certain conditions such as very extensive wetland crossings, fueling of equipment outside of a specific wetland may not be practical and/or may be environmentally disruptive. We have reviewed each of the locations where Creole Trail has requested a variance to items IV.A.1.d and e of our Procedures and we agree that a variance is justified at most of these locations.

In support of its request, Creole Trail has indicated that it would file with the Commission prior to construction a project-specific SPCC Plan that complies with our Procedures as well as site-specific plans for locations where the 100-foot setback could not be maintained. Creole Trail would also implement measures such as designated fueling areas with dedicated personnel to monitor fueling operations within wetlands and waterbodies, secondary containment, on-site absorbent material, spill kits, and additional training for contractors working in the areas at which it has requested this variance. However, in its justifications for the variance request, Creole Trail stated that “many” of the procedures outlined in the SPCC Plan would be employed during construction at the locations for which the variance is requested, without specifying which measures would or would not be employed. Because it is unclear what measures Creole Trail would implement at these locations, we have qualified our approval of variances to items IV.A.1.d and e, making the approval subject to an acceptable SPCC Plan that includes site-specific measures to be implemented at locations where the 100-foot buffer would not be maintained.

TABLE 4.4.2-1

Approval or Denial of Requested Variances from FERC Procedures

Milepost	Applicable Item in our Procedures [a]	Reason for Variance Request	Approved/Denied	Basis for Approval/Denial
Segment 2				
1 to 2.9	IV.A.1.d and e	Pipeline would be constructed entirely within marshland; area includes HDD exit point for Calcasieu Ship Channel crossing.	Approved subject to filing of acceptable SPCC Plan.	Extent of wetlands provides no practicable alternative to refueling within wetlands.
3.0 to 20.1	IV.A.1.d and e	Pipeline would be constructed within Calcasieu Lake using special construction techniques conducted from lay barges.	Approved subject to filing of acceptable SPCC Plan.	In-lake construction provides no practicable alternative to refueling from barges within lake.
20.3 to 20.5	IV.A.1.d and e	HDD entry points for Calcasieu Ship Channel and Intracoastal Waterway crossings.	Approved subject to filing of acceptable SPCC Plan.	Variance necessary to allow for maintenance and refueling of HDD equipment, which must remain in place for the duration of the HDD operation.
21 to 22	IV.A.1.d and e	Pipeline would cross extensive wetlands; area includes HDD exit point for the Intracoastal Waterway crossing.	Approved subject to filing of acceptable SPCC Plan.	Variance necessary due to extent of wetland and need to operate HDD-related equipment for extended period during HDD operations.
Various	VI.A.2	Variance requested to accommodate proposed 50-foot separation from existing foreign pipelines.	Not applicable.	No variance is required; proposed pipelines would not be considered loops of existing pipelines.
Various	VI.A.3	Variance requested to allow for 135-foot-wide construction right-of-way in wetlands due to proposed dual pipeline system and soil conditions.	Approved	See discussion in text.
Various (see table 4.4.1-3)	VI.B.1.a	Variance requested to allow for specific additional temporary workspaces to be in or within 50 feet of wetland boundaries.	See discussion in text.	See discussion in text.
Various	VI.D.1	Variance request is related to offset between dual pipelines, but rationale or justification is not specified.	Denied.	Insufficient explanation or justification provided. See text for further discussion.
Segment 3				
4.7 to 6.0	IV.A.1.d and e	Pipeline would cross several wetlands and would be constructed using the push/pull method or matting.	Denied.	Insufficient site-specific description and justification. Appears to be sufficient upland areas between wetlands to avoid the need to refuel within the wetlands, and use of push/pull method would be expected to decrease rather than increase the need to operate equipment in wetland.
6.4 to 7.2	IV.A.1.d and e	Pipeline would cross several wetlands and would be constructed using the push/pull method or matting.	Denied.	Insufficient site-specific description and justification. Appears to be sufficient upland areas between wetlands to avoid the need to refuel within the wetlands, and use of push/pull method would be expected to decrease rather than increase the need to operate equipment in wetland.

TABLE 4.4.2-1 (cont'd)

Approval or Denial of Requested Variances from FERC Procedures

Milepost	Applicable Item in our Procedures [a]	Reason for Variance Request	Approved/Denied	Basis for Approval/Denial
38.4	IV.A.1.d and e	HDD entry point for Barnes Creek crossing.	Approved subject to filing of acceptable SPCC Plan.	Variance necessary to allow for maintenance and refueling of HDD equipment, which must remain in place for the duration of the HDD operation.
72.9	IV.A.1.d and e	HDD entry point for Bayou des Cannes crossing.	Approved subject to filing of acceptable SPCC Plan.	Variance necessary to allow for maintenance and refueling of HDD equipment, which must remain in place for the duration of the HDD operation.
78.6	IV.A.1.d and e	HDD entry point for Bayou Mallet crossing.	Approved subject to filing of acceptable SPCC Plan.	Variance necessary to allow for maintenance and refueling of HDD equipment, which must remain in place for the duration of the HDD operation.
89.3	IV.A.1.d and e	HDD entry point for Bayou Plaquemine Brule crossing.	Approved subject to filing of acceptable SPCC Plan.	Variance necessary to allow for maintenance and refueling of HDD equipment, which must remain in place for the duration of the HDD operation.
Various	VI.A.2	Variance requested to accommodate proposed 50-foot separation from existing foreign pipelines.	Not applicable.	No variance is required; proposed pipelines would not be considered loops of existing pipelines.
Various	VI.A.3	Variance requested to allow for 135-foot-wide construction right-of-way in wetlands due to proposed dual pipeline system and soil conditions.	Approved.	See discussion in text.
Various (see table 4.4.2-2)	V.B.2.a	Variance requested to allow for specific additional temporary workspaces to be within 50 feet of a waterbody.	See discussion in text.	See discussion in text.
Various (see table 4.4.2-2)	VI.B.1.a	Variance requested to allow for specific additional temporary workspaces to be in or within 50 feet of wetland boundaries.	See discussion in text.	See discussion in text.
Various	VI.D.1	Variance request is related to offset between dual pipelines, but rationale or justification is not specified.	Denied.	Insufficient explanation or justification provided. See text for further discussion.

[a] Requirements specified in the referenced Procedure items are summarized below:

IV.A.1.d and e: Require a 100-foot minimum setback from a waterbody or wetland for equipment parking, fueling, and hazardous materials storage.

VI.A.2: Requires that, within wetlands, a loop line be offset no more than 25 feet from an existing pipeline.

VI.A.3 : Limits construction right-of-way width in wetlands to 75 feet.

V.B.2.a: Requires a 50-foot setback from water's edge for all extra work areas (except where adjacent land is actively cultivated or rotated cropland or other disturbed land).

VI.B.1.a: Require 50-foot setback from wetland boundaries for all extra work areas (except where adjacent land is actively cultivated or rotated cropland or other disturbed land).

VI.D.1: Limits vegetation maintenance in wetlands. However, to facilitate leak surveys, allows maintenance of a 10-foot-wide herbaceous area centered over the pipeline and selective cutting of trees within 15 feet of the pipeline that are greater than 15 feet in height.

TABLE 4.4.2-2

Additional Temporary Work Spaces Proposed to be In or Within 50 Feet of Wetlands

Milepost [a]	Size of Additional Temporary Work Space (acres)	Temporary Wetland Impact (acres) [b]	Wetland Type	Approved or Denied	Rationale For Additional Temporary Work Space
Additional Temporary Work Spaces within 50 feet of Waterbodies					
Segment 2					
2.2	1.17	N/A	NA [c]	Approved	False Right-of-Way for HDD pull string
Segment 3					
26.5	0.23	NA	NA	Approved	Bore of State Highway 171
41.0	0.11	NA	NA	Denied	Crossing of Creek B43
50.4	0.17	NA	NA	Approved	Construction of TGP M&R Station
54.1	0.11	NA	NA	Denied	Crossing of Creek A1
66.3	0.69	NA	NA	Approved	HDD of Bayou Nezpique
69.8 (2)	0.46	NA	NA	Approved	Bore of Tepetate Road
78.6[d]	0.69	0.10	PFO	Approved	HDD of Bayou Mallet & Pond
87.1	0.23	NA	NA	Approved	Bore of White Oak Road
Additional Temporary Work Spaces within 50 feet of Wetlands [e]					
Segment 2					
21.8	0.1	0.0	NA	Approved	MLV 2-1 & 2-2
Segment 3					
2.5	0.11	0.0	NA	Approved	Construction in wet area
6.2	0.23	0.0	NA	Approved	Bore of Interstate 10
8.5	0.06	0.0	NA	Approved	Foreign Pipeline Crossing
9.9	0.11	0.0	NA	Approved	Creek Crossing (B131)
10.3	0.23	0.0	NA	Approved	Bore of Houston River Canal
10.3	0.23	0.0	NA	Approved	Bore of Houston River Canal
12.5	0.69	0.0	NA	Approved	HDD of Houston River
20.1	0.80	0.0	NA	Approved	HDD of West Fork Calcasieu River
42.7 [h]	0.69	0.0	NA	Approved	HDD of Calcasieu River
43.9	0.70	0.0	NA	Approved	Foreign Pipeline Crossing/MLV 5-1 & 5-2
45.6	0.23	0.0	NA	Approved	Bore of Parish Line Road
45.8	0.11	0.0	NA	Approved	Creek Crossing (C70)
49.1	0.11	0.0	NA	Approved	Creek Crossing (C72)
72.9	0.69	0.0	NA	Approved	HDD of Bayou des Cannes
73.3	0.69	0.0	NA	Approved	HDD of Bayou des Cannes
Additional Temporary Work Spaces Located Partially or Entirely Within Wetlands					
Segment 2					
2.6 (2)	1.38	1.36	E2EM	Approved	HDD of Calcasieu Lake Approach
20.4	2.46	1.73	E2EM	Approved	HDD of Calcasieu River/Intracoastal Canal
21.2	1.03	1.03	E2EM	Approved	HDD of Intracoastal Canal
22.7 (2)[g]	0.46	0.06	PEM	Approved	Foreign Pipeline Crossing
22.9 (2) [g]	0.46	0.06	PEM	Approved	Bore of Highway 27
24.2 [f]	0.49	0.05	E2SS	Approved subject to revision (see text)	Foreign Pipeline Crossing
Segment 3					
0.4	0.23	0.04	PEM	Approved	Bore of Hwy. 108

TABLE 4.4.2-2 (cont'd)

Additional Temporary Work Spaces Proposed to be In or Within 50 Feet of Wetlands

Milepost [a]	Size of Additional Temporary Work Space (acres)	Temporary Wetland Impact (acres) [b]	Wetland Type	Approved or Denied	Rationale For Additional Temporary Work Space
1.6	0.23	0.02	PEM	Approved subject to revision (see text)	Bore of Cotton Vincent Road
1.6	0.23	0.10	PFO	Approved	Bore of Cotton Vincent Road
3.6 [g]	0.23	0.02	PEM	Approved	Bore of Walker Road
5.8 (4)	0.86	0.23	PFO	Approved	Foreign Pipeline Crossing
6.2	0.23	0.04	PFO	Approved	Bore of Interstate 10
7.7	0.23	0.01	PFO	Approved	Bore of Railroad
7.7	0.23	0.04	PFO	Approved subject to revision (see text)	Bore of Railroad
9.8	0.10	0.02	PFO	Approved	Construction of Targa M&R Station
15.6 [g]	0.23	0.05	PFO	Approved	Bore of Bankens Road / Railroad (west side)
15.6	0.23	0.15	PEM	Approved	Bore of Bankens Road / Railroad (east side)
25.3	0.23	0.08	PFO	Approved subject to revision (see text)	Bore of Boy Scout Road/Camp Edgewood Road
38.6 [g]	0.69	0.35	PFO	Approved	HDD of Barnes Creek
42.7 [h]	0.69	0.31	PFO	Approved	HDD of Calcasieu River
43.2	1.14	0.15	PEM	Approved	Pull string for HDD
43.9 (2)	0.81	0.13	PFO/PEM	Approved	Foreign Pipeline Crossing
69.2	0.11	0.05	PFO	Approved	Creek Crossing (C7)
74.8 (2) [g]	0.23	0.07	PSS	Approved	Creek Crossing (C48-2)
78.6 [d]	0.69	0.10	PFO	Approved (see text)	HDD of Bayou Mallet & Pond
Total		**6.25**			

[a] () indicate that more than one additional temporary work space (ATWS) is present at the same approximate MP.

[b] The affected area would be allowed to revegetate naturally following construction.

[c] NA - wetland types are not listed because there would be no direct impacts at these locations.

[d] This ATWS is listed twice because it would be within 50 feet of both a waterbody and a wetland. Creole Trail initially requested a variance to allow this workspace to extend into wetland B95. In the draft EIS, we recognized that the workspace would have to be within 50 feet of the wetland, but recommended that Creole Trail modify or shift it so that it would be outside of the wetland boundary. During its verification process, the COE identified a new wetland, wetland V12, immediately adjacent to wetland B95. With the two wetlands adjacent to on another, there is no alternative but to have this workspace located partially within a wetland.

[e] Creole Trail also requested a variance for an ATWS that would be associated with the HDD crossing of Bayou Plaquemine Brule at MP 89.3 on Segment 3. Our review of Creole Trail's alignment sheets did not identify a waterbody or wetland within 50 feet of this ATWS; therefore, we have not included it in this table or discussion. Creole Trail would need to provide additional site-specific information and justification if it believes that a variance is required for this work space.

[f] Although this wetland was not shown as requiring a variance on Creole Trail's Additional Temporary Work Space table, it is shown on Creole Trail's wetland impact table (and on the project alignment sheet) as being located partially within a wetland.

[g] Requested variances for these ATWS have been added since the draft EIS was issued as a result of the COE wetland verification process, which determined that these workspaces would be wholly or partially within wetlands.

[h] This ATWS is listed twice in the table because of its proximity to two wetlands. In the draft EIS, we denied Creole Trail's variance request to place this ATWS within less than 50 feet of wetland C59. We have reversed that decision in the final EIS for reasons described in the text.

Construction Right-of-way Width in Wetlands

Item VI.A.3 of our Procedures requires that the construction right-of-way width in wetlands be limited to 75 feet. Creole Trail has requested a variance from this requirement and proposes to use a 135-foot-wide construction right-of-way within all wetlands crossed by Segments 2 and 3. Creole Trail stated in its application that the 135-foot-wide right-of-way would be necessary to accommodate installation of the dual 42-inch-diameter pipelines because of the diameter of the pipelines, the size of the construction equipment, and the soil conditions in the project area. Creole Trail stated that a narrower right-of-way would require the pipe and equipment to be too close to the ditch line, which would pose safety concerns for construction personnel. Given the size of the pipelines, we believe that it would not be feasible to maintain construction disturbance within a 75-foot-wide right-of-way where the dual pipelines would be constructed. Therefore, in the draft EIS, we approved a 110-foot-wide construction right-of-way in wetlands crossed by Segments 2 and 3, which we believed would be appropriate. However, we did not approve a 135-foot-wide construction right-of-way in wetlands due to a lack of adequate justification for the wider right-of-way. The COE and the LADWF concurred with this conclusion in their respective comments on the draft EIS.

In its comments on the draft EIS, Creole Trail filed an expanded discussion and justification for its proposed 135-foot-wide right-of-way width in wetlands. Creole Trail explained in more detail that the proposed right-of-way width is required to maintain safe working conditions, to provide for effective and efficient operation of the equipment required to install the dual 42-inch-diameter pipelines, and to contain excavated material within the right-of-way limits. Creole Trail anticipates that the minimum trench depth would be about 7.5 to 8 feet to accommodate the 42-inch-diameter pipe, concrete coating, 3 feet of cover, and about 0.5 feet of "over-dig" tolerance. Further, Creole Trail anticipates that the submerged or saturated soils in the project area would cause the pipeline trench walls to attain natural slopes ranging from 1:1 to 2:1, resulting in excessively wide trenches. To minimize sloughing of the trench walls, Creole Trail would place excavated material and pipe strings at least 5 feet from the edge of the trench, and would not allow equipment to operate within 10 feet of the trench edge. Additional workspace would also be needed to contain the excavated material, which is expected to have a fluid consistency and may also swell in volume. To contain this spoil material within the right-of-way limits, Creole Trail plans to place spoil a minimum of 2 feet inside of sediment barriers, which in turn would be placed a minimum of 1 foot inside the edge of the construction right-of-way. Where no standing water is present and wetland soils are sufficiently cohesive, Creole Trail would segregate topsoil from the trench line. In this case, sufficient space would be required to maintain separation between the topsoil and the subsoil.

Creole Trail included with its comments a copy of a 1999 study entitled "Temporary Right-of-Way Width Requirements for Pipeline Construction." The study was commissioned by the Interstate Natural Gas Association of America (INGAA) Foundation and conducted by Gulf Interstate Engineering to determine appropriate widths for pipeline construction rights-of-ways for various size pipe diameters. The study considered three issues related to construction rights-of-way: 1) safe operation of equipment and worker safety, 2) environmental impacts, and 3) placement of excavated soil. The INGAA study concluded that a reasonable baseline construction right-of-way width for a single 42-inch pipeline in cohesive soils is 125 feet. The study identified several variables that could potentially justify modification of the baseline right-of-way width. According to the study, wetlands could be a basis for increasing or decreasing the baseline construction right-of-way width depending on soil conditions and other factors. In the case of wet or saturated soils, the study indicates that a wider right-of-way is appropriate to allow for safe movement of personnel, operation of equipment, and for spoil storage.

Based on our review of the additional information filed by Creole Trail, we believe that the proposed 135-foot-wide construction right-of-way is necessary and justified to allow for safe and efficient

construction of the dual 42-inch-diameter pipeline in wetlands in the Creole Trail Project area. Therefore, we approve Creole Trail's variance request.

Additional Temporary Work Space within 50 feet of Waterbodies and Wetland Boundaries

Items V.B.2.a and VI.B.1.a of our Procedures require that all extra work areas such as staging areas and additional spoil storage areas be located at least 50 feet from water's edge or wetland boundaries, respectively, except where the adjacent upland consists of cropland or other disturbed land. The majority of the ATWS proposed for project use would be more than 50 feet from waterbodies and wetland boundaries. However, Creole Trail requested site-specific variances from these requirements for 10 ATWS that would be within 50 feet of waterbodies, for 16 ATWS that would be within 50 feet of wetland boundaries, and for 33 ATWS that are proposed to be located entirely or partially within wetlands. The ATWS for which Creole Trail requested these variances are listed in table 4.4.2-2, as well as: the associated wetland impacts (where applicable); whether the requested variance is approved, denied, or approved subject to revision; and the reason for these work spaces.

We believe that ATWS should be located at least 50 feet from waterbodies and wetland boundaries where topographic conditions permit. However, we recognize that certain site-specific conditions may require placing ATWS within wetlands or within 50 feet of a waterbody or wetland boundary. We have reviewed the list of ATWS for which Creole Trail has requested a variance from items V.B.2.a and VI.B.1.a of our Procedures. With the exception of the ATWS discussed below, we believe that because of the site-specific construction constraints, there are no other reasonable or practical locations for these ATWS. We also agree that the ATWS are necessary for the construction of the proposed pipelines. Therefore, we approve Creole Trail's requests for variances to items V.B.2.a and VI.B.1.a of our Procedures for most of the ATWS listed in table 4.4.2-2. In the draft EIS, we stated that Creole Trail would need to provide additional site-specific justification to support its variance requests for those requests that we have denied in table 4.4.2-2. Further discussion is provided below regarding variance requests that we have indicated in table 4.4.2-2 are denied or approved subject to revision.

Where the ATWS would be located in wetlands or within 50 feet of waterbodies or wetlands, Creole Trail would implement protection measures such as topsoil segregation of wetland soils, installation of silt fence and hay bales along workspace limits to prevent off-site sedimentation, temporary stabilization between construction periods for each pipeline, and final restoration and stabilization within 10 days after construction of the second pipeline. All wetlands affected by ATWS would be restored to preconstruction contours and elevations. Approval of these additional temporary work spaces in wetlands or within 50 feet of wetlands or waterbodies does not relieve Creole Trail from complying with other requirements of our Procedures. Erosion and sedimentation control devices should be monitored and maintained in these areas more frequently than the minimum time intervals required by our Procedures until final grading and revegetation has been completed.

In the draft EIS, we denied Creole Trail's variance request for the ATWS at the following locations on Segment 3 because it appeared that these ATWS could be truncated, reconfigured, or shifted slightly to maintain a 50-foot setback from wetlands or waterbodies:

- MP 42.7 (within 50 feet of a wetland);
- MP 41.0 (within 50 feet of a waterbody); and
- MP 54.1 (within 50 feet of a waterbody).

Five ATWS at MP 24.2 on Segment 2 and at MPs 1.6, 7.7, 25.3, and 78.6 on Segment 3, were identified as being located partially within wetlands as proposed in Creole Trail's application. Based on our review of the alignment sheets and the site-specific conditions at these locations, we recognize that it

would not be practical for these ATWS to be located 50 feet from wetlands. However, we stated in the draft EIS that we believed each of these ATWS could be shifted or reconfigured to avoid direct impacts on wetlands.

Our review of Creole Trail's alignment sheets identified five other ATWS on Segment 3 that appeared to be within 50 feet of wetlands. These ATWS are located at approximate MPs 0.5, 8.6, 9.9, 10.0, and 10.1 on Segment 3. We noted in the draft EIS that if correctly depicted on the alignment sheets, Creole Trail would not be permitted to use these ATWS as currently proposed without obtaining variances for their use.

To reflect the above findings, we recommended that Creole Trail reconfigure or relocate its proposed ATWS so that:

a. the ATWS at the following locations would be minimum of 50 feet from waterbodies or wetland boundaries:

   Segment 3, MP 41.0 - Crossing of Creek B43
   Segment 3, MP 42.7 - HDD of Calcasieu River
   Segment 3, MP 54.1 - Crossing of Creek A1
   Segment 3, MP 0.5 - Crossing of Wetland B45
   Segment 3, MP 8.6 - MLV 3-1 and 3-2
   Segment 3, MP 9.9 - Crossing of Creek B131
   Segment 3, MP 10.0 - Crossing of Creek B117
   Segment 3, MP 10.1 - Crossing of Creek CRK B117 (south side of creek); and

b. the ATWS at the following locations would be outside of wetland boundaries:

   Segment 2, MP 24.2 - Foreign pipeline crossing
   Segment 3, MP 1.6 - Cotton Vincent Road bore (south side)
   Segment 3, MP 7.7 - Railroad bore (north side)
   Segment 3, MP 25.3 - Boy Scout Road/Edgewood Road bore
   Segment 3, MP 78.6 - HDD of Bayou Mallet and pond

In comments on the draft EIS, Creole Trail stated that it would implement all but one of our recommendations listed in part "a" above, and that the revisions would be included in the alignment sheets to be filed with the Secretary prior to construction of the pipeline system. The exception is the proposed ATWS at MP 9.9 on Segment 3. Creole Trail stated in its comments that this ATWS has already been reduced to avoid the wetland and indicated that the proposed configuration is necessary to install the creek crossing. Based on Creole Trail's additional explanation, we have added this ATWS to table 4.4.2-2 and approve a variance for the work space to be within 50 feet of a wetland.

In addition, as indicated in footnote "h" of table 4.4.2-2, we have changed our decision regarding the ATWS at MP 42.7 on Segment 3. Creole Trail initially requested a variance for this ATWS so that it could be placed less than 50 feet from wetland C59, which is located just west of the ATWS. We denied this request in the draft EIS. However, during its verification process, the COE identified a new wetland, wetland V10, to the east of wetland C59. The ATWS would be within wetland V10; therefore, Creole Trail added this location to its list of variance requests. We approve the requested variance to place the workspace within wetland V10 because there is no reasonable alternative location for this HDD staging area. However, to allow Creole Trail to take as much advantage as possible of the small upland area between the two wetlands, we now approve the placement of this ATWS within 50 feet of wetland C59.

Our intent is to allow Creole Trail the flexibility to configure this ATWS in a manner that would minimize impacts on either wetland.

Creole Trail, also agreed to implement all of our recommendations in part "b" above, and stated that these revisions would be included in the alignment sheets to be filed with the Secretary prior to construction of the pipeline system.

Permanent Right-of-way Maintenance in Wetlands

Creole Trail has requested a variance to item VI.D.1 of our Procedures, which limits vegetation maintenance in wetlands. We deny this request because Creole Trail does not provide justification for its request or propose an alternative right-of-way maintenance protocol. Further, elsewhere in its application, Creole Trail indicates that it would maintain the right-of-way within wetlands in the manner specified in our Procedures. We believe it would be appropriate for Creole Trail to maintain each of the two pipelines within the dual pipeline system in accordance with our Procedures. This application of our Procedures to the dual pipelines would allow for two 10-foot-wide corridors (one over each pipeline) to be maintained as herbaceous, and for trees greater than 15 feet high to be selectively removed from within 15 feet of each of the two pipelines. Given the 25-foot offset between the two pipelines, the latter would include the entire area between the two pipelines (where there would be a 5-foot-wide overlap of each 15-foot allowance) as well as 15 feet on the outside of each of the pipelines (i.e., a total of 55 feet). If Creole Trail intended by its variance request to propose a different maintenance protocol, it would need to file a clear description of its proposed protocol and appropriate justification for its request.

4.4.3 Aquatic Resources Mitigation Plan

In addition to the measures required by our Plan and Procedures, Creole Trail would be required to comply with conditions established in the COE's section 404 permit, the LADEQ's section 401 permit, and the LADNR's Coastal Use Permit. As noted previously, Louisiana coastal use regulations (Louisiana Revised Statutes 49:214.30(H)(1) and 49:214.32(F)(1)) require that dredged materials in excess of 500,000 yd^3 be put to beneficial use (under Louisiana Revised Statute 49:214.30(H)(2), even activities requiring dredging of 25,000 yd^3 may be required to put the dredged material to beneficial use).

For the COE to determine whether practicable alternatives have been assessed and incorporated as appropriate, Creole Trail would be required to avoid wetland impacts to the maximum extent possible. Creole Trail 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 a less environmentally damaging alternative exists and the LADNR's requirement to place dredged material in excess of 500,000 yd^3 in a manner that would create or function as a beneficial use. Because a portion of the proposed LNG terminal site (DMPA "O") is currently used by the COE for the placement of dredged material, Creole Trail also must identify a replacement for DMPA "O" that is acceptable to the COE. As discussed in more detail in section 2.1.1, the Port of Lake Charles filed comments on the draft EIS expressing concern that the issue of a replacement site for DMPA "O" has not yet been resolved and describing recent legislation that provides for a land exchange in which part of DMPA "O" is to be replaced by another property referred to as "Area M."

Creole Trail is developing a comprehensive, project-specific ARMP through consultation with the COE, FWS, LADWF, NOAA Fisheries, and other resource agencies to meet all of the above requirements and to address impacts on EFH and other aquatic resources. To date, Creole Trail has prepared a draft ARMP that describes impacts on wetlands, waterbodies, EFH, and other aquatic resources; evaluates potential DMPA sites; and describes certain proposed or anticipated restoration, mitigation, and monitoring measures (see Appendix E). One of Creole Trail's objectives in developing its

ARMP is to ensure that there is no net loss of wetland acreage, function, and value. Once completed and approved, the ARMP will include the specific mitigation measures to be implemented for project-related impacts, including avoidance, minimization, and compensation. Potential mitigation measures identified in the draft ARMP for wetland impacts are discussed below. See sections 4.3.2, 4.6.2, and 4.6.3 for discussions of potential impacts on and proposed mitigation related to waterbodies, EFH, and other aquatic resources (e.g., oyster reefs, other fisheries).

LNG Terminal

Creole Trail has attempted to avoid wetlands to the extent practicable in designing the layout of its proposed LNG terminal and would minimize impacts on affected wetlands by implementing the measures specified in our Plan and Procedures. Creole Trail proposes to mitigate for unavoidable wetland impacts, both temporary and permanent, by compensatory creation/restoration of in-kind wetlands. Creole Trail proposes a mitigation ratio of 1.5:1 for both tidal wetlands (including EFH) and non-tidal wetlands, resulting in a total of 154.3 acres of mitigated wetlands. Construction of the marine facilities would result in the conversion of upland and emergent wetlands to 49.8 acres of open-water. In comments on the draft EIS, the COE, FWS, and LADWF all stated that compensatory mitigation, including mitigation ratios, should be determined based on an acceptable evaluation method in coordination with the appropriate federal and state regulatory and natural resource agencies. The COE also stated that compensatory mitigation would be assessed after Creole Trail's COE application has gone through a section 404 (CWA) avoidance and minimization review process.

Dredged Material Placement and Beneficial Use

In its application, Creole Trail stated that its preference would be to combine wetland mitigation, replacement of the COE's DMPA "O," and beneficial use of project-related dredged material into one site. Creole Trail has evaluated several potential mitigation sites as described in section 3.5 of this EIS. Figure 3.5-1 shows the approximate location of each potential site. In information filed after the recent hurricane activity, Creole Trail stated that no hurricane-related impacts had been identified that would preclude the use of the potential DMPA sites. Although Creole Trail has not yet committed to a particular site or plan, it has identified DMPA Alternative 2, located immediately southwest and west of the LNG terminal property in and around Oyster Lake, as its preferred site. This site would be sufficient to accommodate project-related dredged material and to provide a replacement for DMPA "O" for use by the COE. If DMPA Alternative 2 is used, Creole Trail anticipates that it would construct terraces in an east-west direction around Oyster Lake. These terraces would be spaced sufficiently to provide wind and wave breaks and to provide catch basins to direct the dredged material throughout the open water areas, facilitating the creation of marsh habitat. A dredged material pipeline would be constructed to transport dredged material to the site and to provide permanent dredge material access to the site for the COE. Creole Trail notes that its preferred plan is supported by the private landowner and that it would meet objectives of the Louisiana Coastal Area Ecosystem Restoration Plan that is being implemented by the COE and the LADNR. Creole Trail further notes that this plan would restore up to 4,391 acres of eroding and subsiding marsh, provide valuable coastal wetland habitat, and provide other environmental benefits.

Creole Trail has requested input from several agencies and interested parties regarding the potential DMPA sites it has identified. To date, Creole Trail has filed with the Commission responses from the FWS, the EPA, NOAA Fisheries, and the LADWF (see Appendix B of the draft ARMP for copies of correspondence). These comments do not explicitly express a preference for a particular site (although Creole Trail has indicated that Cameron Parish has expressed a preference for DMPA Alternative 4), nor do they oppose the use of Creole Trail's preferred site. However, some of the agencies identified potential issues at certain sites, recommended additional analysis, and/or offered suggestions on how the mitigation/beneficial use plan should be designed. In addition, NOAA Fisheries expressed

concerns about the feasibility of Creole Trail's planned mitigation design if DMPA Alternative 2 is used, specifically with respect to the construction of terraces using hydraulically dredged material that would have a high water content. NOAA Fisheries also noted that additional DMPA areas would need to be identified and evaluated if the adequate capacity is not available at the sites that have already been identified. The agencies noted that any mitigation/beneficial use plan would also have to take into account the potential impacts associated with implementation of the plan, such as the installation of the dredge material pipeline, and NOAA Fisheries further noted that placement of dredged material in the selected DMPA site by the COE would not constitute project-related compensation and would require separate authorization. In its comments on the draft EIS, the COE noted that there are unresolved issues associated with DMPA Alternative 2, and stated that more detailed plans and additional discussion with the resource agencies are necessary. The LADWF commented that in concept Alternative 2 is a possible solution for the beneficial use of dredged material, but noted that there are several issues that would need to be resolved for this site to be acceptable for short- and/or long-term use.

In comments provided to us during the preparation of the draft EIS, the COE noted that it may be difficult for Creole Trail to use one DMPA site for wetland mitigation, beneficial use of dredged material, and as a replacement site for DMPA "O" because wetlands created to meet wetland mitigation requirements might be adversely affected by the deposition of dredged material during subsequent dredging cycles. The COE reiterated this point in its comments on the draft EIS. Creole Trail's ongoing consultations with the COE and other agencies will include coordination with the COE to ensure that the replacement site for DMPA "O" would meet the future needs of the COE's maintenance dredging cycles. As noted in section 2.2.1, Area M was not identified as one of the alternative DMPA locations being evaluated by Creole Trail. However, Area M is a currently approved DMPA for the COE, and all COE DMPAs undergo NEPA review as part of the approval process.

If the DMPA site that is finally selected cannot be used for tidal wetland creation, mitigation would be conducted either on-site or in the vicinity of the proposed LNG terminal site. Tidally influenced wetlands would be created/restored through grading, contouring, and establishment of tidal conveyances. To ensure that its mitigation efforts are successful, Creole Trail would implement a monitoring program to document the site conditions and success of marsh restoration and creation. Monitoring would begin 6 months after wetland creation and continue for a minimum of 3 years post-mitigation or until the site achieves 80 percent vegetative cover. If monitoring results indicate that wetlands are not becoming sufficiently established, Creole Trail would consult with the COE to refine the mitigation plan and would replant or seed as necessary.

As part of its monitoring of the beneficial use of dredged material, Creole Trail would develop and submit to resource agencies an as-built plan-view drawing of the site. In addition to other criteria that might be established by resource agencies, Creole Trail's monitoring plan would include random topographic sampling to determine site elevations, vegetation sampling, civil and environmental delineation of open water areas versus other habitat types, and recommendations to facilitate successful restoration of the site.

Pipeline Facilities

Creole Trail has attempted to avoid and minimize impacts on wetlands to the extent practicable during the selection of its proposed pipeline route, aboveground facility locations, and workspace requirements. As discussed previously, Creole Trail would also avoid impacts on several wetlands by using the HDD construction method and by not maintaining the right-of-way in wetlands along the HDD path between the entrance and exit points during pipeline operation. Creole Trail would further minimize wetland impacts by adhering to the measures specified in our Plan and Procedures (with approved variances).

Creole Trail would restore wetlands to pre-construction contours and elevations unless it is necessary to correct pre-existing erosion conditions that could affect the operation of the pipeline facilities. Wetlands would be allowed to revegetate naturally from the existing seed bank and root systems that would remain within the affected wetlands and spread from adjacent undisturbed wetlands. This process would be facilitated by the wetland construction techniques required by our Procedures, which are designed to leave existing root systems intact and to prevent the mixing of topsoil and subsoil over the pipeline trench. In comments provided to us during the preparation of this EIS, the FWS also recommended that the mitigation plans defined in the ARMP also include measures to control the growth of invasive exotic vegetation in wetlands (see section 4.5.3 for a discussion of proposed and required measures to control the spread of invasive species).

Creole Trail would conduct annual monitoring in accordance with our Procedures and its ARMP for a minimum of 3 years after construction or until 80 percent cover is established. If, after 6 months, the wetlands do not appear to be recovering, Creole Trail would replant or seed the disturbed area. If the wetlands are still not reestablishing after 1 year, Creole Trail would notify the COE and other appropriate agencies to develop alternative mitigation or restoration plans. Creole Trail proposes additional measures for the monitoring of EFH wetlands, including but not limited to providing NOAA Fisheries and other agencies with pre- and post-construction Light Detection and Ranging (LIDAR) photography to document pre- and post-construction elevations and contours.

As required by the COE or other agencies, Creole Trail proposes to purchase wetland mitigation credits from approved wetland mitigation banks for temporary and permanent impacts on forested wetlands. Creole Trail proposes a mitigation ratio of 1:1 for the temporary loss of forested wetlands that would be allowed to revert to pre-construction conditions, and a ratio of 2:1 for the permanent conversion of forested wetland to emergent or scrub-shrub wetland. Creole Trail has identified mitigation banks within watersheds crossed by the project and proposes to use the Bryan Farm Mitigation Area in the West Fork Calcasieu watershed and the Lonesome Dove, L.L.C. Mitigation Bank in the Mementau watershed. Although acreages may change once the COE completes its wetland determinations, Creole Trail currently proposes to purchase a total of 64.16 acres of mitigation credit at the Bryan Farm Mitigation Area to mitigate for 19.36 acres of temporarily affected forested wetlands at a ratio of 1:1 and for 22.40 of permanently converted forested wetland at a ratio of 2:1. Creole Trail would purchase a total of 10.56 acres of mitigation credit at the Lonesome Dove, L.L.C. Mitigation Bank to mitigate for 4.34 acres of temporarily affected forested wetlands at a 1:1 ratio and 3.11 acres of permanently converted forested wetlands at a 2:1 ratio. As noted previously, the COE, FWS, and LADWF all commented that compensatory mitigation, including mitigation ratios, should be determined based on an acceptable evaluation method in coordination with the appropriate federal and state agencies.

Creole Trail is working with the COE, other federal and state agencies, and the Port of Lake Charles to finalize the details of the ARMP, which would include specific measures for compensatory wetland mitigation, beneficial use of dredged material, replacement of DMPA "O," and mitigation for impacts on EFH and other aquatic resources. Because the ARMP has not yet been finalized, **we recommend that**:

- **<u>Prior to construction</u>, Creole Trail should file with the Secretary a copy of the finalized Aquatic Resources Mitigation Plan developed in consultation with the COE, NOAA Fisheries, FWS, LADNR, LADWF, and Port of Lake Charles.**

4.5 VEGETATION

4.5.1 Habitat/Community Types

The vegetation communities that would be affected by construction and operation of the proposed Creole Trail Project include agricultural lands, upland forest, upland scrub-shrub, coastal grasslands/prairies, developed lands, and emergent, forested, and scrub-shrub wetlands. Open water is generally characterized by a lack of vegetation and, therefore, is not discussed.

Agricultural lands in the project area are primarily used for rice (*Oryza sativa*) production. Rice fields are often rotated as crawfish ponds. Another crop that may be found in the agricultural portions of the project area is sugarcane (*Saccharum officinarum*).

Dominant species found in upland forest communities include sugar-berry (*Celtis laevigata*), Chinese tallow-tree (*Sapium sebiferum*), hercules-club (*Zanthoxylum clava-herculis*), several species of oak (*Quercus* sp.), and yaupon (*Ilex vomitoria*). Pine plantations are also common in the project area. Planted pine plantations are usually dominated by slash (*Pinus elliotti*) or loblolly pine (*P. taeda*) and are used for timber production. Pine plantations exhibit various life cycle stages along the proposed pipeline routes, ranging from recently clear-cut areas to mature stands.

Dominant species found in upland scrub-shrub communities include Chinese tallow-tree and black willow (*Salix nigra*). Other common plants include sumac (Rhus sp.), eastern baccharis (*Baccharis halimifolia*), wax myrtle (*Myrica cerifera*), yaupon, and young trees associated with nearby or adjacent forest species.

Coastal grassland/prairie communities include open areas such as native grasslands, grazed pastures, and maintained rights-of-way. Vegetation in these communities is dominated by grasses and forbs. Coastal grasslands/prairies located on the proposed LNG terminal site are limited to areas used in the past for dredged spoil placement and contain more salt tolerant species. These areas are dominated by Gulf cordgrass (*Spartina spartinae*), West Indian dropseed (*Sporobolus indicus*), annual sumpweed (*Iva annua*), seashore saltgrass (*Distichlis spicata*), big-leaf sumpweed (*Iva frutescens*), saltmeadow cordgrass (*S. patens*), southern dewberry (*Rubus trivialis*), and huisache (*Acacia smallii*). Species commonly found in these communities along the pipeline routes include paspalum (P*aspalum* sp.), little bluestem (*Schizachyrium scoparium*), slender bluestem (*S. tenerum*), broomsedges (*Andropogon* sp.), three-awn grass (*Aristida* sp.), love grass (*Eragrostis* sp.), switch grass (*Panicum virgatum*), sedges (*Carex* sp.), umbrella flat sedge (*Cyperus diandrus*), goldenrod (*Solidago* sp.), and beakrush (*Rhynchospora* sp.).

Developed lands within the project area include residential and industrial lands. Vegetation present in these areas includes grasses, forbs, and landscaping. Common species include Bermuda grass (*Cynodon dactylon*), St. Augustine grass (*Stenotaphrum secundatum*), broomsedges (*Andropogon* sp.), three-awn grasses (*Aristida* sp.), and knotroot bristle grass (*Setaria geniculata*).

The emergent wetland communities in the project area (which include fresh, intermediate, and brackish marsh areas) are characterized by hydrophytic vegetation that grows in saturated soils. Species commonly found in this community include spikerush (*Eleocharis montevidensis*), rush (*Juncus effusus*), small pondweed (*Potamogeton pusillus*), green flatsedge (*Cyperus virens*), and rattlebush (*Sesbania* sp.). Emergent wetlands influenced by tidal activities are dominated by more salt tolerant species such as cord grass (*Spartina* sp.)

Scrub-shrub wetland communities are characterized by hydrophytic vegetation with a woody vegetation overstory (usually less than 20 feet tall). This community is commonly a transitional zone

between marsh habitats and higher elevations. Species commonly found in this community include the Chinese tallow-tree (*Sapium sebiferum*), wax myrtle (*Myrica cerifera*), and sand spikerush (*Eleocharis montevidenis*).

The forested wetland communities located in the project area are primarily bottomland hardwood forests located along major rivers and tributaries and are dominated by mature trees and shrubs. Dominant species present in this community include bald cypress (*Taxodium distichum*), black willow (*Salix nigra*), red maple (*Acer rubrum*), and water oak (*Quercus nigra*), and the Chinese tallow-tree (*Sapium sebiferum*).

4.5.1.1 LNG Terminal

Construction of the proposed LNG terminal would affect about 315.4 acres of vegetation communities, including coastal grassland/prairie (155.1 acres), upland forest land (54.1 acres), emergent wetlands (102.1 acres), scrub-shrub wetlands (0.8 acre), and developed lands (3.3 acres). To minimize impacts on vegetation, Creole Trail restricted the size of the construction areas for the proposed LNG terminal to the minimum necessary and would implement our Plan and Procedures.

Following construction, the entire 315.4 acres would be permanently converted to industrial use for operation of the LNG terminal. About 123.7 acres would be converted to non-vegetated surfaces (e.g., structures, process areas, open water, roads, other gravel or paved surfaces). The remaining 191.7 acres would be restored to pre-construction contours, planted with native grasses, and maintained in an herbaceous state by periodic mowing.

Although construction and operation of the proposed LNG terminal would remove vegetation as described above, the facility would be surrounded by similar vegetation communities and the impacts are not expected to be significant on a regional scale. Mitigation for wetlands affected by the LNG terminal would be conducted in accordance with the ARMP that Creole Trail is developing in cooperation with the COE and other resource agencies.

4.5.1.2 Pipeline

Construction of the proposed pipelines, aboveground facilities, and access roads would require clearing of approximately 1,782.8 acres of vegetated lands, including 677.4 acres of agricultural land, 500.4 acres of upland forest, 394.7 acres of coastal grassland/prairie, 66.1 acres of emergent wetland, 57.3 acres of forested wetland, 63.4 acres of developed lands, 18.7 acres of upland scrub/shrub, and 4.8 acres of wetland scrub/shrub. Wareyards required for construction of the pipeline facilities would affect an additional 222.0 acres of developed land. Operation of the proposed pipeline facilities would require approximately 923.7 acres of vegetation to be converted to permanently maintained pipeline right-of-way, aboveground facilities (e.g., meter and regulation stations and MLVs), or permanent access roads.

During construction, existing vegetation would be cleared from the construction right-of-way and other workspaces as necessary. Following construction, contours along the right-of-way would be restored, disturbed areas would be reseeded, and temporary work areas would be allowed to revert to pre-construction conditions. Implementation of our Plan and Procedures would minimize potential long-term impacts by limiting routine vegetation maintenance activities to no more than once every 3 years. In general, impacts on forest lands would be greatest because it would take longer (perhaps 30 to 40 years) for the trees to become reestablished to preconstruction conditions. In addition, as discussed below, trees would be prevented from growing on a portion of the permanent right-of-way by routine pipeline maintenance activities.

The loss of vegetation could also result in forest fragmentation and the loss or conversion of wildlife habitat. Other impacts could include increased erosion from the conversion of deep rooted vegetation to shallow rooted vegetation on the right-of-way and increased exposure to solar radiation, which could dry the soil and stimulate the growth of early successional species within and immediately adjacent to cleared areas. The removal of trees on the right-of-way could also expose trees growing adjacent to the newly cleared areas to higher levels of wind, which may increase the risk of blow downs.

Creole Trail would restore the construction right-of-way in accordance with our Plan and Procedures. Our Plan requires that areas disturbed by construction be seeded in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or as requested by the landowner or land management agency. Seeding would not be performed in actively cultivated croplands unless requested by the landowner. Our Procedures require topsoil segregation in unsaturated wetlands and the removal of stumps in wetlands be limited to the trenchline where possible to promote natural revegetation of the wetland. As noted previously, Creole Trail would develop a project-specific ARMP in coordination with the COE, LADWF, and other appropriate agencies to ensure successful revegetation of disturbed wetland habitats and/or to compensate for wetland impacts.

To minimize effects on vegetation, Creole Trail has intentionally chosen the pipeline route so that the proposed pipeline route would be collocated with existing facilities. The proposed pipeline routes would be collocated adjacent to previously disturbed pipeline or road rights-of-way for approximately 53 percent of their combined length. To minimize impacts on vegetation communities where collocated with an existing pipeline right-of-way, Creole Trail would overlap the existing right-of-way with 20 feet of the project-related temporary construction right-of-way. Creole Trail would further minimize impacts on vegetation by the use of the HDD method at several waterbody crossings. Wetlands and riparian areas at these locations would be within the HDD path and, therefore, avoided by construction activities. Creole Trail would also refrain from conducting maintenance activities along the HDD path. See section 4.4.3 for more details.

Creole Trail would not use pesticides or herbicides for vegetation clearing or maintenance or to control rodents, mosquitoes, or other vector populations. Although not anticipated, if use of an herbicide or pesticide becomes necessary, Creole Trail would coordinate with the appropriate state and local authorities, including the LADEQ and the EPA. Any herbicide or pesticide application would be conducted by a certified and licensed applicator in accordance with the specific product label directions and any applicable federal, state, or local regulations.

With the implementation of the mitigation measures described above, we conclude that the project would not adversely affect vegetation communities in the project area.

4.5.2 Vegetative Communities of Special Concern

The Louisiana Natural Heritage Program identified several sensitive vegetation communities in the vicinity of the proposed pipeline route including western longleaf pine savannah, flatwoods pond, and remnant coastal prairie. Based on field investigations conducted by Creole Trail, the proposed project would not affect flatwoods, pond or remnant coastal prairie patches. The project would, however, affect a western longleaf pine savannah community located between MPs 36.0 and 36.6 along Segment 3. A portion of this community has been designated by the LADWF and the landowner as the Barnes Creek Savannah Natural Area under the Louisiana Natural Areas Registry Program. The western longleaf pine savannah community is of concern because the majority of its native range throughout the southeastern United States has been replaced with other forest types primarily due to past logging and the infrequency of fires necessary to control diseases and competition from other species during regeneration. Approximately 9.0 acres of this community would be affected by construction of the proposed pipelines

and 3.6 acres would be affected by operation of the pipelines. The proposed pipeline route at this location follows an existing pipeline corridor. Although the existing corridor would be widened to accommodate the proposed new pipeline facilities, use of the existing corridor would minimize clearing and avoid the creation of a new corridor or further fragmentation in this community. As discussed in section 3.6.2.2, a route alternative was evaluated at this location but was not found to be preferable because of impacts the alternative route would have on forested wetlands.

The FWS identified a "distinctive site," referred to as the Crown Point Distinctive Site, as being in the project area and suggested that this site be avoided if possible. The site consists of cypress-tupelo swamp, mature pine-hardwood forest, longleaf pine savannah, mesic longleaf pine woodland, and a saline glade. Creole Trail has confirmed that Segment 3 would parallel this distinctive site between approximate MPs 20.6 and 21.7, but at its closest point (about MP 21.5) the route is about 1,000 feet from the site. Therefore, the project would not affect the Crown Point Distinctive Site.

4.5.3 Invasive Plant Species

Many locations throughout the proposed project area are known to contain exotic and invasive plant species. These species are defined as any species, including its seeds, spores, or other biological material capable of propagating that species, that is not native to the ecosystem and whose introduction does or is likely to cause economic or environmental harm. These species often take advantage of disturbed soil areas and can potentially out-compete native species, causing a permanent change in habitat type. Invasive species that are known to occur in the project area include the Chinese tallow tree, which can tolerate wetland and upland habitats, and the aquatic species water hyacinth (*Eichhornia crassipes*) and giant salvinia (*Salvinia molesta*).

The Chinese tallow tree dominates numerous areas along the proposed pipeline route. The tree is capable of invading areas and rapidly replacing the natural communities with nearly monotypical stands. This species' ability to rapidly reproduce at a young age (3 years) makes it very difficult to control. Because of its prevalence in the project area and absence of a comprehensive regional management program, it is likely that the Chinese tallow tree would reestablish where cleared during construction within 1 to 2 years.

The water hyacinth and giant salvinia are freshwater floating species that can form large colonies that block access, clog drainage ways and water intakes, and shade sunlight from the water column. To prevent the spread of water hyacinth and giant salvinia, Creole Trail's environmental inspectors would monitor waterbodies affected by construction activities for the presence of these species. If these species are present, Creole Trail would require construction personnel to clean all equipment before proceeding to the next waterbody.

In accordance with our Procedures, Creole Trail is required to consult with the appropriate land management or state agency to develop a project-specific wetland restoration plan that would include measures for controlling the invasion and spread of undesirable exotic species and monitoring the success of revegetation and weed control efforts. Our Plan and Procedures also require post-construction monitoring for the first and second growing seasons in uplands, and for 3 years in wetlands, to evaluate the success of revegetation. As part of this monitoring program, Creole Trail would be required to examine the right-of-way for the presence of invasive species. In non-agricultural upland areas, revegetation would be considered successful if the density and cover of non-nuisance species within the areas disturbed during construction are similar to the density and cover in adjacent undisturbed areas. Similarly, wetland revegetation would be considered successful if the cover and distribution of herbaceous and/or woody species is at least 80 percent of the type, density, and distribution of the vegetation in adjacent areas that were not disturbed by construction.

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Terrestrial Wildlife Resources

The proposed Creole Trail project would be located within the Chenier Plain Coastal Ecosystem as described by Gosselink et al. (1979). Based on hydrology and vegetation, the project area can be divided into nine distinct wildlife habitats. Seven of these habitats are present within the proposed LNG terminal, including coastal grassland/prairie, emergent wetland, scrub-shrub wetland, open water, developed, upland forest, and upland scrub-shrub. These habitats, as well as the upland forest and agricultural habitats, are also found along the proposed pipeline routes. Table 4.6.1-1 lists the non-fish wildlife species that may be found in these habitats. The following discussion provides brief descriptions of the physical and biological components of the wildlife habitats identified in the project area. State and federally listed threatened and endangered species are discussed separately in section 4.7. Descriptions of vegetation found in these habitats are provided in section 4.5. The list of species and habitat descriptions included in this discussion are based on information from the LADWF (Craig et al., 1987) and Gosselink et al. (1979).

Open water habitats include rivers, canals, water flats without vegetation, open bay systems, ponds, and lakes. Open water habitats consist of fresh, brackish, and salt waters. The primary open water habitats of concern in the project area are Calcasieu Lake and the Calcasieu Ship Channel. The principal source of freshwater inflow into these open water habitats is the Calcasieu River. However, these waters are also heavily influenced by saltwater intrusion and because of this influence, the range of species adapted to these conditions are relatively broad. Species present in open water habitats include six species of amphibians and reptiles, eight species of birds, and three mammal species (Craig et al., 1987; Gosselink et al., 1979).

Coastal grassland/prairie habitats are considered part of the palustrine system in Louisiana, but differ from marshes in that these areas are rarely inundated. These habitats support approximately seven species of amphibians and reptiles, nine species of birds, and seven species of mammals (Craig et al., 1987; Gosselink et al., 1979).

The upland forest and upland scrub-shrub habitats within the project area are characterized by woody vegetation that grows on unsaturated soils at slightly higher elevations. Species present in upland forest and upland scrub-shrub habitats include approximately 9 species of amphibians and reptiles, 14 species of birds, and 6 species of mammals (Craig et al., 1987; Gosselink et al., 1979).

The upland scrub-shrub habitats within the project area are characterized by herbaceous and woody vegetation that grow in unsaturated soils. Species present are similar to upland forest habitats.

Rice is the primary agricultural crop in the project area. Crawfish are sometimes produced in rotation with rice. Although generally not as diverse as other habitat types, agricultural lands provide habitat for a variety of wildlife species. Such species include eight species of amphibians and reptiles, eight species of birds, and eight species of mammals (Craig et al., 1987; Gosselink et al., 1979).

The emergent wetland habitats in the project area are characterized by emergent, hydrophytic vegetation that grows in saturated soils. Within the project area there are three types of emergent wetlands, including freshwater marsh, intermediate marsh, and brackish marsh. Wildlife is most abundant in freshwater wetlands. Species present in emergent wetlands include approximately 6 species of amphibians and reptiles, 11 species of birds, and 4 species of mammals (Craig et al., 1987; Gosselink et al., 1979).

TABLE 4.6.1-1

Habitats and Typical Non-Fish Wildlife Species Found within the Project Area

Habitat/Common Name, *Scientific Name*	Habitat/Common Name, *Scientific Name*
Open Water Habitat	**Agricultural Land**
northern cricket frog (*Acris crepitans*) central newt (*Notopthalmus viridescens*) pickerel frog (*Rana palustris*) cottonmouth water moccasin (*Agkistrodon piscivorous*) diamondback water snake (*Nerodia rhombifera*) red-eared slider (*Chrysemys scripta*) roseate spoonbill (*Ajaia ajaja*) osprey (*Pandion haliaetus*) American black duck (*Anas rubripes*) American bittern (*Botaurus lentiginosus*) spotted sandpiper (*Actitis macularia*) great egret (*Casmerodius albus*) blue winged teal (*Anas discors*) laughing gull (*Larus atricilla*) common muskrat (*Ondatra zibethicus*) nutria (*Myocastor coypus*) southeastern myotis (*Myotis austroriparius*)	gulf coast toad (*Bufo valliceps*) eastern narrow-mouth toad (*Gastrophryne caolinensis*) chorus frog (*Pseudacris triseriata*) pickerel frog (*Rana palustris*) cottonmouth water moccasin (*Agkistrodon piscivorous*) Louisiana milk snake (*Lampropeltis doliata*) speckled king snake (*Lampropeltis getulus*) diamondback water snake (*Nerodia rhombifera*) red-winged blackbird (*Agelaius phoeniceus*) northern pintail (*Anas acuta*) white-fronted goose (*Anser albifrons*) snow goose (*Chen caerulescens*) common snipe (*Capella gallinago*) red-tailed hawk (*Buteo jamaicensis*) Brewer's blackbird (*Euphagus cyanocephalus*) dickcissel (*Spiza americana*) Virginia opossum (*Didelphis virginiana*) red bat (*Lasiurus borealis*) Seminole bat (*Lasiurus seminolus*) striped skunk (*Mephitis mephitis*) raccoon (*Procyon lotor*) marsh rice rat (*Oryzomys palustris*) common muskrat (*Ondatra zibethicus*) white-tailed deer (*Odocoileus virginianus*)
Coastal Grassland/Prairie Habitat	**Emergent Wetland Habitat**
northern cricket frog (*Acris crepitans*) gulf coast toad (*Bufo valliceps*) spring peeper (*Hyla crucifer*) green anole (*Anolis carolinensis*) corn snake (*Elaphe guttata*) eastern hognose snake (*Heterodon platyrhinos*) rough green snake (*Opheodrys aestivus*) upland sandpiper (*Bartramia longicauda*) cattle egret (*Bulbulcus ibis*) killdeer (*Charadrius vociferus*) common nighthawk (*Chordeiles minor*) American kestrel (*Falco sparverius*) song sparrow (*Melospiza melodia*) painted bunting (*Passerina ciris*) short-eared owl (*Asio flammeus*) eastern kingbird (*Tyrannus tyrannus*) least shrew (*Cryptotis parva*) plains pocket gopher (*Geomys bursarius*) Virginia opossum (*Didelphis virginiana*) striped skunk (*Mephitis mephitis*) eastern cottontail (*Sylvilagus floridanus*) fulvous harvest mouse (*Reithrodontomys fulvescens*) white-tailed deer (*Odocoileus virginianus*)	Woodhouse's toad (*Bufo woodhousii*) eastern narrow-mouth toad (*Gastrophryne caolinensis*) bronze frog (*Rana clamitans*) Missouri slider (*Chrysemys floridana*) speckled king snake (*Lampropeltis getulus*) diamondback water snake (*Nerodia rhombifera*) American black duck (*Anas rubripes*) Virginia rail (*Rallus limicola*) short-eared owl (*Asio flammeus*) glossy ibis (*Plegadis falcinellus*) black rail (*Laterallus jamaicensis*) red-winged blackbird (*Agelaius phoeniceus*) American widgeon (*Anas americana*) American bittern (*Botaurus lentiginosus*) common snipe (*Capella gallinago*) great egret (*Casmerodius albus*) marsh hawk (*Circus cyaneus*) North American mink (*Mustela vison*) common muskrat (*Ondatra zibethicus*) marsh rice rat (*Oryzomys palustris*) swamp rabbit (*Sylvilagus aquaticus*)

TABLE 4.6.1-1 (cont'd)

Habitats and Typical Non-Fish Wildlife Species Found within the Project Area

Habitat/Common Name, *Scientific Name*	Habitat/Common Name, *Scientific Name*
Upland Forest/Upland Scrub-shrub Habitats	**Forested Wetland/Scrub-shrub Wetland Habitats**
northern cricket frog (*Acris crepitans*)	marbled salamander (*Ambystoma opacum*)
marbled salamander (*Ambystoma opacum*)	Woodhouse's toad (*Bufo woodhousii*)
spring peeper (*Hyla crucifer*)	green tree frog (*Hyla cinerea*)
green anole (*Anolis carolinensis*)	red-eared slider (*Chrysemys scripta*)
central newt (*Notopthalmus viridescens*)	five-lined skink (*Eumeces fasciatus*)
six-line racerunner (*Cnemidophorus sexlineatus*)	Texas rat snake species (*Elaphe obsoleta lindheimeri*)
corn snake (*Elaphe guttata*)	speckled king snake (*Lampropeltis getulus*)
eastern hognose snake (*Heterodon platyrhinos*)	cottonmouth water moccasin (*Agkistrodon piscivorous*)
rough earth snake (*Virginia striatula*)	rough earth snake (*Virginia striatula*)
Cerulean warbler (*Dendroica cerulean*)	wood stork (*Mycteria americana*)
yellow warbler (*Dendroica petechia*)	wood duck (*Aix sponosa*)
worm-eating warbler (*Helmitheros vermivorous*)	great blue heron (*Ardea herodias*)
willow flycatcher (*Empidonax trailli*)	red-shouldered hawk (*Buteo lineatus*)
Louisiana waterthrush (*Seiurus motacilla*)	snowy egret (*Egretta thula*)
warbling vireo (*Vireo gilvus*)	summer tanager (*Piranga rubra*)
Cooper's hawk (*Accipiter cooperi*)	American redstart (*Setophaga ruticilla*)
cedar waxwing (*Bombycilla cedorum*)	white-eyed vireo (*Vireo griseus*)
red-tailed hawk (*Buteo jamaicensis*)	red bat (*Lasiurus borealis*)
whip-poor-will (*Caprimulgus vociferus*)	southeastern myotis (*Myotis austroriparius*)
hermit thrush (*Catharus guttata*)	bobcat (*Lynx rufus*)
red-bellied woodpecker (*Melanerpes carolinus*)	North American mink (*Mustela vison*)
barred owl (*Strix varia*)	raccoon (*Procyon lotor*)
white-eyed vireo (*Vireo griseus*)	fox squirrel (*Sciurus niger*)
Seminole bat (*Lasiurus seminolus*)	white-tailed deer (*Odocoileus virginianus*)
bobcat (*Lynx rufus*)	
nine-banded armadillo (*Dasypus novemcinctus*)	
southeastern myotis (*Myotis austroriparius*)	
fox squirrel (*Sciurus niger*)	
white-tailed deer (*Odocoileus virginianus*)	

The forested wetland habitats are bottomland hardwood forests found along major rivers and are dominated by mature trees and shrubs. Forested wetland communities are essential for regulating flooding and stream recharge and also provide a very productive habitat for wildlife. Forested wetland habitats support approximately nine species of amphibians and reptiles, eight species of birds, and seven species of mammals (Craig et al., 1987; Gosselink et al., 1979).

Scrub-shrub wetland habitats are characterized by emergent, hydrophytic vegetation that grows in saturated soils with a dominant component of woody vegetation. Woody vegetation can reach a maximum height of 20 feet. The scrub-shrub community may be a transitional zone between marsh habitats and higher elevations. Wildlife species in these wetland habitats are similar to those found in forested wetland habitats.

Developed land consists of residential, industrial, and other areas developed for active human use. Residential land occurs throughout the project area in varying densities. The project area crosses a few industrial areas, including existing gas plants and boat yards. These areas generally do not have diverse vegetative communities or provide substantial forage or cover for wildlife. Although they may be used by some wildlife species that are well adapted to human activity, these areas are not considered to provide significant value as wildlife habitat.

4.6.1.1 Potential Project Impacts on Terrestrial Wildlife

The impact of construction and operation of the proposed project on terrestrial wildlife and wildlife habitats would vary depending on the timing of construction and types of construction techniques used, as well as on the requirements of each species and the habitat present where various project components would be constructed. Some smaller, less mobile wildlife, such as small mammals, amphibians and reptiles, could be killed or injured by construction activities. Other wildlife, such as birds and larger mammals, would likely leave the immediate construction area when construction activities approach and move to similar habitats nearby. In general, impacts on terrestrial wildlife would be short term and minimal because much of the area affected by construction would be allowed to revert to the pre-construction habitat type following construction.

LNG Terminal

Construction and operation of the LNG terminal would affect 315.4 acres of wildlife habitat, converting it to industrial use. About 123.7 acres would be occupied by LNG terminal components such as the LNG storage tanks, buildings, process areas, impoundments, roads, and paved or gravel areas. Of the 123.7 acres, about 49.8 acres would be permanently converted from coastal grassland/prairie, upland forest, and emergent wetland to open water for the marine basin and tugboat dock. The remaining 191.7 acres of land at the LNG terminal site would be restored to pre-construction contours and maintained in an herbaceous state. To the extent that wildlife is not hindered by fencing and can adapt to the human activities at the operational LNG terminal, some of this area may continue to provide habitat. In addition, impacts on wildlife habitat at the LNG terminal would be moderated by the fact that similar habitat types are present in the areas adjacent to the facility. Although human activity and noise during operation of the LNG terminal would extend beyond the property boundary, some of the wildlife species that occur in adjacent areas may become acclimated to the presence of the facility. The ARMP that Creole Trail is developing in cooperation with the COE and other agencies would include wetland mitigation and/or compensation plans that would also serve to mitigate impacts on wildlife that is dependent on wetland habitats.

The FWS noted that lighting, communication, and/or flare towers associated with the operation of the LNG terminal could result in impacts on trans-Gulf migratory birds. In a letter dated May 2, 2005, the

FWS listed the guidelines for the siting, construction, operation and decommissioning of communication towers. Creole Trail has committed to implementing these guidelines during construction and operation of the LNG terminal.

Pipeline Facilities

Construction of the proposed pipeline facilities, including aboveground facilities, ATWS, and access roads would affect about 1,782.8 acres of upland and wetland vegetation habitats and 722.3 acres of open water. About 923.7 acres of upland and wetland vegetation habitats and 169.5 acres of open water would be within the permanent footprint of the pipeline facilities following construction. Contractor wareyards would affect only developed lands. Following construction, temporary work areas and non-forested portions of the permanent rights-of-way would be allowed to revert to pre-construction conditions. Portions of the permanent right-of-way in upland forests and forested wetlands would be maintained in an herbaceous state in accordance with our Plan and Procedures (and approved variances) to facilitate leak surveys. Because most of the pipeline construction areas would revert to pre-construction conditions, impacts on most wildlife habitat would be temporary and short term. Long-term impacts would be limited to upland forests and forested wetlands, which, even where not maintained as herbaceous, would take many years to become re-established.

To minimize impacts on wildlife, the affected areas would be revegetated and maintained according to our Plan and Procedures. Our Plan does not allow routine vegetative maintenance to occur more frequently than every three years, except along a 10-foot wide herbaceous corridor centered on the pipeline that can be maintained annually. The Plan also prohibits vegetative clearing between April 15th and August 1st along the permanent easement, which prevents disturbance of ground-nesting birds. As noted previously, Creole Trail would develop a project-specific ARMP in coordination with the COE, LADWF, and other appropriate agencies to ensure successful revegetation of disturbed wetland habitats and/or to compensate for wetland impacts. As also noted previously, impacts on wildlife habitat would be further minimized by the collocation of portions of the pipeline segments with existing corridors, by encompassing several wetlands and riparian areas within the HDD path at certain waterbody crossings, and by refraining from conducting maintenance activities between the HDD entrance and exit at those locations. Further, Creole Trail would continue to consult with federal and state resource agencies to determine construction timeframes that would avoid or minimize impacts on wildlife species and to develop appropriate mitigation plans.

4.6.1.2 Unique or Sensitive Wildlife Habitats

No public or conservation lands have been identified within the proposed pipeline corridors. The closest National Wildlife Refuges (NWR) to the project area are the Cameron Prairie NWR and the Sabine NWR. Segment 2 would run adjacent to but not cross the Cameron Prairie NWR near MPs 2 to 3, and would be a minimum of 7,000 feet from the Sabine NWR at approximately MP 9. See section 4.8.3.2 for additional information about the Cameron Prairie NWR.

Sensitive wildlife habitats that could potentially occur in the project area include habitat for wintering migratory waterfowl and waterbird nesting colonies. Common bird species likely to occur in rookery colonies within the proposed project area include cattle egret, white ibis (*Eudocimus albus*), snowy egret, tri-colored heron (*Egretta tricolor*), green heron (*Butorides virescens*), little blue heron (*Egretta caerulea*), roseate spoonbill, great egret, yellow-crowned night heron (*Nyctanassa violacea*), and black-crowned night heron (*Nycticorax nycticorax*). In a May 2, 2005 letter to the Commission, the FWS recommended spatial and timing restrictions to be observed if wading bird colonies are identified in the project area. Specifically, the FWS indicated that for colonies containing nesting wading birds, activities within 1,000 feet of a rookery should be restricted to the non-nesting period for the species present, and

for colonies containing nesting gulls, terns, or black skimmers, activities within 650 feet of a rookery should be restricted to the non-nesting period for the species present.

Creole Trail conducted aerial surveys on March 4, 2005 along Segments 2 and 3. Environmental investigations were also conducted from February 1 to April 13, 2005 along Segments 2 and 3. No evidence of colonial waterbird rookeries was identified within the vicinity of the project area. Based on the results of Creole Trail's surveys, the FWS concurred in a June 22, 2005 letter that the proposed project would not be likely to affect colonial waterbird rookeries. However, the FWS also noted that because of the time period between its consultation letter and actual commencement of the project, further coordination with the FWS would be necessary if a colonial waterbird rookery is observed within 1,000 feet of the project area prior to or during construction. The FWS also noted that if the project is not initiated within 1 year of its letter, follow-up consultation would be necessary.

Creole Trail has stated that it would continue to consult with the FWS and other appropriate agencies to determine what steps are necessary to avoid or mitigate for impacts on wildlife and would forward all correspondence to the Commission when available. Creole Trail has also stated that it would continue to monitor the project area for colonial wading bird rookies and that it would conduct any additional necessary surveys within the year of construction.

4.6.2 Aquatic Resources

The main surface water resource in the project area is Calcasieu Lake, which is nearly 17 miles long and a little more than 5 miles wide at its widest point. Calcasieu Lake receives freshwater water from the Calcasieu River, which drains approximately 3,900 square miles in southern Louisiana, and numerous bayous and smaller rivers. Other sources of freshwater into the lake include runoff, direct precipitation, and municipal, industrial, and agricultural return flow. Calcasieu Lake receives salt water from the Gulf of Mexico by way of the Calcasieu Pass. Calcasieu Lake is naturally shallow, with an average depth of approximately 6 feet and a maximum reported depth of 11 feet.

The COE maintains a deep draft ship channel (the Calcasieu Ship Channel) at a depth of 40 feet along the western shore of the lake that extends from the confluence of Prien Lake and the Calcasieu River near Prien, Louisiana, to the end of the jetties in the Gulf of Mexico. The proposed LNG terminal site is on the western shore of the Calcasieu Ship Channel about 3 miles north of the Gulf of Mexico.

The proposed pipeline routes would cross 175 waterbodies including 43 perennial streams, 1 lake, 4 manmade ponds, 65 intermittent streams, and 62 manmade ditches in the Calcasieu and Mermentau River watersheds. Waterbodies crossed by the proposed pipeline routes support warmwater marine, estuarine, and freshwater fish communities. The pipeline routes cross several large rivers, including the Calcasieu River, Houston River, West Fork Calcasieu River, and Bayou Nezpique, and several other streams, canals, and wetlands. The LADWF classifies all waterbodies in Louisiana as warmwater fisheries (Reed, 2003). The following sections provide an overview of the fishery resources found within the project area and potential impacts on these resources.

4.6.2.1 Fish and Invertebrates

The fisheries in the vicinity of the proposed LNG terminal and all of Segment 2 are classified as either estuarine or marine. Further inland, where freshwater inflow from the Calcasieu River and other smaller tributaries occur, there is reduced mixing with marine waters and the fisheries become more estuarine and brackish, ultimately becoming freshwater fisheries. All waters crossed by Segment 3 are considered freshwater. Aquatic organisms in the project area reflect the great diversity of fish and invertebrate resources found in the surrounding coastal waters and the Gulf of Mexico. The ecological

stability of aquatic resources, notably the abundance and diversity of fish and invertebrate species, is dependent in large part on salinity, substrate, and vegetation.

Life histories of many Gulf fish species can be characterized as estuarine-dependent. These species typically spawn in the Gulf, allowing their larvae to be carried inshore by currents. Juvenile fish generally remain in these estuarine nurseries for about a year, taking advantage of the greater availability of food and protection that estuarine habitats afford. Upon reaching maturity, estuarine fish either remain in the estuary, migrate to sea to spawn (returning to the estuary between spawnings), or migrate from the shallow estuaries to spend the rest of their lives in deeper offshore waters (Marx and Herrnkind, 1986).

Estuary-dependent species potentially occurring within the project area include Gulf menhaden (*Brevoortia patronus*), shrimp, crabs, and sciaenids. True-estuarine fish, which inhabit estuaries throughout their entire life and are likely to occur within the project area, include killifish (*Fundulus spp.*), sheepshead minnow (*Cyprinodon variegatus*), mosquito fish (*Gambusia affinis*), silversides (*Menidia beryllina*), striped mullet (*Mugil cephalus*), Atlantic croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus*), hardhead catfish (*Arius felis*), silver perch (*Bairdiella chrysura*), hogchoker (*Trinectes maculatus*), and least puffer (*Sphoeroides parvus*).

Non-estuarine fish, including coastal pelagic marine fish and freshwater fish, are also likely to occur in the project area. The major coastal pelagic families occurring in the region are Carcarhinidae (requiem sharks), Elopidae (ladyfish), Engraulidae (anchovies), Clupeidae (herrings), Scombridae (mackerels and tunas), Carangidae (jacks and scads), Mugilidae (mullets), Pomatomidae (bluefish), and Rachycentridae (cobia). Coastal pelagic species traverse shelf waters of the region throughout the year. Some species form large schools (e.g., Spanish mackerel), while others travel singly or in smaller groups (e.g., cobia).

The major freshwater families occurring in the project area are Lepisosteidae (gars), Amiidae (bowfins), Ictaluridae (catfishes), Anguillidae (freshwater eels), Cyprinidae (minnows and carp), and Centrarchidae (sunfishes, basses, and crappies) (Gosselink et al., 1979). Common freshwater fish species that may occur in waterbodies along the northern portions of Segment 2 and along Segment 3 include creek chubsucker, inland silverside, red ear sunfish, swamp darter, and mosquitofish. The channelized ditches and/or canals crossed by the project, most of which only intermittently contain water, are not likely to consistently sustain fish populations.

Benthic invertebrates are an important food source for fish and larger invertebrates. Additionally, invertebrates are valuable indicators of water/sediment pollution and construction-related sediment disturbance. In general, populations of invertebrates increase from fall to spring in coastal Louisiana waters. Estuaries, such as the Calcasieu Lake estuary, often determine the shellfish resources of the Gulf of Mexico. Shellfish species range from those located only in brackish wetlands to those found mainly in saline marsh and inshore coastal waters. Creole Trail's contractors conducted substrate characterization and oyster assessments along the proposed pipeline routes in Calcasieu Lake. The results of these studies are described below in section 4.6.2.2 and a copy of Creole Trail's report is provided in Appendix F.

The major waterbodies in the project area provide habitat for a wide variety of aquatic invertebrates that play an important role in the transfer of food energy to higher trophic levels within coastal waters. Dominant motile benthic species likely to occur in the shallow fringes of these major waterbodies include gastropods, such as the oyster drill (*Thais haemostoma*) and moon snail (*Polinices lewisii*), and crustaceans, such as hermit crabs (*Clibanarius vittatus*) and mud crabs (*Rhithropanopeus harrisii*, *Neopanope texana*, and *Panopeus herbstii)*. Sessile macroepifauna, such as the sea pansy (*Renilla mulleri*), and acorn barnacles (*Balanus* spp.) are found throughout the nearshore Gulf and are likely to occur within the project area on hard surfaces such as pilings, rock jetties, and other structures (Hoese and Moore, 1977).

Shellfish species in the project area range from those located only in brackish wetlands to those found mainly in saline marsh and inshore coastal waters. Up to 15 species of penaeid shrimp can be expected to occur in the project area, of which the brown shrimp (*Farfantepenaeus aztecus*) and white shrimp (*Litopenaeus setiferus*) are the most numerous. At least eight species of portunid (swimming) crabs are common residents of the coastal and estuarine waters of the northern Gulf of Mexico. However, blue crabs (*Callinectes sapidus*) are the only species that are located throughout the Gulf and comprise a substantial fishery (Turner and Brody 1983).

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

4.6.2.2 Commercial and Recreational Fisheries

The fishery resources found within the project area can be classified as warmwater marine, warmwater estuarine, and warmwater fresh (freshwater areas are limited to the pipeline routes). Table 4.6.2-1 is a list of representative commercial and game aquatic species known to occur in the project area.

Recreational and commercial fisheries are considered a vital part of Louisiana's economy. According to a national survey by the FWS, Louisiana's recreational fishing industry was worth $605 million in 1993 (Weber et al., 1995), with the majority (83 percent) of fishing occurring in estuaries (NOAA Fisheries, 2005b). In 1992, two of the top 10 commercial fishing ports in the United States were in Louisiana (Weber et al., 1995), and over 33 percent of commercial fishes harvested in the lower 48 states come from the Louisiana coastal zone (Coalition to Restore Coastal Louisiana, 2000).

Commercial fishery landings for Cameron, Louisiana, were rated sixth in the nation in 2002 and 2003, averaging 304.5 million pounds. As of February 24, 2005, annual landings of blue crab and oysters were nearly 48 million pounds with a value of almost $33 million, and nearly 14 million pounds with a value of over $33 million, respectively (NOAA Fisheries, 2005a). The principal finfish harvested by anglers are Atlantic croaker, black drum, gafftopsail catfish, red drum, sand seatrout, sheepshead, southern flounder, and spotted seatrout. Other important commercial species in Louisiana include Atlantic menhaden, white shrimp, Atlantic croaker, brown shrimp, striped mullet, southern flounder, and unclassified bait-fish (NOAA Fisheries, 2005a).

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

TABLE 4.6.2-1

Representative Game and Commercial Aquatic Species Known to Occur in Creole Trail Project Area

Common Name	Scientific Name	Fishery Classification
Brown shrimp	*Farfantepenaeus aztecus*	Warmwater marine/estuarine
Pink shrimp	*Farfantepenaeus duorarum*	Warmwater marine/estuarine
White shrimp	*Litopenaeus setiferus*	Warmwater marine/estuarine
Red drum	*Sciaenops ocellatus*	Warmwater estuarine
Spanish mackerel	*Scomberomorus maculates*	Warmwater marine
Atlantic croaker	*Micropogonias undulates*	Warmwater marine/estuarine
Gulf menhaden	*Brevoortia patronus*	Warmwater marine/estuarine
Black drum	*Pogonias cromis*	Warmwater marine/estuarine
Gafftopsail catfish	*Barge marinus*	Warmwater marine/estuarine
Sand seatrout	*Cynoscion arenarius*	Warmwater estuarine
Sheepshead	*Archosargus probatocephalus*	Warmwater marine/estuarine
Southern flounder	*Paralichthys lethostigma*	Warmwater marine/estuarine
Spotted seatrout	*Cynoscion nebulosus*	Warmwater estuarine
Striped mullet	*Mugil cephalus*	Warmwater marine
Blue crab	*Calinectes sapidus*	Warmwater marine/estuarine
Bonnethead shark	*Sphyrna tiburo*	Warmwater marine
Spotted gar	*Lepisosteus oculatus*	Warmwater fresh
Bowfin	*Amia calva*	Warmwater fresh
Blue catfish	*Ictalurus furcatus*	Warmwater fresh
Channel catfish	*Ictalurus punctatus*	Warmwater fresh
Flathead catfish	*Pylodictis olivaris*	Warmwater fresh
Gizzard shad	*Dorosoma cepedianum*	Warmwater fresh
Threadfin shad	*Dorosoma pentense*	Warmwater fresh
Largemouth bass	*Micropterus salmoides*	Warmwater fresh
Black crappie	*Pomoxis nigromaculatus*	Warmwater fresh
Freshwater drum	*Aplodinotus grunniens*	Warmwater fresh
Red swamp crayfish	*Procambarus clarkii*	Warmwater fresh
White River crayfish	*Procambarus zonangulus*	Warmwater fresh

Source: Gosselink et al., 1979

Oyster Assessment and Substrate Characterization

American oysters (*Crassostrea virginica*) are an important commercial fishery in Louisiana. Calcasieu Lake is a public oyster area. Public oyster reefs are an important source of seed oysters for leaseholders to transplant to privately leased areas, and also provide a yield of sack oysters sold directly to markets. In 2002, public waters accounted for 55 percent of the total oyster harvest (LADWF, 2003). Long-term data show that oyster stocks were relatively stable from 1982 through the 1990s. In Calcasieu Lake, the abundance of market-sized oysters has remained stable despite fluctuations in the number of sacks harvested (LADWF, 2003).

In July 2005, Creole Trail filed a report entitled *Oyster Assessment and Substrate Characterization for the Proposed Cheniere Creole Trail Pipeline Located in Calcasieu Lake in Cameron Parish, Louisiana* (PBS&J, 2005) (see Appendix F). The report details the findings from surveys conducted in compliance with guidelines developed by the LADWF for sampling in oyster seed grounds, seed reservations, and tonging areas. The surveys were conducted to characterize and quantify the different substrate types and to determine the presence, quantity, condition, and demography of oyster

reefs within a 3,000-foot-wide study corridor centered along the proposed pipeline alignment. The surveys were completed in two phases: Phase I consisted of a side-scan sonar survey, bathymetric survey, and sub-bottom profiling; Phase II included side-scan sonar ground truthing, a substrate characterization, an oyster assessment, and a water quality investigation. The assessment identified 248.15 acres of oyster reefs and cultch substrate within the study corridor. Based on density, mortality rates, and multiplying factors provided by the LADWF, 475,754 sacks of marketable oysters are predicted to be produced from the oyster reefs in the study area.

The substrate characterization identified three substrate types in the 350-foot-wide study corridor. Creole Trail subsequently provided updated acreages for each substrate type to reflect route modification filed with its August 31, 2005 supplemental filing. Creole Trail stated that only substrate Types II and III would be affected by the project. A total of 697.3 acres of Type II would be affected, which is composed of 236.56 acres of moderately firm mud, 453.24 acres of firm mud or sand, and 7.5 acres of buried shells. About 48.54 acres of Type III substrate would be affected, including 32.12 acres of oyster reef. Substrate information was used to calculate compensation amounts as discussed in section 4.6.2.3.

In information filed after the recent hurricane activities, Creole Trail noted that sampling conducted by the LADWF in Terrebonne and Iberia Parishes (east of the project area) found oyster mortality levels of about 30 percent. However, impacts of Hurricane Rita on oyster beds in Calcasieu Lake have not yet been evaluated. Such impacts could potentially include oyster mortality due to burial by sediment deposition, increased predation, or contamination from suspended toxins. The existing local fishery may also be affected by administrative closures due to elevated bacteria levels. Creole Trail proposes to mitigate for impacts on oyster fisheries based on its baseline oyster assessment, which was conducted prior to the hurricanes.

4.6.2.3 Construction Impacts on Aquatic Resources

Potential impacts on aquatic resources from project construction and operation include those associated with dredging of the berth area as well as pipeline construction across waterbodies and through wetlands.

LNG Terminal

The dredging of the marine facilities (ship berths, maneuvering basin, and tugboat dock) would affect approximately 51.9 acres of existing open water (areas to be deepened within and adjacent to the Calcasieu Ship Channel) and about 49.8 acres of land that would be converted to open water for the new facilities. The marine basin would be dredged to 45 feet below MLG and the tugboat dock would be dredged to 25 feet below MLG. The dredging of the marine facilities would create approximately 49.8 acres of new deep water habitat. Materials dredged from these areas would be placed in a DMPA and used in a beneficial manner.

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

Suspended sediments from dredging and dewatering could affect benthic species by adversely affecting water quality. The primary mechanisms of impact on biota from dredging and dewatering of dredge spoil would be interference with respiration, feeding, and alteration of habitat suitability. Suspended particles could physically clog breathing and feeding organs or could result in lowered oxygen

levels through increases in chemical oxygen demand. As suspended sediments settle out of the water column, they could smother immobile benthic invertebrates, such as barnacles, sponges, and hydroids. However, dredging would not be expected to noticeably increase turbidity in the already turbid waters of the Calcasieu Ship Channel.

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

Overall impacts on the fishery resources in the LNG terminal area generally would be minimal and short term. There would be a net gain of new deep open water habitat that would be created through the conversion of coastal land into open water for the marine facilities. Dredging in the existing deep water habitat in and adjacent to the Calcasieu Ship Channel would not result in a loss of that habitat. This activity would be comparable to periodic maintenance dredging of the ship channel. The marine terminal also would create some additional hard substrate areas on the submerged pilings and other structures that would allow for the growth of attached organisms and the creation of three-dimensional structures that are used by some species for refuge. Fish and benthic organisms in the area would be affected slightly during the construction phase of the marine facilities, but recruitment and re-colonization would replenish the species with a minor potential for a subtle shift in species using the marine basin area.

The portion of the shoreline from which the berthing area would be created has little shallow habitat that could be characterized as potential nursery. The vegetation change from upland species to unvegetated bottom is abrupt with no known submerged vegetation. Creole Trail has developed a draft ARMP (see Appendix E) that will be reviewed by the COE, NOAA Fisheries, and other federal and state agencies and would address the possibility of providing a more contiguous habitat of higher quality for fish, crabs, and shrimp (see section 4.4.3). Given the steep shoreline and limited tidal wetlands in the marine basin area, little nutrient export is likely occurring, and the buffering of wave energy is minimal. The area within the new marine basin would provide for increased protection from wave energy compared to the currently exposed shoreline.

NOAA Fisheries defines the low salinity season for the Calcasieu Lake area as January through March and the high salinity season as August through October. The remaining months are identified as transitional periods. Project dredging and marine construction, depending on the size of dredge used, is expected to take up to 17 months, which means that the dredging would extend through various salinity cycles. Given the location of the dredging and the comparatively small volumes of water moved, the dredging is not expected to have a significant effect on salinity at the marine facilities or the DMPA that is selected for the project. Dredging-related salinity changes should, therefore, have essentially no effect on any of the species in the area.

Construction of the LNG terminal would affect 64.3 acres of wetlands identified as EFH, including 3.1 acres of estuarine emergent wetlands and 61.2 acres of palustrine emergent wetlands. Operation of the LNG terminal would permanently affect 15.7 acres of wetlands identified as EFH, including 1.5 acres of estuarine emergent wetlands and 14.2 acre of palustrine emergent wetland. Creole Trail's draft ARMP includes proposed mitigation for wetland impacts.

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

Pipelines

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

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

The proposed pipelines would cross 44 perennial and 65 intermittent waterbodies (see Appendix C). Creole Trail would minimize the impact of pipeline construction and restoration activities on fisheries, fish habitat, and other aquatic organisms within and adjacent to these waterbodies by implementing applicable measures of our Procedures (with approved variances). Creole Trail initially proposed to construct the pipelines beginning in the second quarter of 2009 through the end of the year. In its comments on the draft EIS, Creole Trail indicated that its current construction schedule contemplates commencing select HDDs in 2007 and conducting mainline construction in 2008. Our Procedures state that instream work for warmwater fisheries must be completed between June 1 and November 30 unless expressly permitted or further restricted by the appropriate state agency in writing on a site-specific basis.[2] Creole Trail would be required to comply with construction windows as specified in its waterbody crossing permits.

Calcasieu Lake Construction

Creole Trail would cross Calcasieu Lake using a combination of HDD at the shoreline approaches and open-cut trenching across the remainder of the lake. Construction methods proposed for the Calcasieu Lake crossing are described in section 2.3.2.2. Dredging in Calcasieu Lake would result in similar impacts on fishery resources as were described above for the dredging of the LNG terminal. The effects of dredging would include increased turbidity, sedimentation, and noise. Pipeline construction in Calcasieu Lake would involve dredging and temporary stockpiling of excavated sediments adjacent to the pipeline trench and floatation channels. Approximately 692.7 acres, or 17.1 miles, of bottom sediments

[2] For the Sabine Pass LNG and Pipeline Project, the LADWF stated that, while there are no designated timing windows for instream construction work, requests are reviewed on a case-by-case basis during project permitting.

(EFH) would be disturbed temporarily in Calcasieu Lake due to pipeline construction. However, the use of the HDD method to construct the shore approaches would avoid the disturbance of about 0.9 mile of bottom sediments in the lake.

Alteration of benthic community patterns could render the area of the pipeline rights-of-way temporarily unavailable as feeding areas or habitat for fishes or other bottom feeding species. The duration of this temporary impact would be for the length of construction activities plus benthic recolonization time. There would be no impacts from the operation of the pipelines because they would be buried beneath the lake bottom.

As discussed in section 4.6.2.1, the proposed pipelines would cross oyster habitat in Calcasieu Lake. Oysters inhabiting the areas directly affected by dredging operations could be destroyed. Oysters in the adjacent area could also be affected by the increased turbidity and deposition of sediments suspended by construction activities, which could smother oysters, interfere with feeding, and keep oyster spat from setting successfully.

Creole Trail would implement several mitigation measures to minimize impacts on oyster fisheries during the Calcasieu Lake crossing. These measures include constructing the pipeline in Calcasieu Lake during the summer months, installing turbidity curtains on the edges of the construction corridor next to dredging and backfill equipment within 1,500 feet of active oyster leases (see discussion in section 2.3.2.2), and restoring disturbed habitat to pre-construction contours. Creole Trail's draft ARMP (Appendix E) identifies other potential mitigation measures, which are subject to further coordination with appropriate regulatory agencies, including but not necessarily limited to the LADWF. As noted in section 2.3.2.2, the LADWF is mandated under Louisiana law (Louisiana Revised Statutes 56:3:434 and 435.1) to protect oyster resources. Under Louisiana Revised Statute 56:639, the LADWF also has authority over the establishment and maintenance of artificial reefs in navigable waters of Louisiana and waters of the federal exclusive economic zone adjacent to Louisiana waters.

These additional measures include:

- providing cultch and seed to repopulate affected oyster areas;
- creating up to 45 acres of reef for finfish and oysters;
- implementing a monitoring plan to document cultch planting and measure the success of created reefs;
- paying monetary compensation to the LADWF for impacts on substrates; and
- paying restitution to the LADWF for economic impacts on the oyster fishery based on calculated projections of oyster production.

Compensation costs for substrate impacts vary by substrate type and are defined in a LADWF memorandum entitled "Cultch Compensation Costs for Public Oyster Seed Grounds, Reservations and Tonging Areas" (LADWF, 2003). The estimated compensation value for oysters within the construction and permanent rights-of-way in the lake were calculated based on the results of Creole Trail's substrate characterization and oyster assessment. See Appendix F for details on how compensation costs for substrate impacts and oysters were calculated.

Other Waterbody Crossings

Creole Trail proposes to cross most major waterbodies and several minor and intermediate tributaries using the HDD method (see table 4.3.2-1). Use of the HDD method would avoid impacts on those waterbodies and associated aquatic resources. As discussed in section 4.3.2.1, a frac-out during a HDD could potentially affect fish or aquatic invertebrates due to the suspension of drilling mud in the water. To minimize this risk, we have recommended that Creole Trail develop a Drilling Mud Contingency Plan.

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

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

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

4.6.2.4 Hydrostatic Testing

Creole Trail would conduct hydrostatic tests following construction to ensure the integrity of the completed pipelines. After each section of pipeline is tested, the water would either be reused in another test section or discharged, most likely back to the source from which it was appropriated. Pre-tests would also be conducted on HDD segments before they are pulled into place. Table 4.3.2-2 lists the waterbodies that Creole Trail proposes to use as sources and possible discharge locations for hydrostatic testing. Withdrawal of hydrostatic test water could entrain fish eggs and juvenile fish. Creole Trail would minimize the potential effects of hydrostatic test water withdrawals on fisheries by screening intake hoses to prevent the entrainment of fish and other aquatic organisms. Additionally, Creole Trail would regulate the rate of withdrawal to minimize the potential for adverse impacts on aquatic resources or downstream flows. Creole Trail would not use any chemical additives in hydrostatic test water.

4.6.2.5 Spills

Direct spills of petroleum or other toxic products into or near waterbodies during construction or facility operation could be harmful to aquatic organisms, depending on the type, quantity, and concentration of the spill. A fuel spill could release contaminants, which could affect fish directly or indirectly through changes in food sources or contamination of the water. To reduce the potential for direct surface water contamination, Creole Trail would implement procedures in its SPCC Plan, which, in accordance with our Procedures, would include restrictions on refueling equipment or storing fuel or other hazardous materials at least 100 feet from waterbodies. Adherence to the SPCC Plan would reduce the potential of a spill and the response time for control and cleanup of a spill, should one occur. Therefore, the probability of a spill of hazardous materials would be reduced and temporary or permanent impacts to fisheries are expected to be negligible.

4.6.2.6 Operational Impacts on Aquatic Resources

LNG Terminal

Post-construction and operational impacts on aquatic resources would be minimal and primarily associated with periodic maintenance dredging in the berthing area. Based on expected shoaling rates of 25,000 to 40,000 yd^3 per year, Creole Trail anticipates that minimal maintenance dredging would be required. Any maintenance dredging would be limited to the footprint of the original dredged area. A hydraulic cutterhead dredge would be used. The dredged material would be placed on DMPAs previously approved by the COE and LADNR. Long-term maintenance dredging would be conducted in accordance with applicable federal or state regulations. Any permitting or agency coordination efforts would be conducted at the time of the maintenance activities to accommodate the current environmental or regulatory conditions and requirements at that time.

The increased ship traffic (300 to 400 LNG ships per year) represents a small incremental increase in the total annual vessel traffic in the Gulf area beyond the Calcasieu Ship Channel. The location of the LNG terminal near the beginning of the Calcasieu Ship Channel would prevent the LNG ships from affecting resources further up the channel. Creole Trail would have to prepare a SPCC Plan as part of its LAPDES permit for stormwater management during facility operation that would address measures to minimize the potential for spills and leaks to enter the aquatic environment and spread to more distant locations. In addition, Creole Trail would be required to comply with the conditions of other federal and state permits for stormwater control.

LNG ships would arrive at the LNG terminal fully loaded from international ports. To maintain a constant draft during the unloading operation, the LNG ships would bring on ballast water during transfer of their LNG cargoes and retain this ballast water until after departing the harbor. Because LNG is lighter than sea water (LNG has a specific gravity of 0.467 as compared to sea water, which has a specific gravity of 1.04), a smaller volume of sea water is required to provide equivalent ballast. Creole Trail estimates that LNG ships ranging from 125,000 m^3 to 250,000 m^3 in LNG capacity would take on between about 14.8 and 28.8 million gallons of water (56,000 m^3 to 109,000 m^3) for ballast during the LNG unloading operations. Water would be taken on through openings in the side of the ships at a rate of about 1.2 to 2.4 million gallons per hour (approximately 4,700 to 9,100 m^3 per hour) over a 12-hour period. Smaller aquatic organisms such as zooplankton, ichthyoplankton, or small fish in the immediate vicinity of the ship berth could be entrained during ballast water intake.

Ballast water intakes on LNG ships are well below the waterline; therefore, entrainment would be limited to organisms in the deeper water column (25 to 30 feet below the surface). The location of the LNG terminal site in an area with regular vessel traffic, periodic maintenance dredging, and tidal

exchange limits the potential for impacts on high quality nursery or spawning habitats that typically have smaller life stages. Intake of ballast water is not expected to have a significant impact on aquatic species. In addition to water withdrawn for ballast, LNG ships may also withdraw water for cooling the ship boilers. The specific volumes needed for this operation are not available; however, based on the limited annual LNG ship traffic, it will not result in appreciative impingement and entrainment impacts beyond what is described for ballast water.

The LNG ships associated with the proposed project could import or export exotic species into or out of the Calcasieu Ship Channel. The absence of ballast water discharges within the waterway would decrease the potential for importing an exotic species.

Saltwater intrusion into Calcasieu Lake from increased ship traffic is a potential impact associated with operation of the LNG terminal. Salinity within estuaries varies seasonally as a function of the amount of rainfall and freshwater inflow. Other natural influences that may affect salinities include winds, tides, and existing salinities in the Gulf of Mexico. Construction of the project would not alter the existing Calcasieu Ship Channel. The project would not significantly increase the saltwater wedge farther into the estuary based on the surface area of the new marine basin area relative to the entire upstream water surface area. Additionally, the increased ship traffic would be located in the Calcasieu Ship Channel, which is mixed naturally by currents and artificially by existing ship traffic.

As discussed in section 4.3.2.3, the LNG vaporization facility would use 19 SCVs during normal operations that would produce up to 547,200 gpd (380 gpm) of condensate. This slightly acidic process water would be buffered with sodium hydroxide to raise the pH prior to discharge. The discharge water would be between 15°C and 25°C and have a pH of 6.5 to 7.5. The water would be discharged into the firewater pond and then released with the excess water discharging into the Calcasieu Ship Channel. The discharge water would not contain chlorides. The small, localized discharge would not be expected to affect the water column in the Calcasieu Ship Channel or any fish species. Mixing of the discharge water in the channel would be facilitated by freshwater outflow, tidal flushing, and surges created by passing ships.

Pipelines

Post-construction or operational impacts of the pipelines would be minimal. Restoration of the vegetation along the rights-of-way and extra work spaces would minimize erosion potential relative to waterbodies. Minimal impact on fisheries is expected from maintenance mowing or manual removal of woody vegetation in the vicinity of the pipeline rights-of-way, as maintenance would be in accordance with our Plan and Procedures. Adherence to our Plan and Procedures would allow for the continued reestablishment of vegetation along the edges of the waterbodies minimizing long-term effects on the fisheries. Creole Trail would implement measures outlined in our Procedures, consistent with federal and state requirements, to avoid maintenance work within streams where adverse conditions would be created during spawning period(s).

4.6.3 Essential Fish Habitat

In 1996, new habitat conservation provisions were added to the Magnuson-Stevens Fishery Conservation Management Act (MSFCMA) that mandated the identification of EFH for managed species. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802(10)). The MSFCMA granted NOAA Fisheries legislative authority for fisheries regulation in the United States within a jurisdictional area located between 3 and 200 miles offshore, depending on geographical location. NOAA Fisheries also was granted legislative authority to establish eight regional fishery management councils, each responsible for the proper management and

harvest of finfish and shellfish resources within their respective geographic regions. Fishery management councils developed Fisheries Management Plans (FMP), which outline measures to ensure the proper management and harvest of the finfish and shellfish within these waters. The Calcasieu estuary lies within the management jurisdiction of the Gulf of Mexico Fisheries Management Council (GMFMC). Table 4.6.3-1 lists invertebrate and fish species that are managed by the GMFMC for which EFH has been identified.

TABLE 4.6.3-1

Invertebrate and Fish Species Managed by the Gulf of Mexico Fishery Management Council for which Essential Fish Habitat has been Identified

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

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

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

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

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

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

We incorporated EFH consultations for the Creole Trail Project with the interagency coordination procedures required under NEPA. **For purposes of reviewing this Project under NEPA, the FERC is the lead federal agency. As such, the FERC requests that NOAA Fisheries consider this document as notification of initiation of EFH consultation. An assessment of potential effects of the entire Project (including the LNG terminal and pipelines) is included below. A more detailed assessment is contained in Appendix G.**

4.6.3.1 Federally Managed Species

All estuarine systems of the Gulf of Mexico are considered essential habitat for fish managed by the GMFMC (GMFMC, 1998). Although aquatic and tidally influenced wetland habitats within the project area are considered EFH, the primary categories of EFH in the project area for the species identified by NOAA Fisheries (2005a) include mud substrates, shell reefs, estuarine water column, estuarine emergent wetlands. In reviewing the project location, NOAA Fisheries (2005a) reported that designated EFH occurs in the proposed LNG terminal area for postlarval, juvenile, and subadult life stages of white shrimp, brown shrimp, and red drum. Portions of the proposed pipelines are in areas identified as EFH for the same three species and life stages, as well as for the late juvenile, subadult, and adult life stages of bonnethead shark (NOAA Fisheries, 2005b). Essential habitat for the adult stage of red drum, although not present at the proposed LNG terminal site or along the proposed pipeline route, occurs in the general vicinity of the project and could potentially be affected by a DMPA site if a site is selected offshore near the Calcasieu Ship Channel entrance jetties (e.g., DMPA Alternative 4 as described in section 3.5). Managed species and EFH categories used by these species are summarized in table 4.6.3-2 and discussed below. Table 4.6.3-3 summarizes the seasonal abundance data of each of the EFH designated species within the project area and the seasonal relative abundance for each of these species.

TABLE 4.6.3-2

Summary of EFH Categories Potentially Used by Specific Life Stages of Federally Managed Fish Species

Species/Life Stage	EFH Categories				
	Mud Substrates	Shell Reefs	Estuarine Water Column	Estuarine Emergent Wetlands	Submerged Aquatic Vegetation
Red Drum					
Postlarval	X		X	X	X
Juvenile	X		X	X	X
Subadult	X	X	X		
Adult	X	X	X		
White Shrimp					
Postlarval	X	X	X	X	X
Juvenile	X	X	X	X	X
Subadult	X	X	X	X	X
Brown Shrimp					
Postlarval	X		X	X	X
Juvenile	X		X	X	X
Subadult	X		X	X	
Bonnethead Shark					
Late Juvenile			X		
Subadult			X		
Adult			X		

TABLE 4.6.3-3

Relative Abundance of EFH Designated Species within the Project Area

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

[a] Relative abundance provided for salinity seasons as provided by GMFMC (EFH maps) and was determined as the highest monthly relative abundance value in the Estuarine Living Marine Resources database for that salinity season.

[b] Life stages for which EFH is mapped include only adults and juveniles.

R=Rare, C=Common, A=Abundant, HA=Highly Abundant, NP = Not Present

N/A = Not available

EFH Species Accounts

Brown Shrimp (*Farfantepenaeus aztecus*). Brown shrimp inhabit coastal waters from low tide to a depth of approximately 110 meters throughout the Gulf of Mexico, and are most abundant off the coasts of Texas, Louisiana, and Mississippi. Non-spawning adults prefer turbid waters to soft sediments

(i.e., mud and sand). In the spring and fall, adult brown shrimp move to slightly deeper waters (46 to 91 meters) to spawn. Brown shrimp eggs are demersal (benthic) and usually hatch within one day at temperatures greater than 24°C. Larval brown shrimp are most abundant offshore, but do occur in waters that range from 0 to 82 meters deep. Post-larval brown shrimp migrate to shallow vegetated habitats in estuaries in the spring, typically reaching their destination between February and April (with another minor peak in the fall). Late post-larval and juvenile brown shrimp are most abundant in shallow (less than 1 meter) estuarine habitats in the spring and early summer, but typically are present through the fall.

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

Although adult brown shrimp typically inhabit offshore waters (Patillo, et al., 1997), there is a high probability that they occur within the proposed project area, as characteristics of the open water habitat type closely resemble those preferred by adult brown shrimp, such as turbid waters and soft sediments (Patillo, et al., 1997; Lassuy, 1983). Further, the GMFMC (2003) considers brown shrimp present from spring through fall; and most abundant in spring and early summer (outside the low salinity season, which lasts from March through July). Larval and juvenile brown shrimp are common in Calcasieu Lake year-round (ELMR, 2005).

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

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

The GMFMC (2003) consider juveniles to be highly abundant year-round preferring turbid estuaries and marsh edges (Patillo, et al., 1997). Therefore, there is a high probability that juvenile white shrimp occur in both the open water and intertidal brackish marsh habitat types.

Red Drum (*Sciaenops ocellatus*). In the Gulf of Mexico, red drum occur in a variety of habitats, ranging from depths of about 40 m offshore to very shallow estuarine waters. They commonly occur in virtually all of the Gulf's estuaries (GMFMC, 1998), where they are found over a variety of substrates including sand, mud and oyster reefs. Red drum can tolerate salinities ranging from freshwater to highly saline, but optimum salinities for the various life stages have not been determined. Types of habitat occupied depend upon the life stage of the fish. Spawning occurs in deeper water near the mouths of bays and inlets, and on the Gulf side of the barrier islands (Perret et al., 1980) from September through November. Eggs typically hatch in late summer and early fall mainly in the Gulf, and larvae are

transported into estuaries where the fish mature before moving back to the Gulf (Pattillo et al., 1997). Larval red drum are most abundant in estuaries from mid-August through late November. Estuarine wetlands are especially important to larval, juvenile, and subadult red drum. Yokel (1966) concluded that abundance of red drum varied directly with the estuarine area (habitat). An abundance of juvenile red drum has been reported around the perimeter of marshes in estuaries (Perret et al., 1980). Young fish are found in quiet, shallow, protected waters with grassy or slightly muddy bottoms (Simmons and Brewer 1962). Within these estuarine nurseries, larvae, post-larvae, and juveniles prefer habitats protected from currents with submerged and emergent vegetation and muddy substrates, but also tolerate non-vegetated hard and soft-bottomed areas. Larval and post-larval red drum feed primarily on copepods, whereas juveniles feed on a wide variety of small invertebrates. Juvenile red drum become most abundant in early winter. Much like adult red drum, late juveniles utilize a wide variety of habitats. However, they still prefer protected waters and do not become abundant in open waters until mid-September to early October. Estuarine wetlands are very important to larval and juvenile red drum. While adult red drum use estuaries, they tend to spend more time offshore as they age. Schools of large red drum are common in deep Gulf waters. Shallow bay bottoms or oyster reef substrates are especially preferred by subadult and adult red drum (Miles, 1950). Adult red drums are roving predators that opportunistically feed on a variety of invertebrate and vertebrate prey including crab, shrimp, and other fishes.

Larval, juvenile, adult, and spawning red drum are present in varying degrees of abundance throughout the year in Calcasieu Lake. Larval red drum, although rare, may occur year-round, whereas juveniles are common year-round. Adult red drum are common April through November, and spawning occurs in September through December (ELMR, 2005).

Bonnethead Shark (*Sphyrna tiburo*). Bonnethead shark is considered part of the small coastal shark complex and is managed under the Atlantic Tunas, Swordfish, and Sharks Fisheries management Plan. Bonnethead sharks occur in shallow coastal waters where it frequents sandy or muddy bottoms. Juvenile bonnethead sharks appear to prefer habitat dominated by seagrass (in northwest Florida) or mangroves (Louisiana). In areas where neither of these habitat types is available, juvenile bonnetheads are in very low numbers or absent (i.e., Mississippi Sound). Adult Bonnethead sharks, however, are found in diverse habitats ranging from areas with a mud or sand bottom to areas dominated by seagrass. Evidence from the habitat association tables indicates bull sharks are found among the most diverse environmental conditions with salinities ranging from 15 ppt (in Louisiana and Mississippi) to 33 ppt (in northwest Florida) and over all habitat type (Carlson, 2004).

There is no data regarding bonnethead sharks found for Calcasieu Lake specifically; however, according to correspondence from NOAA Fisheries, bonnethead sharks have the potential to occur in the Calcasieu Ship Channel and Calcasieu Lake. Based on the documented habitat preferences of bonnethead sharks and habitats present in Calcasieu Lake, late juvenile, subadult and adult bonnethead sharks may be present over mud and sand substrates during summer and fall when water is warmer that 21°C and salinity is highest (>26 psu).

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

Estuaries are important habitats for most of the major prey species of coastal pelagics (GMFMC and SAFMC 1985, 1990). For this reason estuarine habitats and factors which affect them are considered

as a part of the coastal pelagic management unit. All the coastal pelagic species, except dolphin, move about and forage on any locally abundant prey. Coastal pelagics feed throughout the water column on a variety of fish, especially herrings. Squid, shrimp, and other crustaceans also are eaten. Many of the prey species of the coastal pelagics are estuarine-dependent in that they spend all or a portion of their lives in estuaries.

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

Estuaries are important habitat for the prey species of red drum. This is especially true for larvae, juvenile and early adults of red drum as they spend virtually all of their time in estuarine habitat. Larval red drum feed almost exclusively on mysids, amphipods, and shrimp, whereas larger juveniles feed more on crabs and fish (Peters and McMichael, 1987). Overall, crustaceans (crab and shrimp) and fish are most important in the diet of red drum; primary food items are blue crab, striped mullet, spot, pinfish and pigfish. As they grow larger, red drum eat proportionately more crab, with fish diminishing in importance as food for the largest red drum (Mercer, 1984).

Potential for EFH at the LNG Terminal Site

Creole Trail identified potential EFH at the LNG terminal site based on its wetland delineations and consultations with NOAA Fisheries. Construction and operation of the LNG terminal would affect 64.3 and 15.7 acres of EFH, respectively. Table 4.6.3-4 lists EHF identified within the property that Creole Trail has leased for the proposed LNG terminal and summarizes impacts on EFH that would be affected by construction and operation of the terminal. During construction, 51.9 acres of existing open water adjacent to the site would be dredged; however, this area would not be within the LNG terminal boundary once construction is completed. About 49.8 acres of new open water habitat would be created by construction of the proposed marine facilities.

TABLE 4.6.3-4

EFH Affected by Construction and Operation of the Proposed Creole Trail LNG Terminal

Wetland Identifier	Wetland Type	Construction Impacts (acres)	Operation Impacts (acres)
WET A3	Emergent	0.2	0.0
WET A5 [a]	Emergent	0.0	0.0
WET B4	Emergent	1.9	0.6
WET B5	Emergent	1.0	0.9
WET B7 [a]	Emergent	0.0	0.0
WET B8 [a]	Emergent	0.0	0.0
WET P1 [a]	Emergent	0.0	0.0
USACE-1	Emergent	61.2	14.2
Total		64.3	15.7

[a] Wetlands A5, B7, B8, and P1, which have been identified as potential EFH, are present within the property to be leased for the LNG terminal, but are outside of the construction footprint and would not be affected by construction or operation of the project. These wetlands have been included in this table to provide consistency with the EFH tables included in Creole Trail's Draft ARMP and Essential Fish Habitat Report, provided as Appendices E and G, respectively. In addition, this table only lists the acres of EFH that would be affected by construction and operation of the LNG terminal, and does not quantify the total amount of EFH present within the LNG terminal property.

Potential for EFH within the DMPA

As noted above, a DMPA for the proposed Creole Trail Project has not yet been selected. Appropriate consultations regarding potential impacts on EFH would be conducted once the site is determined.

Potential for EFH Along the Pipelines

EFH along the proposed pipelines is found in areas of tidally influenced marsh (estuarine emergent wetlands), tidally-influenced waters (estuarine water column), tidally influenced water bottoms (estuarine mud bottoms), and shell reefs. No submerged aquatic vegetation was identified in the project area, although this community may be interspersed within estuarine wetlands found along the pipeline routes.

EFH was identified between MPs 0.0 and 24.5 of Segment 2. No EFH was identified within Segment 3 because waterbodies in this segment are considered freshwater habitat. Calcasieu Lake and the Calcasieu Ship Channel are the main basins that comprise EFH in the project area. Calcasieu Lake is a shallow coastal lagoon that receives moderate freshwater inflow from the Calcasieu River and receives saltwater via the Calcasieu Ship Channel. Depth of water in Calcasieu Lake averages 6 feet with depths ranging from 1 to 11.9 feet. The Calcasieu Ship Channel is a dredged channel containing moderate ship traffic that is located between the Gulf of Mexico and the Port of Lake Charles. The fishery resources along Segment 2 are classified as warmwater marine and warmwater estuarine. Calcasieu Lake supports fisheries for oyster, brown shrimp, white shrimp, and blue crab.

4.6.3.2 Potential Construction Effects on EFH

Due to subsidence and erosion, Louisiana is presently losing approximately 24 square miles of marsh annually, which represents 90 percent of the total coastal marsh loss experienced in the continental United States.[3] Given the magnitude of wetland loss in Louisiana, impacts on even a few acres of wetlands that have been designated as EFH must be considered carefully because of their contribution to the cumulative loss of habitat for marine fishery species. In addition to being designated as EFH for brown shrimp, white shrimp, and red drum, wetlands in the project area provide nursery and foraging habitats supportive of a variety of economically important marine fishery species, including striped mullet, Atlantic croaker, gulf menhaden, spotted and sand seatrout, southern flounder, and blue crab. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Fishery Conservation and Management Act by the Gulf of Mexico Fishery Management Council (GMFMC) (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NOAA Fisheries (e.g., billfishes and sharks). These wetlands also produce nutrients and detritus, important components of the aquatic food web, which contribute to the overall productivity of Calcasieu Lake and the nearshore Gulf of Mexico.

LNG Terminal and Marine Basin

The LNG terminal site was carefully chosen to avoid large wetland areas. A total of 64.3 acres of emergent wetland designated as EFH would be temporarily affected by construction of the LNG terminal; a total of about 15.7 acres of EFH would be permanently affected. Approximately 51.9 acres of open water within and adjacent to the Calcasieu Ship Channel would be dredged during construction of the marine facilities. Excavation and dredging of the marine facilities (marine basin and tugboat dock) would convert 49.8 acres of land to deep water habitat. Long-term impacts on EFH resources associated with

[3] Barras, J.A., S. Beville, D. Britsch, S. Hartley, S. Hawes, J. Johnston, P. Kemp, Q. Kinler, A. Martucci, J. Porthouse, D. Reed, K. Roy, S. Sapkota, and J. Suhayda. 2003. Historical and projected coastal Louisiana land changes: 1978-2050: USGS Open File Report 03-334.

dredging in open waters would be expected to be minimal and temporary because dredging would not result in a permanent alteration of habitat structure. Further, Creole Trail proposes to mitigate for these impacts by creating or restoring 154.3 acres of marsh (see discussion of Creole Trail's draft ARMP in section 4.4.3).

Impacts on EFH at the LNG terminal site would be similar to those described for aquatic resources in section 4.6.2.3. Adverse effects on fish and fish habitats typically associated with dredging activities include destruction of benthic habitats, the impairment of water quality and the direct (injury or mortality) and indirect (i.e., habitat alteration) effects on the fish and their prey species. The extent of the effect depends on hydrologic processes, sediment texture and composition, chemical content of the sediment, and the behavior or life stage of the species of concern.

Disturbance of bottom sediments during dredging can significantly increase turbidity and downcurrent deposition of re-suspended sediments. Increased turbidity can result in the physical impairment of estuarine species (e.g., turbidity-induced clogged gills resulting in suffocation, or abrasion of sensitive epithelial tissue). Resuspension of sediments by cutterhead dredges has been studied by the COE. McLellan et al. (1989) describes resuspension characteristics of the most commonly used dredges. As discussed in the report, the cutterhead suction dredge (as would be used for dredging of the proposed marine terminal basin) resuspends the lowest amounts of sediment at the dredging location, primarily because of the net suction of the cutterhead. The turbidity around the suction head returns to background levels within several tens of feet from the cutterhead. By contrast, hopper dredges and mechanical dredges can create much larger sediment plumes. Because of the enclosed nature of the berth dredging and the large volumes of water required to accomplish the dredging, there should be a net movement of water towards the dredge, limiting the migration of sediments outside of the dredging vicinity.

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

- the materials to be dredged are primarily stiff clays with some silty deposits that typically do not create high turbidity levels during dredging;
- the dredging would be performed with a hydraulic cutterhead dredge, which generally creates less turbidity at the dredge site than other types of dredges (i.e., mechanical bucket or hopper dredges); and
- with a cutterhead dredge, the cutter speed can be adjusted to match the sediment properties, thus minimizing turbidity.

Dredging also could result in the chemical impairment of the water column due to the suspension of contaminated sediments. As described in more detail in section 4.2.2, the limited water, sediment, and soil sampling conducted by Creole Trail indicates that these resources are not contaminated within the area to be dredged. Based on elutriate testing, none of the identified metals would be released by dredging operations at concentrations that would exceed Louisiana state water quality standards or criteria. However, there is a potential for contamination from offsite sources through air or waterborne deposition.

Dredging and the direct removal of suitable benthic substrates could affect EFH by removing suitable cover or settlement structure. Dredging typically homogenizes bottom substrates, reducing the structural complexity of habitats. However, information gathered from a Corpus Christi Bay National Estuary Program publication from May 1998 (Montagna et al., 1998) identified anthropogenic and natural disturbances and their affects on benthic communities. The report states that "Although benthic

communities are removed by dredging and smothered by dredge spoil, soft-bottom benthic communities recover within a year." Therefore, it is expected that recovery and colonization would occur relatively quickly within the newly dredged marine basin.

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

Although dredging would occur in open waters that provide habitat for a variety of finfish species, these activities would not have a measurable permanent impact on these species. Some of these species would recolonize the deeper water created by the slip or adjust to the greater water depths while others would find similar suitable habitat in adjacent areas of the Calcasieu Ship Channel. Species that currently occupy this habitat also inhabit the deeper water habitats that currently exist in the adjacent to the Calcasieu Ship Channel. Therefore, these species would not experience a loss of habitat due to dredging. Dredging of land area for the marine facilities would result in the creation of 49.8 acres of open water habitat that would largely compensate for the effects of dredging in the open water area adjacent to the site.

Pipelines

Table 4.6.3-5 lists the potential EFH affected by construction and operation of the proposed pipelines. Pipeline construction in Calcasieu Lake would involve trenching and temporary stockpiling of excavated sediments adjacent to the pipeline trench and floatation channels. Approximately 692.7 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Calcasieu Lake due to construction of Segment 2. Approximately 0.9 mile of bottom sediments in Calcasieu Lake would be avoided through directional drills of the shore approaches.

In addition to the EFH within Calcasieu Lake, construction of the pipelines would affect another 43.0 acres of EFH along Segment 2, including about 6.5 acres of EFH avoided by the HDD method. The construction-related effects on these wetlands would be temporary. The affected wetland areas would reestablish to their pre-construction condition and would be monitored in accordance with our Procedures and Creole Trail's ARMP. If revegetation is not successful, Creole Trail would actively revegetate the disturbed area (see section 4.4.3). The duration of the temporary impacts would be limited to the construction period and vegetation would reestablish within one to two growing seasons. NOAA Fisheries has not yet verified EFH locations along the pipeline rights-of-way. Therefore, the acres and locations of EFH potentially affected by construction and operation of the project may change.

Open water (EFH habitat) construction activities in Calcasieu Lake would affect the benthic community through disruption of existing sediments. Direct impacts could include the permanent loss of organisms that occupy the area of the construction activity and the temporary or permanent alteration of soft bottom aquatic habitat in the channel area. Construction could physically damage benthic organisms, resulting in stress, burial, sublethal injury, or death. The composition of the macrobenthic community depends upon bottom sediment conditions, and is vulnerable to physical or chemical alterations of the substratum.

TABLE 4.6.3-5

Potential EFH Affected by Construction and Operation of the Proposed Creole Trail Pipelines

EFH Identifier	Begin MP	End MP	Wetland Type	Construction Impacts (acres)	Operation Impacts (acres)[a]
Segment 2					
CRK P14 (Calcasieu Ship Channel)	0.1	0.3	Open Water	0.0[b]	0.0
WET B1	0.3	0.4	Emergent	0.0[b]	0.0
WET B2	0.4	0.4	Emergent	0.0[b]	0.0
WET B4	0.5	0.5	Emergent	0.0	0.0
WET B3	0.6	0.7	Emergent	1.8	0.0
WET B5	0.8	0.8	Emergent	0.0	0.0
WET B6	0.9	0.9	Emergent	0.9	0.0
WET B8	1.0	1.7	Emergent/Open Water	10.0	0.0
Lake P1 (subsided marsh south of Calcasieu Lake)	1.7	2.5	Open Water	15.6	0.0
WET V1	2.4	2.4	Emergent	<0.1	0.0
WET E83	2.5	2.9	Emergent/Open Water	3.9[b, c]	0.0
CRK P17	2.7	2.7	Open Water	0.0[b, c]	0.0
Lake P2 (Calcasieu Lake)	2.9	20.1	Open Water	692.7	0.0
WET P68	20.2	20.2	Emergent	0.5	0.0
WET P67	20.2	20.4	Emergent	4.6	0.0
CRK P16 (Intracoastal Waterway)	20.5	20.6	Open Water	0.0[b, c]	0.0
WET P7	20.7	21.0	Emergent	0.0[b, c]	0.0
Unnamed open water	21.0	21.0	Open Water	0.0[b, c]	0.0
WET C103(A16)	21.0	21.6	Emergent	0.0[b, c]	0.0
WET C97	21.7	21.9	Emergent	4.2	0.0
CRK C68	22.0	22.0	Open Water	0.1	0.0
WET C101-1	21.9	22.0	Scrub/Shrub	0.0	0.0
WET C101-2	22.0	22.0	Scrub/Shrub	0.0	0.0
WET V2	22.5	23.4	Emergent	1.3	0.0
WET C130	23.0	23.0	Emergent	0.0	0.0
WET C131	23.1	23.1	Emergent	0.1	0.0
WET C132	23.3	23.3	Emergent	<0.1	0.0
WET C133	24.0	24.0	Emergent	<0.1	0.0
WET C134	24.2	24.3	Scrub/Shrub	0.0	0.0
WET D1	24.5	24.5	Emergent	<0.1	0.0
Project Total				735.7	0.0

[a] No wetlands or waterbodies would be permanently affected or lost as a result of the proposed project; therefore, no permanent impacts on EFH would occur. All EFH designated wetlands and waterbodies would be restored to pre-construction contours, elevations, and habitat conditions following construction.

[b] These potential EFH locations would be crossed by HDD, thus impacts to potential EFH at these locations would be avoided during construction and operation.

[c] Associated with the HDD of the Calcasieu Lake shoreline.

Impacts on EFH resources resulting from wetland and waterbody construction activities could include temporary sedimentation and turbidity, alteration or removal of fish cover, introduction of water pollutants, or entrainment of fish. Dredging typically homogenizes bottom substrates, which can alter the existing bottom type and reduce the structural complexity of habitats. The existing substrates that would be affected by construction vary from soft to firm muds. The potential reduction in foraging success resulting from the loss of benthic species during construction and the lack of recolonization by

invertebrates could affect managed fish species. However, the direct adverse impacts on bottom substrates would be minor, lasting only during and immediately after active construction activities.

Richardson et al. (1977) and Bingham (1978) found that the effects of dredged material placement on benthos probably were related to direct burial of benthos and changes in sediment characteristics, rather than increased turbidity from placement operations or introduction of pollutants or organic matter. The immediate impact of stockpiling dredged sediments would be to smother portions of the benthic invertebrate populations that inhabit surficial sediments along the stockpiled areas adjacent to the pipeline trench. Similarly, trenching would injure or kill portions of the local populations that inhabit the trench path. However, species that contribute the bulk of benthic faunal assemblages in estuarine habitats (including the annelids, arthropods, and mollusks) exhibit high reproductive potential. This enables benthos to efficiently replace lost individuals through larval recruitment. Recolonization of sediments is expected to begin immediately after construction is complete (Rhoads and Germano 1982, 1986).

The potential impacts of HDD operations to be conducted at the pipeline entrance and exit into and from Calcasieu Lake are discussed in section 4.3.2.1. For the reasons discussed in that section, it is expected that the effects of HDD operations in Calcasieu Lake would be localized, temporary, and affect a very small area of the Calcasieu estuary. Therefore, these activities are not expected to have a significant impact on EFH. Removal of trees from the edges of the waterbodies crossed by the pipeline could reduce shading of the waterbody, eliminate escape cover, and potentially result in locally elevated water temperatures. Elevated water temperatures could lead to reductions in levels of dissolved oxygen and influence fish survival and fitness. However, wetlands that comprise the EFH along the pipeline routes consist primarily of marsh vegetation that would become reestablished within a few years following construction. Less than 0.1 acre of scrub-shrub EFH wetland was identified within the study corridor; woody vegetation in these areas would take longer to reestablish.

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

- use of best management construction and restoration practices, including repairing of banks;
- restricting the number and limits of airboat and tracked equipment passage over marshes;
- backfilling the pipeline ditch to marsh elevation;
- replanting marsh vegetation on all impacted areas; and
- and monitoring to document recovery of the pipeline right-of-way and to determine the need for mitigation if it does not fully recover.

For other recent pipeline projects in southwest Louisiana, NOAA Fisheries also recommended documenting the need for compensatory wetland mitigation through ground and aerial (low altitude infrared photography) surveys prior to and immediately after construction.

These recommendations have been incorporated into the draft ARMP that Creole Trail has proposed to mitigate for EFH and wetland impacts (see section 4.4.3 and Appendix E).

4.6.3.3 Potential Operational Impacts on EFH

LNG Terminal and Marine Facilities

Operation of the LNG terminal facilities would involve frequent berthing of the large LNG ships and an increase in large-vessel traffic in the Calcasieu Ship Channel. Such activities are already common in the vicinity of the proposed LNG terminal. During LNG ship entry and departure maneuvering, there would be short periods of turbidity associated with incidental propeller wash from the handling tugs. This would represent an increase in the number of episodic turbidity events above those currently occurring due to shipping traffic within the Calcasieu Ship Channel. However, the Calcasieu Ship Channel has high levels of turbidity, so biota has adjusted to the suspended sediments and would not likely experience any substantial degradation of habitat conditions due to the LNG terminal shipping operations.

Operation of the LNG facility would require periodic maintenance dredging of the turning basin and berth areas in order to maintain adequate clearance beneath the LNG tankers and barges. We do not know the frequency of maintenance dredging for the Creole Trail LNG terminal. However, Creole Trail anticipates that minimal maintenance dredging would be required based on expected shoaling rates of 25,000 to 40,000 yd^3 per year. Dredging would be conducted in accordance with applicable federal and state requirements. Dredge materials would be deposited in accordance with permits issued by the COE and the state at approved DMPAs. Maintenance dredging would be limited to the footprint of the originally dredged area and the amount of dredging would be much less than that which is periodically performed to maintain the Calcasieu Ship Channel. Therefore, impacts on EFH resulting from project-related maintenance dredging would represent a minor increase over those occurring during COE dredging of the federal navigation channels in the project vicinity.

The LNG terminal would use SCVs that would produce up to 547,200 gpd (380 gpm) of fresh water. This process water would be buffered to raise the pH and then discharged into the firewater pond. When the firewater pond is full, the excess water would be released into the Calcasieu Ship Channel. The volume of water discharge to the Calcasieu Ship Channel would fluctuate based on daily uses of water and environmental conditions at the site. The small, localized discharge would not be expected to affect the water column in the Calcasieu Ship Channel or EFH. Mixing of the discharge water in the channel would be facilitated by freshwater outflow, tidal flushing, and surges created by passing ships.

Direct spills of petroleum or other potentially toxic products into the berthing area or Calcasieu Ship Channel during facility operation could be harmful to aquatic organisms, depending on the type, quantity, and concentration of the spill. To reduce the potential for direct surface water contamination from an accidental or unintentional release of any pollutant, Creole Trail would implement the procedures in its SPCC Plan to be developed prior to construction.

Pipelines

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

Conservation Measures and Mitigation Plans

LNG Terminal

To reduce turbidity during dredging, Creole Trail would use a hydraulic cutterhead dredge, which generally creates less turbidity than other types of dredges (i.e., mechanical bucket or hopper dredges). Therefore, no additional mitigation would be necessary to protect EFH from turbidity. Excavation of marine facilities would create an additional 49.8 acres of deep open water habitat, potentially increasing the acreage of EFH in the vicinity of the proposed LNG terminal. Therefore no mitigation is necessary to compensate for impacts to open water habitats.

During design of the LNG facilities, Creole Trail sited major LNG facility components in upland areas to the maximum extent possible, thus minimizing cumulative impacts to valuable wetland habitats. A total of about 102.9 acres of wetlands would be affected by construction of the terminal, and about 34.5 acres of wetland would be permanently affected by operations. At a minimum, mitigation for permanent wetland impacts would have to comply with the COE section 404 and LADEQ section 401 permit conditions, as well as with any requirements established by the LADNR's CZMP. Creole Trail has proposed to mitigate unavoidable wetland impacts resulting from construction and operation of the LNG terminal and, accordingly, has developed a draft ARMP that is under review by federal and state agencies. The draft ARMP incorporates agency recommendations received to date, including those of NOAA Fisheries (see Appendix E).

As proposed in its draft ARMP, Creole Trail would compensate for the permanent loss and temporary disturbance of 64.3 acres of wetlands identified as EFH at a mitigation ratio of 1.5:1. This compensation ratio would result in the creation or restoration of 96.4 acres tidal marsh. Creole Trail proposes to monitor the created or restored tidal wetlands annually for at least 3 years. Creole Trail's proposed monitoring plan calls for further consultation with appropriate agencies and reseeding or planting if monitoring indicates poor plant survival or insufficient coverage.

Pipelines

Pipeline construction in Calcasieu Lake would involve trenching and temporary stockpiling of excavated sediments adjacent to the pipeline trench and floatation channels. Approximately 692.7 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Calcasieu Lake due to pipeline construction, and approximately 0.9 mile of bottom sediments in Calcasieu Lake would be avoided through directional drills.

Creole Trail proposes monetary compensation to the LADWF for impacts on oysters and fishery resources within Calcasieu Lake. The proposed compensation amounts were calculated based on information obtained from Creole Trail's substrate characterization and oyster assessment and on rates defined by the LADWF. In addition to monetary compensation, Creole Trail proposes to create up to 45 acres of reef for finfish and oysters to enhance EFH in Calcasieu Lake. The reefs would be designed to attract sport fish and/or recruit oysters. The proposed locations for created oyster reefs would be within the Lower Calcasieu Lake Conditional Management Area. Proposed reef locations were determined based on suitable habitat for oyster recruitment, flow pattern and depth contours of the lake, and salinity regime and proximity to existing oyster reefs. Creole Trail proposes to construct seven 5-acre oyster reefs for oyster recruitment and two 10-acre reefs for creation of finfish habitat. Creole Trail is coordinating with the LADWF to identify the applicable specifications for construction of fishery reefs in Calcasieu Lake.

Pipeline construction and restoration activities within and adjacent to waterbodies would be conducted in accordance with our Procedures and Creole Trail's ARMP to minimize impacts on EFH. In addition, post-construction right-of-way maintenance would be conducted in accordance with our Procedures. Adherence to our Procedures would allow for the continued regrowth of vegetation along the edges of the waterbodies, thus minimizing long-term effects on EFH. Creole Trail would monitor wetland for at least 3 years after construction. If wetlands are not revegetating naturally to at least 25 percent cover after 6 months, the wetlands would be seeded or planted with native vegetation based on consultation with appropriate agencies. If wetlands are still not re-establishing after 1 year, Creole Trail would notify the COE and other appropriate agencies to develop an alternative mitigation or restoration plan. If after the third year of monitoring plant coverage is less than 80 percent, Creole Trail would coordinate with the COE to refine the mitigation plan and replant or seed as necessary. In this case, monitoring would extend to a fourth year. Marsh wetlands do not typically require vegetation maintenance. Other than future maintenance and repairs at specific locations as needed, essentially no ground disturbance would occur during operation of the pipeline.

Conclusions

We conclude that the project would have minimal impacts on EFH with implementation of our Procedures, the finalized ARMP that would be developed with guidance from state and federal agencies, and with the conditions and stipulations that would be attached to Creole Trail's Section 404 Permit. Our Procedures and the ARMP (once developed and finalized) would further minimize potential impacts. Use of these measures would reduce the potential for unanticipated, long-term impacts, and the area that would be impacted is small relative to the available habitat in the area.

4.7 THREATENED AND ENDANGERED SPECIES

To comply with section 7 of the ESA, Creole Trail consulted with the FWS and NOAA Fisheries regarding the presence of federally listed or proposed threatened or endangered species and their critical habitats in the project area. Creole Trail, as the FERC's non-federal representative for the purposes of complying with the ESA, has been assisting the FERC in meeting its section 7 obligations by conducting informal consultation with the FWS. We also contacted and consulted with the FWS and NOAA Fisheries about which species under their respective jurisdictions would be potentially affected by the proposed project. In addition to these consultations, Creole Trail consulted the Louisiana Natural Heritage Program (LNHP) to obtain a list of state-listed special status species in the project area.

4.7.1 Federally Listed Threatened and Endangered Species

The FWS and NOAA Fisheries identified 21 federally listed endangered or threatened species in southwestern Louisiana or the waters of the Gulf of Mexico that should be considered when determining the potential effects of the Creole Trail Project (see table 4.7-1). According to the FWS (2005c), the Louisiana black bear, West Indian manatee, and pallid sturgeon are not known to occur in the project area; therefore, no further consultation with the FWS is required for these species unless the scope or location of the proposed project changes. These species have been eliminated from further consideration in this EIS. The piping plover is also not known to occur in the vicinity of the LNG terminal or proposed pipelines. However, piping plover and its critical habitat are known to occur at one of the potential DMPA sites being evaluated for the beneficial use of dredged material or wetland mitigation activities (see section 4.7.1.5).

4.7.1.1 Marine Mammals and Sea Turtles

Whales

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

While there are no prescribed routes for ships transiting open waters of the Gulf of Mexico, entrance into the Gulf is through the Straits of Florida, south of the Florida Keys and Florida reefs. From there, a merchant vessel would cross the Gulf by the most direct, safest route to its destination port. A system of shipping safety fairways[4] and fairway anchorages has been established for the Gulf of Mexico and is shown on some, but not all, navigation charts. These fairways are near port entrances and along coastal trade routes, but do not extend across the Gulf of Mexico or into the deep waters of the open Gulf.

[4] 33 CFR 166.105 defines a shipping safety fairway as "a lane or corridor in which no artificial island or fixed structure, whether temporary or permanent, will be permitted."

TABLE 4.7-1

Federally Listed Endangered or Threatened Species Potentially Occurring in the Project Area

Species	Status [a]		Project Component of Potential Occurrence		Parish	Preferred Habitat	Determination
	Federal	State	Terminal	Pipeline			
Mammals							
Sperm whale *Physeter macrocephalus*	E	SAN	X		Cameron/ Offshore waters	Abyssal and pelagic; prefers deep water (>590 feet), and is sometimes found around islands or in shallow shelf waters. Offshore in Gulf of Mexico.	Not likely to adversely affect
Blue whale *Balaenoptera musculus*	E	SAN	X		Cameron/ Offshore waters	Pelagic; generally prefers cold waters and open seas, but young are born in warmer waters of lower latitudes.	Not likely to adversely affect
Sei whale *Balaenoptera borealis*	E	SAN	X		Cameron/ Offshore waters	Pelagic; generally in deep water along the edge of continental shelf and in open ocean.	Not likely to adversely affect
Fin whale *Balaenoptera physalus*	E	SAN	X		Cameron/ Offshore waters	Pelagic; usually found in largest numbers 25 miles or more from shore. In the western Atlantic, occurs mainly over continental shelf in summer, in depths of 300-600 feet.	Not likely to adversely affect
Humpback whale *Megaptera novaeangliae*	E	SAN	X		Cameron/ Offshore waters	Pelagic and coastal waters, sometimes frequenting inshore areas such as bays. Winters largely in tropical/subtropical waters near islands or coasts and summers in temperate and subpolar waters.	Not likely to adversely affect
North Atlantic right whale *Eubalaena glacialis*	E	NL	X		Cameron/ Offshore waters	Coastal and shelf waters; range from wintering and calving areas in coastal waters off the southeastern United States to summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and Scotian Shelf.	Not likely to adversely affect
Birds							
Bald Eagle *Haliaeetus leucocephalus*	T	E	X	X	Cameron, Calcasieu, St. Landry	Areas with abundant sources of large open waterways such as lakes, reservoirs, seacoasts, and large rivers. In addition to waterways, the availability of perches, usually tall trees or cliffs, adjacent to foraging and nesting areas. Occasional transient on rivers for foraging or feeding.	Not likely to adversely affect
Brown Pelican *Pelecanus occidentalis*	E	T	X	X	Cameron	Shallow coastal waters within 20 miles or less of the shoreline and in depths up to 80 feet. Breeds on small coastal islands and forages for fish along coastal and inland waterways	Not likely to adversely affect
Piping Plover *Charadrius melodus*	T	T	X	X	Cameron	Ocean, river, and inland lake shorelines, sandy beaches, sandbars, dunes, and silty flats. Forages on mudflats and sand beaches.	Not likely to adversely affect
Red-cockaded woodpecker *Picoides borealis*	E	E		X	Allen, Calcasieu, Evangeline	Open pine forests with large, widely spaced trees. Nests in large old pines (60+ years). Forages in pine or pine-hardwood stands.	Determination pending

TABLE 4.7-1 (cont'd)

Federally Listed Endangered or Threatened Species Potentially Occurring in the Project Area

Species	Status [a]		Project Component of Potential Occurrence		Parish	Preferred Habitat	Determination
	Federal	State	Terminal	Pipeline			
Reptiles							
Green Sea Turtle *Chelonia mydas*	T	T	X	X	Cameron	Lagoons, bays, inlets, shoals, and estuaries, as well as coral reefs, rocky outcrops, and high-energy beaches. Found throughout Gulf of Mexico and the adjoining beaches, where the seawater temperature is above 25°C.	Not likely to adversely affect
Hawksbill Sea Turtle *Eretmochelys imbricata*	E	E	X	X	Cameron	Tropical and subtropical seas, including southern Florida and the northern Gulf of Mexico. Coral reefs, rocky outcrops, high energy shoals.	Not likely to adversely affect
Kemp's Ridley Sea Turtle *Lepidochelys kempii*	E	E	X	X	Cameron	Shallow coastal waters, tidal rivers, estuaries, and seagrass beds with substrates of sand and mud.	Not likely to adversely affect
Leatherback Sea Turtle *Dermochelys coriacea*	E	E	X	X	Cameron	Open sea and coastal waters. Prefer sandy beaches with deepwater approach for nesting.	Not likely to adversely affect
Loggerhead Sea Turtle *Caretta caretta*	E	T	X	X	Cameron	Tropical and temperate waters with temperatures above 10 C.	Not likely to adversely affect
Fish							
Gulf sturgeon *Acipenser oxyrhynchus desotoi*	T	T	X	X	Cameron	Lake Pontchartrain and the Pearl River system in eastern Louisiana and western Mississippi east to the Suwannee River is Florida.	Not likely to adversely affect
Smalltooth sawfish *Prestis pictinata*	E	NL	X	X	Cameron	Generally found in shallow waters very close to shore over muddy and sandy bottoms.	Not likely to adversely affect
Plants							
American chaffseed *Schwalbea americana*	E	NL		X	Allen	Pimple mounds in longleaf pine flatwoods.	Not likely to adversely affect

[a]
- E Endangered
- T Threatened
- NL Not listed
- S2 Imperiled in Louisiana
- SAN Accidental non-breeding species in the state of Louisiana
- SZN Transient non-breeding species in the state of Louisiana

LNG ships en route to the proposed Creole Trail LNG terminal would normally travel west in the Gulf of Mexico to the Calcasieu Pass sea buoy, and then enter the Calcasieu Ship Channel to the proposed LNG terminal. The distance from where a LNG ship would enter the Gulf of Mexico to the Calcasieu Pass sea buoy is approximately 657 nautical miles. At a transit speed of 19.5 nautical miles per hour (mph), the inbound and outbound trips would each take approximately 34 hours.

To provide protection to marine mammals and sea turtles against vessel strikes, NOAA Fisheries developed the *Vessel Strike Avoidance and Injured/Dead Protected Species Reporting Policy* (Strike Avoidance Policy). Since the draft EIS was issued, NOAA Fisheries has revised its Strike Avoidance Policy. A copy of the revised policy is provided in Appendix H as Part A of the Protected Species Harm Avoidance Measures. Creole Trail has agreed to implement the measures included in the revised Strike Avoidance Policy in its Terminal Use Agreement that would be signed between Creole Trail and LNG shippers docking at the LNG terminal. These guidelines would minimize the potential for whale encounters and collisions. Therefore, the project is not likely to adversely affect sperm whales in the Gulf of Mexico.

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

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

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

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

The North Atlantic right whale is a large baleen whale that is found in coastal and shelf waters (NOAA Fisheries, 2005a). The North Atlantic right whale is among the rarest of the world's whales, due to historic commercial whaling. However in recent years, the greatest known cause of North Atlantic right whale mortality is collision with ships (NOAA Fisheries, 2005a). For most of the year, North Atlantic right whale distribution is strongly correlated with that of their primary prey, copepods. Five "high use" areas were identified along the east coast of North America in the initial Recovery Plan for the North Atlantic right whale (NOAA Fisheries, 1991b). Still considered to be key habitat areas, the most southerly of these areas is located within 15 miles of the Atlantic coast of Florida and Georgia (Sebastian Inlet, Florida to the Altamaha River, Georgia). While many of the remaining North Atlantic right whales gather along the coast of Florida/Georgia for the calving period between December and March, limited data suggests that a few individuals might also winter in other areas that include the waters near Bermuda and in the Gulf of Mexico (Reeves, 2001). For example, there was a rare occurrence of two North Atlantic right whales, a female and calf, in Corpus Christi Bay in January 2006. NOAA Fisheries expects

North Atlantic right whales to be occasional transients in the Gulf of Mexico that would not occur with any regularity (NOAA, 2005f).

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

Sea Turtles

The green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles have been listed as federally endangered or threatened and have been documented in the Gulf of Mexico. All five sea turtles have been known to occur along the continental shelf and coastal areas in the Gulf of Mexico. Sea turtles nesting on beaches in the United States are under the jurisdiction of the FWS; sea turtles occurring in U.S. waters are the responsibility of NOAA Fisheries.

Green sea turtle – Green sea turtles have a circumglobal distribution in tropical and sub-tropical waters. In the United States, this species occurs in the Atlantic Ocean around the Virgin Islands, Puerto Rico, and along the Atlantic and Gulf coasts of the continental United States from Massachusetts to Texas (NOAA Fisheries/FWS, 1991a). Green sea turtles utilize shallow estuarine habitats and other areas with an abundance of marine algae and sea grasses, their principal food sources. Green sea turtles are listed as threatened species with the exception of the Florida and Mexican breeding populations, which are considered endangered.

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

Nesting within the LNG terminal site is highly unlikely, as green sea turtles prefer to nest on high-energy beaches with deep sand and little organic content. Further, the Minerals Management Service (MMS) (1997) indicates that reports of green sea turtle nesting in the northern Gulf are "isolated and infrequent."

Hawksbill sea turtle – The hawksbill sea turtle occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans, and is widely distributed in the Caribbean Sea and western Atlantic Ocean, regularly occurring in southern Florida and the northern Gulf of Mexico. The hawksbill sea turtle is one of the most infrequently encountered sea turtles in offshore Louisiana (LADWF, 2005b). However, a hawksbill was reported near Calcasieu Lake in 1986 (Fuller et al., 1987).

Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are found at depths of less than 70 feet. Hatchlings are usually associated with floating masses of sargassum in the open ocean. Coral reefs and other hard substrates (i.e., jetties and rocky outcrops) are the most common foraging habitats of juveniles, subadults, and adults, as their diet consists

primarily of sponges. Nesting occurs on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls; these beaches are typically low-energy, with woody vegetation near the waterline. In the continental United States, nesting sites are restricted to Florida where nesting is sporadic at best (NOAA Fisheries/FWS, 1993). Due to the lack of suitable foraging and nesting habitats, there is a low probability of this species occurring within the project area.

Kemp's ridley sea turtle – According to the FWS and NOAA Fisheries (1992), the Kemp's ridley sea turtle is the smallest of all living sea turtles. Adult and juvenile Kemp's ridleys are primarily restricted to the Gulf of Mexico, although juveniles have been recorded from throughout the Atlantic Ocean. Nesting occurs from April through July and is essentially limited to an 11-mile stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico. No Kemp's ridley sea turtle nesting habitat occurs near the project site (i.e., sandy beaches), and nesting has not been known to occur in the area. The estuarine and offshore waters of Louisiana are considered important foraging areas. Adults are primarily shallow-water benthic feeders that specialize on portunid crabs. Other food items include shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and occasionally marine plants. Juveniles typically feed on *Sargassum* spp. and associated infauna. During the non-breeding season, Kemp's ridley sea turtles prefer warm bays, shallow coastal waters, tidal rivers, estuaries, and seagrass beds with substrates of sand and mud. According to the FWS, juvenile Kemp's ridleys are generally found in Louisiana's coastal waters from May through October, whereas adults are common during the spring and summer near the mouth of the Mississippi River. In the winter, Kemp's ridleys typically move offshore to deeper, warmer waters, but some of the deepwater channels and estuaries in Louisiana might provide important thermal refuge.

Leatherback sea turtle – The leatherback sea turtle has been found in the Atlantic, Pacific, and Indian oceans; as far north as British Columbia, Newfoundland, Great Britain, and Norway; as far south as Australia, Cape of Good Hope, and Argentina; and in other water bodies such as the Mediterranean Sea. Leatherbacks are mainly pelagic, inhabiting the open ocean and seldom entering coastal waters except for nesting purposes. Leatherbacks are abundant in the northern Gulf, but primarily in deep waters of the continental slope and beyond (Hansen et al., 1996; Mullin and Hoggard, 1998); however, they also occur on the shelf in smaller numbers. This species has been reported as occurring in shallow coastal waters but not usually near shore (Lee and Socci, 1989). A 1987 aerial survey of shallow Gulf of Mexico waters found that leatherback sea turtles occurred with the highest frequency in offshore Louisiana in October (NOAA Fisheries/FWS, 1992). The leatherback typically nests on beaches with a deepwater approach. Leatherbacks nest primarily in tropical regions; major nesting beaches include Malaysia, Mexico, French Guiana, Surinam, Costa Rica, and Trinidad. In the continental United States, leatherbacks nest only sporadically in some of the Atlantic and Gulf states; the largest U.S. nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida.

Loggerhead sea turtle – The loggerhead sea turtle favors warm temperate and sub-tropical regions and is widely distributed in tropical and subtropical seas. This species typically occurs over the continental shelf, and in bays, estuaries, lagoons, creeks, and mouths of rivers, but has been found as far as 500 miles offshore. In the continental United States, loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey and sporadically along the Gulf coast (NOAA Fisheries/FWS, 1991b). Nesting occurs primarily on barrier islands adjacent to continental landmasses in warm-temperate and sub-tropical waters. Nest sites are typically located on open sandy beaches, above the mean high tide, and seaward of well-developed dunes. In Louisiana, this species has been found throughout the coastal region but nesting has only been recorded from the Chandeleur Islands, which is over 250 miles east of the project area (LADWF, 2005c).

Adults occupy a variety of habitats, ranging from turbid bays to clear waters of reefs, whereas subadults occur mainly in near shore and estuarine waters. Hatchlings move directly to sea after hatching,

and often float in masses of Sargassum. The loggerhead diet consists of a wide variety of benthic and pelagic food items, including conches, shellfish, horseshoe crabs, prawns and other crustacea, squid, sponges, jellyfish, basket stars, fish, and hatchling loggerheads.

Sea Turtle Impacts

The green, Kemp's ridley, leatherback, and loggerhead sea turtle require open or sparsely vegetated beaches for nesting. The project area is predominantly composed of densely vegetated, low energy beaches. The hawksbill sea turtle has a wider range of tolerance for nesting than any other species; however, it has not been known to nest in Louisiana. The Creole Trail project area does not provide suitable nesting habitat for sea turtles.

Sea turtle occurrence is expected throughout the estuarine and marine environments of the project area. Occurrences of sea turtles are expected to range from common in preferred foraging habitats, such as near the jetties of the Calcasieu Ship Channel and surrounding habitats, to less common inshore, in areas such as Calcasieu Lake. Potential effects on sea turtles from construction of the project could include avoidance of the area due to noise and activity, alteration or loss of habitat, effects on prey species composition and abundance, and changes in water quality (NOAA Fisheries, 2005a). Increased vessel traffic and project activities are not expected to affect sea turtle use of this area as they are likely acclimated to (and avoid) disturbance associated with ongoing shipping activities. Although nearshore pipeline construction activities may result in the temporary displacement of sea turtles from foraging and resting habitats due to increased water turbidity, these impacts are expected to be temporary and minor and, as such, adverse impacts on foraging and resting sea turtles are not expected.

The most likely impact on sea turtles from construction and operation of the Creole Trail Project would include potential impacts associated with dredging, pile driving, and LNG ship traffic. Dredging and marine construction is anticipated to take about 17 months. Creole Trail proposes to dredge the marine basin using a hydraulic cutterhead dredge. According to NOAA Fisheries, cutterhead dredges have not been implicated in takes of sea turtles or other federally listed threatened or endangered species, probably because they advance at such a slow pace and are noisy, giving mobile sea turtles time to get out of the way of the cutterhead (NOAA Fisheries, 2005e). Suspended sediments from dredging could affect sea turtles in the immediate area by adversely affecting water quality. However, sea turtles would likely avoid the area during dredging activities, and there is adequate habitat in the general vicinity.

Although direct mortality is not documented, recent takes of sea turtles have been documented that could result in injury or death to sea turtles. A recent cold-stunning event in the shallow waters of the Laguna Madre, Texas resulted when temperatures dropped over 19 degrees Fahrenheit in less than 72 hours during late December 2004. At least 20 juvenile green turtles stranded during this event. Two green turtles entrained by the cutterhead dredge operating in the Brazos Santiago Pass area at the time of the cold-stunning event were deposited on a beach where dredge spoil was being deposited, and were consequently found adjacent to the opening of the dredge pipeline. Cold-stunning events have not been documented in the immediate project area.

Studies have shown that the sound waves from pile driving may result in injury or trauma to fish, sea turtles, or animals with gas-filled cavities, such as swim bladders, lungs, sinuses, and hearing structures (Abbott and Sawyer, 2002). The intensity of the sound pressure levels produced during pile driving depends on a variety of factors including, but not limited to, the type and size of the pile, the substrate into which the pile is being driven, the depth of water, and the type of the of pile-driving equipment being used. We anticipate that impact pile drivers would be used to drive the majority of the piles for the LNG terminal. Generally, vibratory hammers are not well suited for driving piles in the types of soils found at the LNG terminal. Use of impact pile driving would result in greater acoustic

impact on the surrounding aquatic environment than vibratory pile driving. In comments on the draft EIS, Creole Trail stated that the contractor may elect to use a vibratory hammer in substrates predominantly composed of fine textured clays and silts for pile driving activities within the marine basin. To the extent that vibratory hammers are used, they may result in reduced noise impacts as compared to impact pile drivers. Pile driving for the marine structures would take place after dredging to a depth of about 45 feet below MLG.

In comments provided during the preparation of this EIS, NOAA Fisheries cited a study in which sea turtles were observed to be in a behaviorally agitated state at a sound level of 175 decibels (dB) at a reference pressure of 1 micropascal (re: 1 µPa) (NOAA, 2005). Therefore, NOAA Fisheries recommended that the EIS provide information about the anticipated duration and timing of pile driving, as well as estimates of the source level of underwater noise resulting from pile driving and the transmission loss rate, so that a 175 dB re: 1 µPa could be calculated.

Creole Trail anticipates that all of the pile driving required for the project would be conducted over a 13-month period during construction of the LNG terminal, including both onshore and in-water pile driving. The majority of pile driving would be onshore for the LNG tanks and other terminal components. Given this schedule, pile driving would take place at all times of the year. However, the specific timeframes for in-water pile driving have not been identified at this time and would occur during only a portion of the 13-month period. Pile driving would be limited to daytime hours unless delays require nighttime work to meet the project schedule. Creole Trail anticipates that seven pile drivers would operate simultaneously at peak pile driving conditions during construction of the proposed LNG terminal. Creole Trail estimates that each pile driver would generate noise during 60 percent of its active period based on the anticipated time for support activities such as crane movement, pile attachment, lifting, and positioning.

Pilings for marine structures at the proposed Creole Trail LNG terminal would be 42-inch-diameter, tubular steel piles with a reinforced concrete infill for the top 10 feet. Published studies indicate that steel pile driving activities (for piles ranging from 12 to 66 inches in diameter) generate underwater noise in the range of 210 to 231 dB re: 1 µPa at a distance of 3.3 feet from the noise source. Transmission loss rates for this activity range from 0.23 to 0.46 dB per foot (Nedwell 2002, 2003; Hastings and Popper 2005). Physical site conditions, which would change with time, would dictate the actual transmission loss rate.

As noted previously, sea turtles are known to occur in the vicinity of the Calcasieu Pass entrance jetties about 3 miles from the LNG terminal site. Sea turtles are less common inshore, and there is no known biologically important sea turtle habitat (e.g., breeding, resting, important foraging areas) in the immediate vicinity of the LNG terminal site (Baker, 2005). However, NOAA Fisheries indicated that sea turtles may sometimes feed or rest in the area of the LNG terminal site, and noted that protocols such as species monitoring and the use of bubble curtains are sometimes used to reduce the impacts of pile driving noise on sea turtles. Therefore, we recommended in the draft EIS that Creole Trail consult with NOAA Fisheries to develop pile driving sound mitigation measures.

In its comments on the draft EIS, Creole Trail stated that sea turtles may be present in the project vicinity from April through September and that sea turtles may use the Calcasieu Ship Channel to reach Calcasieu Lake for foraging. However, Creole Trail stated that it does not expect sea turtles to remain within the project area for extended periods of time due to the industrial nature of the ship channel and the lack of suitable foraging or nesting habitat along the shoreline in the project area. Creole Trail also stated that it does not anticipate that sea turtles would be adversely affected by pile driving activities during construction of the LNG terminal. Creole Trail agreed to coordinate with NOAA Fisheries on this matter and to file all correspondence with the Commission.

Creole Trail subsequently filed copies of correspondence with NOAA Fisheries documenting discussions regarding this matter. As a result of these discussions, NOAA Fisheries and Creole Trail identified several measures that Creole Trail has agreed to implement to minimize the potential impacts of pile driving on sea turtles and marine mammals. These measures are provided in Appendix H as Part B of the Protected Species Harm Avoidance Measures. With the implementation of these measures, pile driving activities associated with construction of the proposed LNG terminal are not likely to adversely affect sea turtles.

Sea turtles can be vulnerable to boat strikes while feeding, swimming, and resting near the surface of the water. However, in the open waters of the Gulf of Mexico, the LNG vessels would represent an incrementally small increase in vessel traffic over current conditions and would occupy a relatively small area compared to the area traversed by sea turtles. As noted previously, Creole Trail has agreed to implement the Strike Avoidance Policy (see Appendix H). The project would not include any other activities, such as water intake or discharge in the Gulf of Mexico, which could pose an entrainment risk to sea turtles or directly impact sea turtles or marine mammals. With the implementation of Strike Avoidance Policy, LNG traffic from operation of the proposed project is not likely to adversely affect sea turtles (green, hawksbill, Kemp's ridley, leatherback, and loggerhead) or their habitats.

Dredge spoil placement has the potential to affect sea turtles depending on which DMPA is selected for project use and as a replacement for DMPA "O." In comments provided to Creole Trail, NOAA Fisheries stated that DMPA Alternative 2 (Creole Trail's preferred site) and 6 would not be expected to adversely affect sea turtles. DMPA Alternative 4 has the greatest potential to affect sea turtles, and alternatives 1, 3, and 5 may affect sea turtles, but to a lesser extent due to their greater distances inshore. The Protected Species Harm Avoidance Measures provided in Appendix H, which Creole Trail has agreed to implement, include a seasonal restriction to be implemented if DMPA Alternative 4 is used for dredged materials resulting from the project. As noted in section 4.7.1.5, additional consultations with NOAA Fisheries will be conducted once the DMPA site(s) is selected.

Operational discharges from the LNG terminal would be limited to stormwater discharges and discharge of water that would be generated during the LNG vaporization process. These discharges would be conducted in accordance with applicable permits, and the volume of water that would be discharged into the Calcasieu Ship Channel would vary based on daily conditions. The project would not include water intake or discharge in the Gulf of Mexico; therefore, there would be no entrainment risk to sea turtles or direct impact on sea turtles.

4.7.1.2 Birds

Bald Eagle

The bald eagle has been listed as a federally threatened species and is widely distributed throughout the United States (FWS, 2005d). The bald eagle has potential nesting habitat in the project area in Cameron, Calcasieu, and St. Landry Parishes (FWS, 2005c). Bald eagles nest in Louisiana from October through mid-May, primarily in cypress snags in swamps or near fresh to intermediate marshes or open water in the southeastern parishes. Bald eagles will often return to the same nest for a number of years; however, they may also use alternate nests within the vicinity. Shoreline trees that provide a clear view of the water to locate aquatic prey are often chosen as nest sites (FWS, 2005c). Bald eagles primarily feed on fish, but are opportunistic and will eat a variety of mammals, amphibians, crustaceans, and birds. Wintering habitat used by bald eagles in Louisiana is characterized by abundant, readily available food sources. Most wintering areas are associated with open water where eagles feed on fish or waterfowl.

Creole Trail conducted field investigations between February and April 2005 and aerial surveys on March 4, 2005. No eagle nests were observed in the project area during these surveys. The FWS (2005b) has indicated that there are no known bald eagle nests in the vicinity of the project area. In addition, the FWS reviewed the results of aerial surveys conducted by Creole Trail. Based on its review, the FWS concurred that the project is not likely to adversely affect bald eagles. If a bald eagle nest is found within 1,500 feet of the project area, the FWS would need to be contacted to develop measures (e.g., spatial restrictions around active bald eagle nests) to avoid impacts on this species.

Brown Pelican

The brown pelican is usually found in bays, tidal estuaries, or along coastal areas (LADWF, 2005a). According to the FWS (2005c), potential brown pelican habitat exists in Cameron Parish. In Louisiana, brown pelicans nest in mangrove trees, shrub thickets, or within dunes of barrier islands between November and July (LADWF, 2005a). Birds seldom venture more than 20 miles out to sea and most foraging occurs in shallow estuarine waters, using sand spits and offshore sand bars for loafing and nocturnal roost areas (FWS, 2005C). It is likely that brown pelicans forage in the project vicinity. Additionally, a known rookery is located approximately two miles from the project area on Rabbit Island in Calcasieu Lake (FWS, 2005C). Construction activities such as preconstruction surveys of the pipeline route, trench excavation, pipe fabrication and installation, and backfilling could temporarily displace this species into nearby suitable habitat. HDD operations along the shorelines of Calcasieu Lake may temporarily discourage brown pelicans from foraging near the construction area. The Cameron Prairie National Wildlife Refuge and Sabine National Wildlife Refuge would provide similar and ample habitat for any brown pelicans displaced by the project, and would be avoided during construction.

No colonial waterbird rookeries or brown pelican nests were observed during Creole Trail's March 2005 aerial surveys of the project area. In addition, based on our consultation with the LADWF, the LADWF's August 2005 brown pelican surveys identified no new brown pelican nests in the project area (Hess, 2005). Based on the above information, the project is not likely to adversely affect the brown pelican. The FWS concurred with this finding in its comments on the draft EIS.

Red-cockaded Woodpecker

The red-cockaded woodpecker (RCW) has the potential to occur along the proposed pipeline route in Allen, Calcasieu, and Evangeline Parishes. The federally listed endangered RCW inhabits open, park-like stands of mature pine trees containing little or no hardwood midstory, and few or no overstory hardwoods. The species excavates its nesting cavities in live pine trees, typically in trees where the heartwood has been weakened by red heart fungus (FWS, 2003). As the trees must have enough heartwood to contain the roosting chamber, cavity trees generally range from 60 to 150 years in age, but stands as young as 30 years have contained active colonies. Older growth pine or pine-dominated stands are also needed for foraging, but not to the extent needed for nesting or roosting (FWS, 2003). This habitat, in association with or proximal to nesting/roosting habitat, is necessary for survival of a RCW population.

Pairs of birds typically nest in units known as groups, with nesting occurring from late April through early June. A group may include one breeding pair and as many as four other birds (FWS, 2003). The aggregate area encompassing cavity trees occupied or formerly occupied by an RCW group plus a 200-foot-wide buffer is termed a cluster. Minimum cluster area size is 10 acres (FWS, 2003). Studies have shown a great deal of variance in the minimum home range size required by RCWs (FWS, 2003). Currently, the FWS recognizes that factors influencing home range quality include frequency of burning, quantity of hardwood midstory, abundance of grass or forb groundcover, and average age of the stand.

If foraging habitat being utilized by woodpeckers were cleared during construction of the proposed pipeline, and clearing of that habitat limited the availability of suitable foraging area, reproductive success or overall survival of the individuals or group using the area could be reduced. Further, clearing of active cavity trees could have direct (e.g., injury or mortality) or indirect (e.g., lost reproduction) impacts on red-cockaded woodpeckers.

Creole Trail conducted surveys for RCW habitat during February, March, and April 2005 along the proposed pipeline routes. However, at that time, Creole Trail was unable to obtain access to conduct surveys in certain areas, including an area between MPs 36.0 and 36.6 on Segment 2, that was previously identified as potential RCW foraging habitat. In a May 2005 letter, the FWS described certain information recommended to be included in Creole Trail's RCW survey report (e.g., survey methodology, pine stand characteristics, and other information), and stated that if suitable habitat exists, then all suitable nesting habitat within 0.5 mile radius of the project boundary should be surveyed by a qualified biologist for the presence of RCW clusters in accordance with the Recovery Plan for the Red-Cockaded Woodpecker. Access to the area between MPs 36.0 and 36.6 was revoked before it could be surveyed in accordance with the guidelines presented in the FWS' RCW recovery plan (2003) survey protocol (FWS, 2003).

In December 2005, Creole Trail submitted to the FWS additional information regarding its survey methodology, detailed habitat descriptions, and further explanation of how it arrived at its conclusions regarding habitat suitability. In February 2006, Creole Trail conducted another habitat survey that included the area between MPs 36.0 and 36.6 on Segment 2. Creole Trail also conducted additional habitat evaluations at other areas to obtain additional information requested by the FWS regarding the age, composition, and density of pine stands. In an April 13, 2006 letter to PBS&J, the FWS service provided comments based on its review of Creole Trail's February 2006 survey report and an April 3, 2006 site visit. The FWS recommended that Creole Trail conduct additional nesting habitat surveys within 0.5 mile of the project footprint, and foraging habitat analysis if RCWs are present, at two sites (between MPs 16.5 and 17.1 and MPs 36.0 and 36.6). In addition, the FWS recommended that Creole Trail conduct a foraging habitat analysis at a third site between MPs 37.1 and 37.8. According to the FWS letter, PBS&J indicated that it would conduct these additional surveys on Creole Trail's behalf. At this time, we do not have adequate information to allow for a complete review of potential project impacts on this species. Therefore, **we recommend that:**

- **Creole Trail should consult with the FWS after conducting the additional surveys for the RCW as recommended by the FWS. The results of consultations with the FWS, any additional survey reports, and FWS comments on the survey reports should be filed with the Secretary <u>as soon as they become available</u>.**

4.7.1.3 Fish

Gulf Sturgeon

The Gulf sturgeon is listed as threatened in the Gulf of Mexico by NOAA Fisheries. The FWS and Gulf States Marine Fisheries Commission (GSMFC) have developed a recovery plan to restore the Gulf sturgeon to a viable, self-sustaining element of its ecosystem (FWS and GSMFC, 1995). Based on distribution information from the NOAA Fisheries (2005c), the present range of the Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in eastern Louisiana and western Mississippi east to the Suwannee River is Florida. The Creole Trail Project area is not within the current range of the Gulf sturgeon. Therefore, the project is not likely to adversely affect the Gulf sturgeon.

Smalltooth Sawfish

The smalltooth sawfish is listed as endangered in the Gulf of Mexico by NOAA Fisheries. Sawfish species inhabit shallow coastal waters of tropical seas and estuaries throughout the world, where they are generally found in shallow waters very close to shore over muddy and sandy bottoms (NOAA Fisheries, 2005d). They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths. Historically, the smalltooth sawfish was common throughout the Gulf of Mexico from Texas to Florida. However, the current range of this species has contracted to peninsular Florida (NOAA Fisheries, 2005d). The project area is not located within or in proximity to the smalltooth sawfish's current range; therefore, the project is not likely to adversely affect the smalltooth sawfish.

4.7.1.4 Plants

American Chaffseed

According to the FWS (2005c), the American chaffseed grows on "pimple mounds" in the longleaf pine flatwoods of Allen Parish of southwestern Louisiana. The American chaffseed is a tall perennial herb in the snapdragon family. The plant, which is a partial parasite on the roots of other plants, grows to a height of 12 to 24 inches at the time of flowering in the spring.

Creole Trail conducted surveys for American chaffseed on suitable habitat along the proposed pipeline route for which access had been granted in March through April 2005, and no specimens were identified in the project area. At that time, Creole Trail had identified approximately 12.9 acres of construction workspace remaining to be surveyed in areas identified through aerial photograph review as pine or pine/hardwood stands for which access had not been granted. In a letter dated June 1, 2005, the FWS requested that Creole Trail provide additional information in its survey report regarding survey methodology, a habitat description of areas surveyed, and an explanation of why the habitat was or was not suitable for the American chaffseed. Creole Trail submitted additional information to the FWS in December 2005 to respond to this request. At that time, Creole Trail also provided the FWS with information it had obtained from land managers on some of the inaccessible properties indicating that no threatened or endangered species were present on those properties. In February 2006, Creole Trail conducted additional surveys for American chaffseed habitat, including areas containing potentially suitable habitat for which access permission had previously been unavailable. Based on its review of Creole Trail's habitat assessments, the FWS concurred in an April 13, 2006 letter to PBS&J that the project is not likely to adversely affect the American chaffseed.

4.7.1.5 DMPA Alternatives

As discussed in sections 3.5 and 4.4.3, Creole Trail is evaluating several DMPA sites for potential use in meeting project mitigation requirements. In comments on the alternative DMPA sites, the FWS noted that the federally listed threatened piping plover and its critical habitat occur near one of the potential sites. NOAA Fisheries stated that use of some of the sites would have the potential to affect sea turtles. Additional consultations with FWS and NOAA Fisheries will be conducted once the DMPA site(s) is selected.

4.7.2 State-Listed Species

The LNHP database search identified nine state species of concern that may occur within 3 miles of the proposed pipeline routes.

The roseate spoonbill inhabits marshes, swamps, ponds, rivers, and lagoons. In Louisiana, the roseate spoonbill is considered rare, and frequently inhabits freshwater marshes. The roseate spoonbill has been known to nest in low bushes along coastal islands and on treeless spoil banks along waterways (NatureServe, 2005). Roseate spoonbills prefer to forage in shallow waters, and foraging grounds average a distance of 7.5 miles from breeding grounds. The closest known roseate spoonbill colony is located on Rabbit Island, approximately 2.5 miles from the pipeline (LNHP, 2005b). The portion of the project near Calcasieu Lake may provide potential foraging habitat to the roseate spoonbill, however the Cameron Prairie National Wildlife Refuge and Sabine National Wildlife Refuge would provide similar and ample habitat and would be avoided during construction.

The paddlefish inhabits the slow-flowing water of medium and large rivers, river-margin lakes, channels, oxbows, backwaters, and impoundments with access to spawning areas (LNHP, 2005b). The paddlefish prefers water depths of greater than 5 feet, and seeks deeper water in late fall and winter. The paddlefish was last recorded in the West Fork Calcasieu River, just below the Houston River in 1989. Creole Trail plans to cross both the Houston and West Fork Calcasieu using the HDD method which would avoid any impacts on the paddlefish.

According to the LNHP (2005b), there are recorded occurrences of seven plant species of concern within two miles of the project area (purple false foxglove, Mead's sedge, wild coco, long-sepaled false dragon-head, brookweed, low nutrush, and Lindheimer's bee-balm). Based on the historical records of occurrence, these species are not known to occur in the project area.

4.7.3 Conclusions and Recommendations

A variety of measures have been proposed by Creole Trail that would minimize impacts on federally and state-listed species, including implementation of our Plan and Procedures and the project-specific SPCC Plan. These measures would reduce the loss of vegetated habitats, minimize water quality impacts, and minimize delays in restoration of areas temporarily disturbed during construction. While beneficial to general wildlife, fisheries, and vegetation in the area, these measures would also benefit listed species with the potential to occur in the vicinity of the project. Additionally, Creole Trail committed to implementing the measures specified in the Protected Species Harm Avoidance Measures (see Appendix H) developed in consultation with NOAA Fisheries to avoid or minimize impacts on marine mammals and sea turtles. Based on the information described above, we believe that except for the RCW and American chaffseed (for which determinations are pending), the project is not likely to adversely affect threatened or endangered species.

In addition to the measures described above, Creole Trail indicated that prior to construction it would conduct additional surveys (using a qualified biologist) to identify federally or state-listed bird species potentially occurring in the vicinity of project. Should any protected species be identified, Creole Trail would work with the FWS and LADWF to develop appropriate mitigation measures to avoid impacts on these species.

In an April 24, 2006 letter to the Commission, NOAA Fisheries concurred that with the implementation of the measures specified in Appendix H, the Creole Trail Project is not likely to adversely affect federally listed species under NOAA Fisheries' jurisdiction (NOAA Fisheries, 2006). Consultation with NOAA Fisheries would need to be re-initiated if a take occurs, new information reveals effects of the project not previously considered, the project is modified in a manner that causes an effect not previously considered, or a new species is listed or critical habitat designated that may be affected by the project.

We have not completed consultation with the FWS. Further, while construction of the LNG terminal would begin upon receipt of the necessary permits and approvals, pipeline construction is not planned to begin until 2009. Therefore, **we recommend that:**

- **Creole Trail not begin construction activities <u>until</u>:**

  a. the FERC completes any necessary consultations with the FWS, and

  b. Creole Trail receives written notification from the Director of OEP that construction and/or implementation of conservation measures may begin.

  If construction has not begun <u>within 1 year</u> from the date of issuance of the FERC approval of the project, Creole Trail should consult with the appropriate offices of the FWS and NOAA Fisheries to update the species list and to verify that previous consultations and determinations of effect are still current. Documentation of these consultations, and the need for additional surveys and survey reports (if required), and FWS or NOAA Fisheries comments on the surveys and survey reports and their conclusions, should be filed with the Secretary of the Commission <u>prior to beginning construction</u>.

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

The Creole Trail Project LNG import terminal would be located in an open area along the western side of the Calcasieu Ship Channel about 1.5 miles west of Cameron, Louisiana and about 3.0 miles north of the Gulf of Mexico coast in Cameron Parish, Louisiana.

The pipeline portion of the Creole Trail Project would consist of Segments 2 and 3. Segment 2 would consist of 25.3 miles of dual 42-inch-diameter pipelines, which would begin at the proposed LNG terminal, extend north through Calcasieu Lake, and terminate at its interconnection with pipeline Segment 3 south of Sulphur, Louisiana. Segment 3 would consist of 91.5 miles of dual 42-inch-diameter pipelines, which would begin at the terminus of Segment 2, proceed north to the intersection with State Highway 27, continue east, and terminate at the Columbia Gulf Rayne Compressor Station in Acadia Parish. Creole Trail's proposed pipelines would interconnect with 16 other interstate or intrastate pipelines along the pipeline routes, which would require the construction of approximately 1.7 miles of interconnecting pipeline. A more detailed description of the pipeline facilities is provided in section 2.1.3. Route maps of the proposed pipelines are provided in Appendix B.

4.8.1 Land Use

Most of the land affected by the construction and operation of the Creole Trail Project would be open water and open land. Other land uses affected would include forest, agricultural, and developed areas. Construction would affect a total of 3,096.9 acres of land: 367.3 acres of land for the LNG terminal and 2,729.6 acres for the pipeline facilities. Operation of the project would affect 1,216.8 acres of land, including 123.7 acres for operation of the LNG terminal facilities and 1,093.0 acres for the permanent pipeline right-of-way, aboveground facilities, and modified access roads. Table 4.8.1-1 summarizes the acres of each land use category that would be affected by construction and operation of the proposed project.

4.8.1.1 LNG Terminal

Creole Trail proposes to use approximately 367.3 acres within an approximate 771.6-acre leased parcel. Permanent LNG terminal facilities would include marine facilities (ship berths, maneuvering basin, tugboat dock); LNG transfer lines; LNG storage tanks; LNG vaporization and sendout; vapor handling system; control and safety systems; and utilities, infrastructure, and support systems. An entrance road would be constructed along the eastern boundary of the LNG terminal site from State Highway 27/82, which is south of the proposed LNG terminal. The permanent LNG terminal facilities would occupy approximately 123.7 acres within an approximately 315.4-acre fenced area. Of the 123.7 acres, 49.8 acres are open and forest land that would be permanently converted to open water for use as marine facilities. In addition to the 123.7 acres that would be used for the permanent LNG terminal facilities, approximately 243.6 additional acres would be used for temporary construction areas, including laydown, office, and parking areas.

TABLE 4.8.1-1

Land Use Affected by Construction and Operation of the Proposed Creole Trail Project

Facility	Open Water (acres)		Agricultural (acres)		Open Land [a] (acres)		Forest [b] (acres)		Developed (acres)		Total (acres)	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
LNG Terminal												
Marine Basin	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.9	0.0
LNG Facilities	0.0	0.0	0.0	0.0	258.0	98.8	54.1	22.9	3.3	2.0	315.4	123.7 [c]
Subtotal	51.9	0.0	0.0	0.0	258.0	98.8	54.1	22.9	3.3	2.0	367.3	123.7
Pipeline Facilities												
Rights-of-Way [d]	722.3	169.5	676.9	331.4	477.0	254.3	552.5	299.7	20.1	11.6	2,448.8	1,066.5
Aboveground Facilities [e]	0.0	0.0	0.0	2.8	5.6	4.8	2.0	4.4	0.0	0.1	7.6	12.1
Access Roads	0.0	0.0	0.5	0.4	1.6	1.3	3.5	3.4	43.3	9.3	48.9	14.4
Wareyards	0.0	0.0	0.0	0.0	0.3	0.0	2.0	0.0	222.0	0.0	224.3	0.0
Subtotal	722.3	169.5	677.4	334.6	484.5	260.4	560.0	307.5	285.4	21.0	2,729.7	1,093.0
Project Total	774.2	169.5	677.4	334.6	742.5	359.2	614.1	330.4	288.7	23.0	3,096.9	1,216.7

[a] Open land includes rangeland, upland scrub-shrub, non-forested wetlands, and coastal grasslands/prairies.

[b] Forest land includes forested wetlands.

[c] Approximately 49.8 acres of the open land and forest land permanently affected would be converted to open water for the marine facilities.

[d] Includes additional temporary work spaces.

[e] Represents area affected outside of construction or permanent rights-of-way.

Note: Due to rounding, totals may be off by 0.1.

Const. = Construction

Oper. = Operation

The LNG terminal site is under the jurisdiction of Cameron Parish, Louisiana, which has no county zoning ordinances. The site is mostly flat and currently used for cattle grazing and sport hunting. The site has been previously used by the COE as a dredged material placement area and for oil and gas operations. As noted in section 4.1.2, the site includes an abandoned petroleum storage tank battery that would be removed prior to construction. Creole Trail indicated that the abandoned tanks would be removed in accordance with applicable state regulations that require the removal or decontamination of contaminated soils and containment system components. As noted below, we recommend that Creole Trail provide additional information regarding the removal and disposal of the abandoned tank battery.

Several pipeline rights-of-way cross the 771.6-acre leased parcel, however, these pipelines would be avoided during construction and operation of the LNG terminal or, in the case of one pipeline that has been abandoned in place, would be removed by Creole Trail. The site is bound by the Calcasieu Ship Channel on the east side, by State Highway 27/82 and a ferry and boat landing to the south, and otherwise surrounded by wetlands and open space.

Creole Trail would remove an abandoned 6-inch-diameter production flow line owned by Apache Corporation (Apache) that has been inactive for more than 10 years. Creole Trail would remove this pipeline because it is beneath the proposed LNG tanks. Creole Trail has stated that it would dispose of all removed facilities in accordance with applicable federal and state regulations.

To further assist us in evaluating potential impacts associated with the removal of the abandoned facilities described above, **we recommend that**:

- **Creole Trail file information describing how it would remove and dispose of the abandoned petroleum storage tank battery and Apache pipeline present at the LNG terminal site. This information should also include a discussion of whether there would be any contamination associated with the abandoned facilities and, if so, how contaminated materials would be managed during removal and disposal of the facilities. Creole Trail should file this information with the Secretary for review and written approval of the Director of OEP <u>prior to beginning construction of the LNG terminal</u>.**

The marine basin would include a maneuvering area for the LNG ships outside of the Calcasieu Ship Channel and two LNG ship berths, each equipped with appropriate mooring systems and accessories for safe berthing and de-berthing of LNG ships. A portion of the Calcasieu Ship Channel would be dredged to allow for construction of the marine basin, which would affect 51.9 acres of open water during construction. However, the completed marine facilities would be outside of the ship channel Approximately 49.8 acres of open and forest land would be permanently converted to open water to accommodate the permanent LNG marine basin and a tug boat facility.

Land use impacts associated with the construction and operation of the LNG terminal primarily would be associated with the conversion of about 123.7 acres of land from existing uses to industrial use for operation of the terminal, about 16 percent of the total 771.6-acre tract of land leased by Creole Trail. Of the remaining 647.9 acres of land, about 191.7 acres would be within the terminal's perimeter fencing and maintained in an herbaceous condition following construction. The remaining 456.2 acres would remain open and would not be disturbed by construction or operation of the facility.

4.8.1.2 Pipelines

Pipeline Segment 2 would primarily affect the open water of Calcasieu Lake between approximate MPs 3.0 and 20.1. The other predominant land use that would be affected by Segment 2 includes open land consisting of non-forested wetlands (emergent and scrub shrub) and coastal grasslands. Segment 3 would primarily affect forested uplands (harvested and non-harvested) and agricultural lands.

Creole Trail proposes to use a 135-foot-wide construction right-of-way for Segments 2 and 3, and a 300-foot-wide construction right-of-way for construction within Calcasieu Lake. In agricultural areas, Creole Trail proposes to increase the construction right-of-way on either segment by 15 feet to accommodate topsoil segregation. The construction right-of-way width for the interconnecting pipelines, where applicable, would be 75 feet. The construction rights-of-way would comprise 831.3 acres for Segment 2 and 1,538.6 acres for Segment 3, for a total of 2,369.9 acres. Of the land use temporarily affected, 655.7 acres (28 percent) would consist of agricultural land, 522.0 acres (22 percent) of forest land, 453.3 acres (19 percent) of open land, 19.1 acres (less than 1 percent) of developed land, and 719.8 (30 percent) of open water. Following construction, Creole Trail would retain a 75-foot-wide permanent right-of-way for Segments 2 and 3 and a 50-foot-wide permanent right-of-way for the interconnecting pipelines. Of the total area affected during construction of the proposed pipelines, approximately 1,066.5 acres would be maintained as permanent right-of-way. Table 4.8.1-2 shows the current land uses that would be affected by the proposed pipeline facilities.

TABLE 4.8.1-2

Land Use Affected by Construction and Operation of the Proposed Creole Trail Pipelines

Pipeline/Facility	Agricultural		Forest [a]		Open Land [b]		Developed		Open Water		Total	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
Segment 2												
Pipeline	0.0	0.0	2.8	1.9	107.9	63.6	3.2	2.0	717.4	167.8	831.3	235.3
Additional Temporary Workspaces	0.0	0.0	2.1	0.0	8.7	0.0	0.4	0.0	2.3	0.0	13.5	0.0
Aboveground Facilities [c]	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Access Roads [d]	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.2	0.0	0.0	4.9	0.2
Wareyards	0.0	0.0	2.0 [e]	0.0	0.3 [e]	0.0	184.0	0.0	0.0	0.0	186.3	0.0
Segment 2 Total	0.0	0.0	6.9	3.4	116.9	63.6	192.5	2.2	719.7	167.8	1,036.0	237.0
Segment 3												
Pipeline	655.7	331.4	519.2	297.8	345.4	190.7	15.9	9.6	2.4	1.7	1,538.6	831.2
Additional Temporary Workspaces	21.2	0.0	28.4	0.0	15.0	0.0	0.6	0.0	0.2	0.0	65.4	0.0
Aboveground Facilities [c]	0.0	2.8	2.0	2.9	5.6	4.8	0.0	0.1	0.0	0.0	7.6	10.6
Access Roads [d]	0.5	0.4	3.5	3.4	1.6	1.3	38.4	9.2	0.0	0.0	44.0	14.3
Wareyards	0.0	0.0	0.0	0.0	0.0	0.0	38.1	0.0	0.0	0.0	38.1	0.0
Segment 3 Total	677.4	334.6	553.1	304.1	367.6	196.8	93.0	18.9	2.6	1.7	1,693.7	856.1
Pipeline Total												
Pipeline	655.7	331.4	522.0	299.7	453.3	254.3	19.1	11.6	719.8	169.5	2,369.9	1,066.5
Additional Temporary Workspaces	21.2	0.0	30.5	0.0	23.7	0.0	1.0	0.0	2.5	0.0	78.9	0.0
Aboveground Facilities [c]	0.0	2.8	2.0	4.5	5.6	4.8	0.0	0.1	0.0	0.0	7.6	12.1
Access Roads [d]	0.5	0.4	3.5	3.4	1.6	1.3	43.3	9.3	0.0	0.0	48.9	14.4

TABLE 4.8.1-2 (cont'd)

Land Use Affected by Construction and Operation of the Proposed Creole Trail Pipelines

Pipeline/Facility	Agricultural		Forest [a]		Open Land [b]		Developed		Open Water		Total	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
Wareyards	0.0	0.0	2.0	0.0	0.3	0.0	222.0	0.0	0.0	0.0	224.3	0.0
Pipeline Total	677.4	334.6	560.0	307.5	484.5	260.4	285.4	21.0	722.3	169.5	2,729.6	1,093.0

[a] Includes forested wetlands.

[b] Includes rangeland, upland scrub-shrub, non-forested wetlands, and coastal grasslands/prairies.

[c] Most of the land required for the construction of aboveground facilities overlaps with the pipeline construction right-of-way and is accounted for in the pipeline land use acreage. The acreage shown for construction of the aboveground facilities represents only the area that would be affected outside of the pipeline construction right-of-way.

Similarly, most of the land that would permanently occupied by aboveground facilities would be located within the permanent pipeline right-of-way and are accounted for in the pipeline operations acreages. Acreages shown for operations of aboveground facilities represent the portion of the permanent aboveground facility footprint that extends outside of the permanent pipeline right-of-way.

[d] Represents access roads that would be constructed or modified for construction. Does not include existing roads that would not require modification.

[e] These portions of the wareyards consist of palustrine emergent and forested wetlands and would be avoided and protected by Creole Trail.

Note: Due to rounding, totals may be off by 0.1.

Const. = Construction
Oper. = Operation

Existing Rights-of-Way

Approximately 1.0 mile (4 percent) of Segment 2 and approximately 60.7 miles (66 percent) of Segment 3 would parallel existing pipeline, road, or utility rights-of-way. The remaining 24.3 miles (96 percent) of Segment 2 and 30.8 miles (34 percent) of Segment 3 would be constructed on newly created right-of-way (see table 4.8.1-3). A minimum offset from the existing rights-of-way centerlines would be established for the proposed new permanent rights-of-way to ensure there is adequate workspace for containment and storage of trench spoil and for construction equipment to operate at a safe distance from in-service pipelines and power lines. This offset also would avoid potentially adverse influence on adjacent active pipelines that may result from the hydrostatic pressure gradient created by the pipeline's open ditch line in incohesive, saturated soil conditions. Where the proposed pipelines would be constructed adjacent to existing pipelines, Creole Trail would typically install its nearest proposed pipeline 50 feet from the existing pipeline. Creole Trail would attempt to overlap 20 feet of its temporary construction right-of-way with the existing pipeline's permanent easement where such an overlap would still allow for the 50 foot separation between the proposed and existing pipelines. Creole Trail's new permanent right-of-way would generally abut the permanent right-of-way of the existing adjacent facility.

TABLE 4.8.1-3

Existing Rights-of-Way Paralleled by the Proposed Creole Trail Pipeline Route

Pipeline Segment/ Mileposts	Length (miles)	Existing Easement	Direction from Existing Right-of-way
Segment 2			
0.0 to 1.0	1.0	Bridgeline Holdings, L.P. Pipeline (Louisiana Resources Company)	North
Segment 3			
1.4 to 10.7	9.3	Proposed Cameron Pipeline	West
15.4 to 16.8	1.4	Tennessee Gas Pipeline	South
16.8 to 18.8	2.0	Tennessee Gas Pipeline	North
27.1 to 27.4	0.3	Texas Eastern Transmission Corporation Pipeline	South
29.1 to 36.8	7.7	Transcontinental Gas Pipeline Corporation (Transco) Pipeline	South
38.3 to 39.4	1.1	Transco Pipeline	South
39.8 to 40.2	0.4	Transco Pipeline	South
40.2 to 41.6	1.4	Trunkline Gas Pipeline Company (TGC) Pipeline	South
42.2 to 43.9	1.7	TGC Pipeline	South
43.9 to 46.7	2.8	TGC Pipeline	North
47.2 to 49.5	2.3	Tennessee Gas Pipeline	North
50.6 to 56.0	5.4	State Hwy 3086, Parish Line Road after MP 52.0	South
61.4 to 69.5	8.1	Florida Gas Transmission Company Pipeline	South
70.7 to 71.2	0.5	Fournerat Road	South
71.6 to 72.0	0.4	Fournerat Road	South
72.5 to 73.8	1.3	Powerline and Fournerat Road	South
73.8 to 73.9	0.1	Powerline and Fournerat Road	South/North
76.4 to 86.3	9.9	Texas Gas Pipeline	South
86.5 to 86.9	0.4	Texas Gas Pipeline	South
87.3 to 89.6	2.3	Texas Gas Pipeline	South
89.6 to 90.6	1.0	Texas Gas Pipeline	North
90.6 to 91.5	0.9	Cypress Pipeline	North

Aboveground Facilities, Temporary Extra Workspaces, Wareyards, and Access Roads

In addition to the construction rights-of-way (2,369.9 acres), Creole Trail proposes to use 7.6 acres for aboveground facilities, 78.9 acres for ATWS, 224.3 acres for wareyards, and 48.9 acres for access roads. Following construction, approximately 14.4 acres of land would be permanently modified for access roads and 12.1 acres would be permanently precluded from other use by the presence of aboveground facilities (M&R stations, MLVs, and pig launcher and receiver). Table 4.8.1-4 lists the acreages that would be affected by the aboveground facilities and wareyards.

The land temporarily affected by extra workspace areas, wareyards, aboveground facilities, and access roads, would be composed of approximately 2.5 acres of open water, 21.7 acres of agricultural land, 38.0 acres of forest land, 31.2 acres of open land, and 266.3 acres of developed land (see table 4.8.1-2). ATWS by milepost and acreages are shown in Appendix I. The ATWS would extend beyond the construction rights-of-way and would affect approximately 30.5 acres of forest land, 23.7 acres of open land, 21.2 acres of agricultural land, 2.5 acres of open water, and 1.0 acre of developed land.

Existing public and private roads would be used to gain access to the pipeline rights-of-way. Creole Trail has indicated that during construction it would use 3 existing roads along Segment 2 and 28 existing roads along Segment 3. Although the construction right-of-way is generally accessible from existing public roads, several locations along the pipeline route are remote. To access these remote locations, Creole Trail would require construction of 1 new access road along Segment 2 and 17 new access roads along Segment 3. All except two of these new access roads would be permanent roads used to provide access to the pipeline and aboveground facilities during operation and maintenance of the proposed facilities, and most would be located within the permanent pipeline right-of-way. Use of access roads during construction, including one within the LNG terminal property, would affect 49.9 acres (see table 4.8.1-5). Temporary access roads would be returned to preconstruction conditions following construction. Permanent access roads would affect 14.4 acres. Additional modifications to existing roads may be required at some locations; however, Creole Trail has not yet identified these areas and has stated that they would be identified during construction, on an as-needed basis based on site conditions.

Creole Trail would use seven wareyards to support construction of the proposed pipelines. Wareyards would temporarily affect 224.3 acres (see table 4.8.1-4). One yard, located in Cameron Parish, would be within the area proposed for the LNG terminal. Six yards would be associated with pipeline construction. Four would be located in Calcasieu Parish and two in Acadia Parish. The majority of the land affected by wareyards is developed land. As discussed in section 4.4, the wareyards contain about 2.3 acres of wetlands, which would be avoided and protected (e.g., with silt fence) during construction. Following construction, wareyards would be vacated and allowed to revert to their preconstruction conditions, and/or be restored per agreements with the landowners.

TABLE 4.8.1-4

Acres of Land Affected by Construction and Operation of the Aboveground Facilities and Wareyards of the Proposed Creole Trail Pipelines

Pipeline/Facility	Milepost	Land Disturbed During Construction (acres)	Land Required for Operation (acres)
Segment 2			
Aboveground Facilities [a]			
LRC M&R Facility, ANR M&R Facility, pig launcher, and MLV	0.0	0.0	1.5
MLV	21.8	0.0	0.0
Wareyards			
CT-W-2 (Westlake)		54.0	0.0
CT-W-3 (Goosport)		13.1	0.0
CT-W-4 (Global Properties)		119.2	0.0
Segment 2 Total		186.3	1.5
Segment 3			
Aboveground Facilities [a]			
Sabine M&R Facility	0.0	0.0	0.4
MLV	8.6	0.0	0.0
Targa M&R Facility	9.8	0.0	0.5
Varibus M&R Facility	21.7	0.0	0.6
Gulf South M&R Facility	22.8	0.0	0.5
MLV	25.3	0.0	0.0
Transco M&R Facility and TGC M&R Facility	32.0	0.0	0.7
TETCO M&R Facility	32.7	7.6	5.0
MLV	43.8	0.0	0.0
Tennessee Gas M&R Facility	50.4	0.0	0.5
MLV	63.6	0.0	0.0
TETCO Egan M&R Facility	70.8	0.0	0.2
Texas Gas M&R Facility	70.8	0.0	0.2
ANR M&R Facility	71.7	0.0	0.4
FGT M&R Facility	74.2	0.0	0.1
Transco M&R Facility and MLV	79.4	0.0	0.5
Columbia Gulf M&R Facility, Cypress M&R Facility, pig receiver, and MLV	91.5	0.0	1.0
Wareyards			
CT-W-5 (Highway 27)		17.1	0.0
CT-W-6 (Highway 97-1)		4.5	0.0
CT-W-7 (Highway 97-2)		16.5	0.0
Segment 3 Total		45.7	10.6
Project Total		232.0	12.1

[a] The acreage shown for construction of the aboveground facilities represents only the area that would be affected outside of the pipeline construction right-of-way.

Acreages shown for operations of aboveground facilities represent the portion of the permanent aboveground facility footprint that extends outside of the permanent pipeline right-of-way.

TABLE 4.8.1-5

Access Roads Required for the Proposed Creole Trail Project

Facility/Milepost	New/Existing	Permanent/Temporary [a]	Length (feet)	Width (feet)	Acres
LNG Terminal	Existing [c]	Permanent	2,100	20	1.0
Segment 2					
20.9	Existing	Temporary	8,600	20	3.9
22.1	New [b]	Permanent	100	20	0.1
22.1	Existing	Permanent	250	20	0.1
22.5	Existing	Temporary	2,400	15	0.8
Subtotal Segment 2					4.9
Segment 3					
0.4	New [b]	Permanent	2,100	20	1.0
8.0	Existing	Permanent	2,900	25	1.7
8.5	New	Permanent	100	20	0.1
9.5	Existing	Permanent	5,500	20	2.5
9.5	New	Permanent	990	20	0.5
12.9	Existing	Temporary	6,500	15	2.2
14.5	Existing	Temporary	3,900	15	1.3
17.3	Existing	Temporary	3,800	20	1.7
20.1	Existing	Temporary	3,900	20	1.8
21.8	Existing	Permanent	8,500	20	3.9
21.8	New [b]	Permanent	5,000	20	2.3
22.8	New [b]	Permanent	915	20	0.4
23.0	Existing	Temporary	3,300	20	0.1
25.2	New	Permanent	100	20	0.1
26.0	Existing	Temporary	1,700	15	0.6
32.0	New [b]	Permanent	100	20	0.1
32.8	New [b]	Permanent	550	20	0.3
33.0	Existing	Temporary	200	15	0.1
37.0	Existing	Temporary	7,800	25	4.5
38.0	Existing	Temporary	2,100	20	1.0
39.0	Existing	Temporary	6,060	15	2.1
40.3	Existing	Temporary	2,400	15	0.8
40.5	Existing	Temporary	1,600	20	0.7
41.5	Existing	Temporary	3,650	20	1.7
43.9	New [b]	Permanent	460	20	0.2
44.5	Existing	Temporary	9,680	20	4.4
50.5	New [b]	Permanent	220	20	0.1
54.9	New	Temporary	63	20	<0.1
63.5	New [b]	Permanent	220	20	0.1
70.8	New [b]	Permanent	100	20	0.1
71.8	New [b]	Permanent	100	20	0.1
72.9	New	Temporary	60	20	<0.1
73.3	Existing	Temporary	55	20	<0.1
73.7	New [b]	Permanent	2,300	20	1.1
75.2	Existing	Temporary	650	20	0.3
75.5	Existing	Temporary	500	20	0.2
75.8	Existing	Temporary	300	25	0.2
76.3	Existing	Temporary	2,200	25	1.3
77.1	Existing	Temporary	330	15	0.1

TABLE 4.8.1-5 (cont'd)

Access Roads Required for the Proposed Creole Trail Project

Facility/Milepost	New/Existing	Permanent/Temporary [a]	Length (feet)	Width (feet)	Acres
77.8	Existing [b]	Temporary	2,980	15	1.0
79.4	New [b]	Permanent	250	20	0.1
81.8	Existing	Temporary	1,800	20	0.8
84.3	Existing	Temporary	2,200	25	1.3
85.9	Existing	Temporary	1,760	15	0.6
86.5	Existing	Temporary	1,770	15	0.6
Subtotal Segment 3					44.0
Total (LNG terminal and pipeline segments)					49.9

[a] Modifications to existing roads to be used as temporary access roads are considered impacts to the developed land use category. Permanent impacts resulting from new or existing access roads are reflected in the appropriate land use classification (see table 4.8.1-2).

[b] Access road impacts would occur within the permanent easement of the pipeline facilities.

[c] Access road would occur within the proposed LNG terminal facility.

Land Use Impacts and Mitigation

Construction of the pipelines would disturb existing land uses within construction work areas along the rights-of-way during construction and creation of new permanent rights-of-way for operation and maintenance of the facilities.

Agricultural lands in the project area are predominantly used for rice/crawfish production and for silviculture. Landowners in agricultural lands would be compensated for the loss of agricultural production in accordance with the terms of landowner agreements. The primary impacts on crop land (primarily rice, crawfish) would be the short-term loss of crop production due to construction-related activities. With the exception of crop land that would be occupied permanently by aboveground facilities, the remainder of the pipeline rights-of-way in crop lands would revert to pre-construction use. Creole Trail would incorporate the measures included in our Plan (including topsoil segregation) as well as landowner requests, to minimize impacts on crop lands. In addition to the measures in our Plan, Creole Trail would provide 4 feet of cover over the pipeline in these areas, and would implement measures that might include conducting pre-construction surveys to identify irrigation lines within the construction work areas and implementing landowner-specific restoration techniques to restore the surface drainage of the agriculture lands or water ponding ability of the land for rice/crawfish flooding potential. Creole Trail would compensate agricultural landowners for crop losses initially as well as any future decrease in production over time, for the use of their land during construction, and for the pipeline easements established across their land.

About 304.1 acres of forest land would be affected by the permanent right-of-way and aboveground facilities. About 102.7 acres of this forest land is used for silviculture. All temporary rights-of-way and ATWS in these areas would be allowed to revert back to forest land. In accordance with our Plan and Procedures, routine vegetation maintenance clearing would be allowed no more frequently than every 3 years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width and centered on the pipeline could be maintained annually in an herbaceous state. Additionally, trees within 15 feet of the pipeline that are greater than 15 feet in height could be selectively cut and removed from the permanent right-of-way.

Open land would be cleared in the construction right-of-way and ATWS to install the pipeline. Creole Trail would use standard overland construction techniques through open land. Creole Trail would incorporate measures included in our Procedures to minimize impacts on wetlands. Following construction, all temporary rights-of-way and ATWS in open land would revert to previous uses. In most areas, the permanent rights-of-way in open land would also revert to previous use, but would be maintained as necessary for operation.

The main open water areas crossed by the proposed pipelines include Calcasieu Lake, the Calcasieu Ship Channel and the Gulf Intracoastal Waterway. Impacts on the ship channel and the Gulf Intracoastal Waterway would be avoided by the use of HDD construction methods. Construction within Calcasieu Lake (Segment 2) would be conducted from a shallow water lay barge spread as described in section 2.3.2.2. Construction of the proposed pipelines in Calcasieu Lake could have short-term impacts on commercial and recreational boats and ferries operating in the lake. To minimize these impacts, Creole Trail would place 50-foot-wide gaps 500 feet apart along the spoil piles to allow recreational boats and other shallow-draft vessels to pass over the open trench. The open trench, spoil mounds, and designated passages would be properly identified with buoys, lights, and other markers as required by the Coast Guard. In addition, Creole Trail would attempt to construct through the lake during periods when recreational and commercial fishermen are less likely to be using the lake. A 75-foot-wide permanent right-of-way would be retained following construction, affecting 169.5 acres of open water. The permanent rights-of-way within open water would be reverted to previous use.

Pipeline Easements

The majority of the land crossed by the pipeline is privately owned. Creole Trail would obtain easements from landowners to construct and operate the pipelines and associated facilities. The easements would give the company the right to construct, operate, and maintain the pipeline, and establish a permanent right-of-way. In return, the company would compensate the landowner for use of the land. Easement agreements between the company and the landowner typically specify compensation for loss of use during construction, loss of non-renewable or other resources, and allowable uses and restrictions on the permanent right-of-way after construction. These terms can include restrictions on the construction of aboveground structures, including house additions, garages, patios, pools, or any other object not easily removable from the right-of-way, or the planting and cultivating of trees and orchards. The areas used as temporary construction right-of-way and temporary extra workspaces would be allowed to revert to pre-construction uses with no restrictions. The acquisition of an easement is a negotiable process that would be carried out between Creole Trail and individual landowners. The details and content of these agreements are beyond the scope of this EIS.

During the scoping period, a few landowners commented that they did not want a pipeline crossing their property. Two of the landowners expressed the view that private corporations should not have the right to use personal property against the wishes of the property owner. One of these objecting landowners stated that if the proposed pipeline is constructed on his property, he would want a personal tap to obtain natural gas from the pipeline. Interconnects with individual landowners along the pipeline are not feasible due to the high-pressure design of the pipeline system and the type of service the proposed facilities would provide.

The other landowner reiterated his initial objections in comments on the draft EIS. We attempted to visit this landowner's property during our July 2005 site visit but were unable to enter the property because the landowner had not granted access permission. We reviewed the route on this landowner's property from the adjacent public road and on aerial photo-based alignment sheets, and we did not identify an environmentally preferable route that would avoid the property. Further, our review indicates that realigning the route to avoid this property would likely result in similar or greater impacts on other landowners' properties. While we acknowledge these comments, it is not possible to route major pipeline facilities to avoid affecting private landowners. The Commission will consider the full record in this proceeding and will grant final authorization to Creole Trail only if it finds that the proposed project is in the public interest. If the Commission authorizes the project and the necessary easements cannot be negotiated, Creole Trail would be granted the right of eminent domain (section 7(h) of the NGA and the procedures set forth under the Federal Rules of Civic Procedure (Rule 71A)). Under these conditions, the landowner could receive compensation as determined by the courts.

We received comments from a few other landowners or tenants regarding the pipeline route on specific properties. A landowner along Segment 2, the owner-operator of Devall Enterprises, Inc., expressed concern that the pipeline route across his property would disrupt business at his barge fleet facility near the intersection of the Calcasieu Ship Channel and the Intracoastal Waterway. Mr. Devall's letter was filed before Creole Trail filed its application with the FERC and was based on preliminary routing plans. After further evaluation by Creole Trail's engineers and as subsequently proposed in Creole Trail's application, the HDD method would be used to construct the pipeline where it exits Calcasieu Lake (the Calcasieu Ship Channel is within the lake at this location) and across the Intracoastal Waterway. With the use of the HDD method at these locations and the proposed placement of the HDD staging area, pipeline construction is not expected to disrupt business at the Devall facility.

Two individuals who own land adjacent to a property crossed by Segment 2 filed comments about the pipeline route across a neighboring property where one of them grazes cattle. The commentors

expressed concern that pipeline construction would affect the natural drainage of the land, which might preclude the land from being used to graze cattle. One of these commentors requested that the pipeline be rerouted to avoid the property. During our site visit, we did not identify an environmentally preferable alternative to the proposed route. Further, as specified in our Plan, Creole Trail would be required to restore the right-of-way to pre-construction conditions, conduct post-construction monitoring, and correct drainage problems if they occur. Therefore, we do not believe that the proposed project would affect the commentor's ability to graze cattle on the property in question.

We received comments regarding the pipeline route on two other properties. Comments regarding the pipeline route on the Thomas Spears property are discussed in section 3.6.3. Comments from the Trustee for the Barnes Creek Savannah Natural Area are discussed in section 4.8.3.5.

4.8.2 Residences and Planned Residential Development

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

Temporary construction impacts on residential areas can include inconveniences caused by noise and dust generated by construction equipment, personnel, and trenching through roads or driveways; ground disturbance of lawns; removal of trees, landscaped shrubs, or other vegetative screening between residences and/or adjacent rights-of-way; potential damage to existing septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from within the right-of-way. Measures would be employed to reduce dust emissions including water application using best management practices and construction operations would be scheduled to avoid concurrent operations by larger emission sources when feasible (see section 4.11.1.4). The primary potential impact from noise would include noise generated during pile driving for installation of LNG storage tanks and other heavy loads at the LNG terminal site. See section 4.11.2 for a discussion of noise impacts.

4.8.2.1 LNG Terminal

There are no existing or planned residential developments located within 0.25 mile of the proposed LNG terminal. The closest residence is approximately 1.5 miles east of the proposed LNG terminal property boundary, across the Calcasieu Ship Channel in Cameron, Louisiana.

The project would not conflict with any approved commercial development plans; however, there are several reasonably foreseeable or planned industrial projects that have been identified along the Gulf of Mexico coast and throughout southwest Louisiana that may occur within the same time period as construction of the proposed project. Section 4.13 includes a description of these planned projects and an analysis of potential cumulative effects when considered in conjunction with the Creole Trail Project.

4.8.2.2 Pipelines

There are no planned residential developments located within 0.25 mile of the proposed pipeline routes. Creole Trail is continuing to consult with the appropriate local agencies to identify any potential plans and would file any new information resulting from these consultations with the Commission.

Prior to recent hurricane activities, 21 structures were identified within 50 feet of the proposed pipeline construction work areas based on a review of aerial photographs and field reconnaissance.

However, many homes and buildings in southwestern Louisiana were damaged by the hurricanes. Information filed by Creole Trail after the hurricanes indicates that three structures along Segment 3, including one residence (MP 7.9), a barn (MP 7.3), and a shed (MP 8.0) within 50 feet of the proposed construction work areas were destroyed. Only the barn at MP 8.0 appears to be undergoing reconstruction at this time.

Of the remaining structures, nine are residential dwellings. These residences are all located along Segment 3. No structures are located within 50 feet of the construction work area along Segment 2. Table 4.8.2-1 lists by MP the structures located within 50 feet of the construction work areas.

Creole Trail proposes to implement the following mitigation measures when working in residential areas:

- use specialized construction methods such as stovepipe and/or drag section;
- limit the duration of an open trench to the contractor's working hours for a distance of 100 feet on either side of a residence except in areas where the pipeline is within 25 feet of the residence;
- backfill the distance of 100 feet from either side of the residence immediately after the pipeline is installed;
- notify homeowners in advance of construction activities and any scheduled disruption of utilities, and minimize disruptions to the extent practicable;
- should any project-related work activity in a residential area disrupt ingress and egress to the affected area, offer to temporarily relocate the landowner to a motel and provide a meal allowance or provide alternative access to their property;
- attempt to leave any mature trees and landscaping intact within the construction work area, unless the trees and landscaping would interfere with installation techniques or present unsafe working conditions;
- segregate topsoil in the ditchline;
- restore fences, mailboxes, and other structures that are removed during construction;
- restore sidewalks, driveways, and roads as soon as practicable;
- conduct restoration in accordance with our Plan and with landowner agreements; and
- contact landowners after cleanup to ensure that conditions of all landowner agreements have been met.

TABLE 4.8.2-1

Structures Within 50 feet of the Proposed Creole Trail Pipeline Construction Work Areas

Segment/Parish	Milepost	Type	Distance from the Pipeline Centerline	Distance from the Construction Work Area [a]
Segment 2				
None				
Segment 3				
Calcasieu	2.6	Residence	95	35
Calcasieu	7.3	Structure [b]	45	10
Calcasieu	7.9	Structure	43	33
Calcasieu	7.9	Residence [b]	19	11
Calcasieu	7.9	Residence	55	45
Calcasieu	8.0	Residence	24	14
Calcasieu	8.0	Structure [b]	95	0 [c]
Calcasieu	8.0	Residence	125	11
Calcasieu	11.0	Structure	55	10
Calcasieu	12.1	Structure	105	40
Calcasieu	12.4	Structure	145	30
Allen	43.8	Residence	91	26
Jefferson Davis	48.2	Residence	31	10
Jefferson Davis	48.2	Structure	0 [c]	0 [c]
Acadia	72.1	Residence	110	30
Acadia	73.8	Structure	80	35
Acadia	79.4	Structure	55	10
Acadia	87.1	Structure	45	0 [c]
Acadia	91.2	Structure	51	26
Acadia	91.2	Residence	48	26
Acadia	91.2	Residence	128	48

[a] Distances of "0" indicate that the structure or residence is adjacent to, or within, the construction work area.

[b] Residence or structure was destroyed by recent hurricane activity. The barn at MP 8.0 is being reconstructed.

[c] Creole Trail would consult with the landowner(s) to either remove or relocate these structures.

Creole Trail has prepared site-specific construction and restoration plans for the residences within 25 feet of construction work areas. The site-specific plans illustrate the relative locations of the residences, temporary construction areas, permanent right-of-way, and other features, and specify additional mitigation measures that would be implemented during construction at these locations. However, Creole Trail has noted that the landowner at MP 48.2 on Segment 3 has not granted survey permission; therefore, the site-specific plan for this residence may be adjusted once such permission is obtained. In addition, we believe that Creole Trail should provide evidence of landowner concurrence of the site-specific plans where the construction work areas would be within 10 feet of a residence. Therefore, **we recommend that**:

- **Creole Trail file:**

  a. an updated site-specific plan (or reconfirmation of the current site-specific plan, if no changes are deemed necessary) for the residence at MP 48.2 on Segment 3 once access to the property becomes available, and

  b. evidence of landowner concurrence if the construction work area and fencing would be located within 10 feet of a residence.

Creole Trail should file the above information with the Secretary, for review and written approval by the Director of OEP, prior to beginning construction of the pipeline system.

4.8.3 Public Interest and Recreation Areas

Table 4.8.3-1 lists the recreational and special interest areas within 0.25 mile of the proposed Creole Trail Project. One special interest area, the Creole Nature Trail National Scenic Byway, is located within 0.25 mile of the proposed LNG terminal location. The other recreational or special interest areas would be located within 0.25 mile of the proposed pipeline routes. The Creole Nature Trail National Scenic Byway, Barnes Creek Savannah Natural Area, Barnes Creek Natural and Scenic River, Calcasieu River Natural and Scenic River, and the Zydeco Cajun Prairie Scenic Byway would each be crossed once by a pipeline segment. The remaining areas would occur within 0.25 mile of the pipeline routes but would not be directly affected by construction work areas.

TABLE 4.8.3-1

Recreational and Public Interest Areas Within 0.25 mile of the Proposed Creole Trail Project

Facility/Parish	Milepost	Name of Resource	Distance and Direction from Project [a]
LNG Terminal			
Cameron	N/A	Creole Nature Trail National Scenic Byway	800 feet South
Segment 2			
Cameron	23.1	Creole Nature Trail National Scenic Byway	0
Cameron	1.0 to 3.0	Cameron Prairie National Wildlife Refuge	1,300 East
Segment 3			
Calcasieu	20.6 to 21.7	Crown Point Distinctive Site	1,000 to 2,000 feet West
Allen	36.1 to 36.5	Barnes Creek Savannah Natural Area	0
Allen	38.6	Barnes Creek Natural and Scenic River	0
Allen	42.4	Calcasieu River Natural and Scenic River	0
Acadia	82.3	Zydeco Cajun Prairie Scenic Byway	0

[a] A distance of "0" indicates that the area is crossed by the proposed pipeline right-of-way.

4.8.3.1 Creole Nature Trail National Scenic Byway

In the project area, the Creole Nature Trail National Scenic Byway is the same as State Highway 27/82. The Creole Nature Trail National Scenic Byway is a driving trail that takes visitors through three different wildlife refuges and a bird sanctuary. The road passes south of the proposed LNG terminal location and intersects with the construction access road to the site. Impacts on the Creole Nature Trail National Scenic Byway as result of LNG terminal construction would be limited to increased construction-related vehicular traffic (see section 4.9.5) and the visual impacts discussed in section 4.8.5. Operation of the LNG terminal would not affect the Creole Nature Trail National Scenic Byway given the relatively small number of permanent workers' vehicles that would commute to the LNG terminal on a daily basis.

The Creole Nature Trail National Scenic Byway would also be crossed by pipeline Segment 2 at MP 23.1. Creole Trail would conduct a road bore across State Highway 27/82, which would not require road closures or open cutting the roadway (see section 2.3.2). Impacts would be further limited to potential short-term traffic disruptions associated with the construction equipment and personnel during

construction at these locations. Creole Trail would be required to maintain safe and accessible conditions at road crossings in accordance with our Plan.

4.8.3.2 Cameron National Wildlife Refuge

The Cameron Prairie National Wildlife Refuge (CPNWR) is less than 0.25 mile from pipeline Segment 2 between approximate MPs 1.0 and 3.0. The CPNWR would not be crossed by the pipeline route and would not be directly affected by the project. The CPNWR is a 9,621-acre site managed by the FWS for migratory waterfowl and other birds. The management objectives of the refuge include providing the highest quality wintering waterfowl habitat possible; providing for the needs of endangered plants and animals; allowing for compatible public uses such as hunting, fishing, trapping, wildlife observation, and photography; and promoting research on marsh and aquatic wildlife. The refuge provides excellent habitat for native wildlife including alligators, furbearers, white-tailed deer, as well as numerous migratory birds throughout the year, and hunting (e.g., snipe, waterfowl, deer) is allowed primarily in the fall winter months. Recreational and educational activities are also encouraged within the CPNWR and approximately 28,000 people visit the area each year. During construction in the vicinity of this area, noise from construction activities may disturb wildlife and hunting activities; however impacts on this area are expected to be short term and minor. Construction and operation of the LNG terminal and pipeline facilities would have no direct impact on the refuge.

4.8.3.3 Crown Point Distinctive Site

The Crown Point Distinctive Site is located on property owned and managed by Temple-Inland, a forest products company that manages pine plantations for commercial timber harvest. The site consists of high-quality vegetation communities and was identified by the FWS during its review of the Creole Trail Project as an area that should be avoided if possible (see section 4.5.2). The Crown Point Distinctive Site is less than 0.25 mile from Segment 3 between approximate MPs 20.6 and 21.7. The nearest point of construction to the Crown Point Distinctive Site would be about 1,000 feet from MP 21.5. Construction and operation of the LNG terminal and pipeline facilities would not affect this site.

4.8.3.4 Louisiana Great Gulf Coast Birding Trail

The Louisiana Department of Transportation is currently developing the Louisiana Great Gulf Coast Birding Trail. However, the exact roads and routes of the trail have not yet been designated or mapped along any of the proposed pipeline segments; therefore, the potential impacts of the proposed project on the trail cannot be assessed at this time.

4.8.3.5 Barnes Creek Savannah Natural Area

Segment 3 would cross the Barnes Creek Savannah Natural Area between MPs 36.1 and 36.5. The Barnes Creek Savannah Natural Area has been designated under the Louisiana Natural Areas Registry Program by the LADWF and the landowner. This program is designed to honor and recognize landowners with significant natural areas for their commitment to preservation of these resources. The agreement between the landowner and the LADWF is not binding and can be dissolved with a 30-day notice of disturbance to the property. The Barnes Creek Savannah Natural Area qualifies under the program because the property contains longleaf savannah with diverse communities of grasses which support rare plants and animals.

In a scoping comment letter, the Trustee for the Barnes Creek Savannah Natural Area expressed concern regarding the potential impact of the proposed pipeline on the area, and requested that the proposed pipeline be rerouted to an existing right-of-way north of the area. In response to our request for

additional information, Creole Trail provided a copy of a contact report between its land agent and the trustee of the natural area that indicates the trustee's letter was based on a misunderstanding of where the proposed pipeline route would cross this property. Creole Trail also explained that the proposed route intentionally deviates from the existing right-of-way referenced in the scoping letter due to the presence of numerous buildings and ponds on both sides of the existing right-of-way. In reviewing maps of the natural area, we found that Creole Trail's proposed right-of-way does parallel an existing right-of-way through a portion of the natural area, and that the proposed deviation from the existing right-of-way would actually avoid an additional, smaller portion of the natural area. Based on our review of the proposed route, the existing right-of-way, and the contact report provided by Creole Trail, we believe that the proposed route through the natural area is reasonable and would minimize impacts on this resource (also see section 3.6.2.2 for a discussion of an alternative route considered for this area).

4.8.3.6 Natural and Scenic Rivers

Segment 3 of the proposed pipeline would cross two waterbodies, Barnes Creek and the Calcasieu River, that have been designated by the LADWF as Natural and Scenic Rivers at the proposed crossing locations. The Louisiana Natural and Scenic Rivers System was established to preserve, protect, develop, reclaim, and enhance the wilderness qualities, scenic beauty, and ecological regime of certain streams or segments thereof. The program is also intended to preserve aesthetic, scenic, recreational, ecological, and other natural and physical features and resources found along these streams or segments thereof (LADWF, 2005e).

Barnes Creek would be crossed by Segment 3 at approximate MP 38.6. The Calcasieu River would be crossed by Segment 3 at approximate MP 42.4. To minimize impacts on Barnes Creek and the Calcasieu River, Creole Trail has committed to crossing these waterbodies using the HDD construction technique which would preclude the need to disturb the stream bottom or banks. In addition, Creole Trail would not clear trees or other vegetation between the HDD drill entry and exit points during pipeline operation.

4.8.3.7 Zydeco Cajun Prairie Scenic Byway

The Zydeco Cajun Prairie Scenic Byway would be crossed by pipeline Segment 3 at approximate MP 82.3. The Zydeco Cajun Prairie Scenic Byway is a driving tour that traverses small towns, historic places, picturesque landscapes, recreational areas, and agricultural lands within rural Louisiana. Impacts on this roadway would be similar to those impacts associated with the Creole Nature Trail National Scenic Byway. Creole Trail would use the road bore technique to cross the Zydeco Cajun Prairie Scenic Byway, which would minimize impacts on the road and its users. The proposed crossing location would be among agricultural fields with no known unique features.

4.8.3.8 Other Special Interest Areas

The remaining features identified in table 4.8.3-1 would not be directly affected by construction or operation of the proposed project. The church located near MP 87.0 of Segment 3 would not be directly affected, as the church and the associated parking lot are located on White Oak Road, approximately 725 feet north of the proposed crossing of White Oak Road. The radio towers, cemeteries, and compressor station are located a sufficient distance from construction work areas such that impacts would be limited to the typical short-term noise and visual impacts associated with pipeline construction. Visual impacts and noise-related impacts are discussed in sections 4.8.5 and 4.11.2, respectively.

We received scoping comments from the Cameron Preservation Alliance (CPA), which is the steward of the Sabine Pass Lighthouse (located on the Louisiana side of Sabine Pass), in support of the

project. The CPA noted that Creole Trail's mitigation, restoration, and maintenance measures would generally enhance the project area in Cameron Parish for recreational users such as birdwatchers.

4.8.4 Commercial and Recreational Fishing

Construction and operation of the proposed LNG terminal would have minimal impacts on commercial and recreational fishing in the project area. The greatest potential impact on fishing would be associated with the arrival, unloading, and departure of LNG ships calling on the LNG terminal during operations. The Coast Guard would likely impose a moving safety and/or security zone around the LNG vessels while en route and during unloading operations, which could temporarily restrict the movements of commercial or recreational fishing boats. However, fishing boats and pleasure craft would likely be concentrated on the outside of the Calcasieu Ship Channel entrance jetties and would not likely be present in significant numbers within the channel between the jetties and the proposed Creole Trail LNG terminal.

Construction of the proposed pipelines in Calcasieu Lake would temporarily affect commercial and recreational fishing boats in the vicinity of the construction work areas. See section 4.6.2.2 for additional information about the potential impacts of construction in Calcasieu Lake on recreational and commercial fisheries and proposed mitigation measures.

4.8.5 Visual Resources

The degree of visual impact that may result from a proposed project is typically determined by considering the general character of the existing landscape and the visually prominent features of the proposed facilities. The proposed LNG terminal would be constructed in a rural area in Cameron Parish. The closest community, located southeast of the site, would be the community of Cameron, Louisiana.

Visual sensitivity of the proposed LNG terminal site is considered to be low because there are no residences, recreational areas (other than the Creole Nature Trail National Scenic Byway, which is a state highway), or sensitive land uses nearby. The LNG terminal would be located adjacent to the Calcasieu Ship Channel, an area with existing gas and oil related facilities, commercial fishing operations, ferry services, and other industrial activities. Marine developments, including docks and associated shipping traffic, are commonly seen in the vicinity of the ship channel.

During construction of the LNG terminal, temporary facilities (e.g., offices and warehouses), larger construction equipment, and cargo and crane barges would be visible at the LNG terminal site. These visual impacts would be limited to the duration of construction.

During operation of the LNG terminal, the most prominent visual feature at the site would be the four 180-foot-tall LNG storage tanks. The LNG processing facilities would consist of structures of a lower profile. The marine basin would involve converting open land to open water with LNG ship berths and LNG offloading facilities, which would change the existing visual character of this portion of the site, but the marine facilities would also be lower in profile than the LNG storage tanks. Exterior lighting at the LNG terminal would be visible from a distance at night.

Points from which the public might have a view of the LNG terminal include public boat ramps, public roadways, boat yards, and the Calcasieu Ship Channel. Boaters on Calcasieu Lake would also have a view of the LNG storage tanks. The LNG terminal would be most visible to users of the Calcasieu Ship Channel and from areas adjacent to the channel in the vicinity of the site. The shoreline along the Calcasieu Ship Channel within miles in both directions is largely wetlands, dredged material storage, and developed land. Large structures such as the LNG storage tanks might also be visible from the

community of Cameron, although it is located about 1.5 miles from the site and views from that point would be partly obscured by existing industrial and commercial facilities on the east side of the ship channel.

Motorists on State Highway 27/82 would have a view of the LNG storage tanks, especially when waiting for Cameron ferry service. The LNG storage tanks would be located approximately 0.5 mile north of the roadway, which is also the Creole Nature Trail National Scenic Byway. There are no federal or state regulations that protect the viewshed of the Creole Nature Trail National Scenic Byway. The Corridor Management Plan describes the viewshed as being a 0.5-mile radius on either side of the roadway, except where the viewing is limited by trees or levees (Creole Nature Trail, Undated). The LNG tanks and marine basin would be within this radius.

Based on the LNG facility location, the generally low topographic relief, and lack of comparably sized facilities in the immediate vicinity, the proposed LNG facilities would dominate the area viewshed and result in permanent changes to the surrounding visual landscape. Because of flat terrain and limited potential for screening, the visual impacts associated with the LNG terminal would be unavoidable. Due to the size of the facilities, no measures can be taken to visually screen them. However, due to the rural nature of the area, visual impacts of the facility are not expected to cause a significant disturbance. We also note that several Cameron public officials and local organizations have expressed support of the Creole Trail Project through scoping comments and resolutions.

Visual impacts would also occur as a result of the arrival, unloading, and departure of LNG ships calling on the proposed facility. Creole Trail anticipates that approximately 300 to 400 LNG ships would arrive at the proposed facility each year. Ships transiting the Calcasieu Ship Channel are a frequent occurrence and an expected element in the viewshed. Based on review of aerial photographs, USGS topographic maps, and state maps, there are no known special interest or visually sensitive areas that exist along the portion of the Calcasieu Ship Channel that would be used by LNG ships calling on the proposed facility, and the location of the proposed berthing facilities approximately 3 miles from the Gulf of Mexico would minimize the transit time and distance up the Calcasieu Ship Channel. Further, LNG ships similar in size to those proposed to call on the Creole Trail facility currently use the Calcasieu Ship Channel to reach the Port of Lake Charles. The Trunkline facility receiving these LNG ships has been operating for over 20 years. Therefore, the presence of LNG ships in the area would not be unique to area residents.

Construction and operation of the proposed pipelines may affect visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and as a result of the presence of new aboveground facilities. The land uses along the pipeline routes are primarily agricultural, open water, or open land. The landscape setting along the proposed pipeline routes is generally flat, and views of pipeline construction activities may extend for some distance. As noted previously, the proposed pipeline routes would cross two scenic areas, the Creole Nature Trail National Scenic Byway along Segment 2 and Zydeco Cajun Prairie Scenic Byway along Segment 3. The visual impact on these public viewpoints would be short term, with the most noticeable impacts occurring during construction. Minor impacts would occur for a period after construction until vegetation becomes reestablished. Following pipeline construction, disturbed areas would be restored to pre-construction contours, revegetated in accordance with our Plan and Procedures or other applicable regulatory or landowner requirements, and or revert to pre-construction use. Therefore, at most locations along the pipeline rights-of-way there would be no significant alteration of the landscape following construction.

Construction and operation of the proposed aboveground facilities would result in minor permanent visual impacts. The aboveground facilities at MP 0.0 of Segment 2 would be located within the LNG terminal among similar facilities. Therefore, there would be no additional visual impact from

these facilities. The aboveground facilities along the pipeline segments would be permanent but minor visual elements within the existing and mostly rural agricultural, open, or forested landscapes.

4.8.6 Coastal Zone Management

Portions of the project would be located within designated coastal zone management areas (i.e., the LNG terminal and about 19 miles of Segment 2). In addition, as discussed in section 2.2.3.2, the LADWF filed comments stating that it has a Memorandum of Understanding with the LADNR Coastal Management Division under which a permit issued by the LADNR for operations within Lake Calcasieu would include the LADWF's requirements related to construction within the lake.

The CZMP is administered in Louisiana by the Coastal Management Division of the LADNR. Creole Trail submitted a Coastal Use Permit application to the Coastal Management Division on October 10, 2005 concurrent with its COE section 404 permit application. Creole Trail filed a supplement to its application on February 24, 2006.

Determinations from the LADNR that the project is consistent with the laws and rules of CZMP must be received before we issue a notice to proceed. Therefore, **we recommend that:**

- **Creole Trail not begin construction of any facilities associated with the Creole Trail Project until it files with the Secretary a copy of the CZMP consistency determination issued by the LADNR.**

4.8.7 Hazardous Waste Sites

Based on a hazardous material environmental data search, there are no hazardous waste treatment, storage, or disposal sites that are covered by the Resource Conservation and Recovery Act or any other types of waste management sites located within 0.25 mile of the proposed LNG terminal or pipeline Segment 2. However, five hazardous waste sites were identified within 0.25 mile of the construction work areas along Segment 3. Table 4.8.7-1 lists the facilities and locations along pipeline Segment 3 known to be hazardous waste sites.

TABLE 4.8.7-1

Hazardous Waste Sites Within 0.25 Mile of Segment 3 of the Proposed Creole Trail Pipeline

Facility Type	Facility/Owner	Parish	Milepost	Distance from Construction Work Area (feet)	Direction
Large Quantity Generator	Westlake Petrochemicals L.P. – Poly I	Calcasieu	0.4	333	WSW
Small Quantity Generator	Tennessee Gas Pipeline 823	Jefferson Davis	49.8	425	SSE
Very Small Quantity Generator	Florida Gas Transmission Compressor Station 7	Acadia	71.6	197	NNW
Small Quantity Generator	Columbia Gulf Transmission Company	Acadia	91.3	40	S
Small Quantity Generator	Rayne Dot Pumping Station	Acadia	91.5	755	SSE

Of the sites listed in table 4.8.7-1, the Florida Gas Transmission Compressor Station 7 at MP 71.6 and the Columbia Gulf Transmission Company facility at MP 91.3 appear to be the most likely to be encountered during construction based on their distance to the construction work area. Creole Trail has committed to coordinating with landowners and operators of these facilities to ensure that these facilities

are not affected by pipeline construction or operation. Because contamination associated with hazardous waste sites could be encountered during pipeline trenching and other excavation activities, we recommended in section 4.2.1 that Creole Trail develop a Plan for the Discovery and Management of Contaminated Soils and Groundwater.

4.9 SOCIOECONOMIC RESOURCES

Socioeconomic effects that may result from construction and operation of the proposed Creole Trail Project include those related to construction and the number of local and non-local construction workers who would work on the project, their income and local expenditures, and their impact on population, public services, and temporary housing during the construction period. Other potential effects related to construction include local construction expenditures by Creole Trail. Potential economic benefits associated with operation of the project include increased property tax revenue, increased job opportunities and income, and ongoing local expenditures by Creole Trail. A discussion of the effects of the proposed project on the local[5] population, employment, economy, housing, public services, and transportation is provided below.

The data for this EIS was collected before Hurricane Rita devastated the project area on September 24, 2005 and the EIS was written before the full economic and social effects of the hurricane were completely cataloged. Accordingly, our analysis is based on the assumption that recovery and rebuilding efforts will restore the project area to approximate pre-Hurricane Rita conditions.

4.9.1 Population

The proposed LNG terminal would be located in Cameron Parish, Louisiana. The proposed pipeline facilities would be constructed in Cameron, Calcasieu, Beauregard, Jefferson Davis, Allen, and Acadia Parishes, Louisiana. Table 4.9.1-1 describes the population characteristics of the project area.

TABLE 4.9.1-1

Population Conditions in the Vicinity of the Proposed Creole Trail Project

State/	Population			Population Density [a]	
Parish	1990	2000	Percent Change	1990	2000
Louisiana	4,219,973	4,468,976	5.6	96.9	102.6
Cameron Parish	9,260	9,991	7.3	7.0	7.6
Calcasieu Parish	168,134	183,577	8.5	157.0	171.4
Beauregard Parish	30,083	32,986	8.8	25.9	28.4
Jefferson Davis Parish	30,722	31,435	2.3	47.1	48.2
Allen Parish	21,226	25,440	16.6	27.8	33.3
Acadia Parish	55,882	58,861	5.1	85.3	89.8

[a] Persons per square mile, based on population and area size.

Source: U.S. Census Bureau, 2000.

Cameron Parish is the most sparsely populated parish in the project area, with only 7.6 persons per square mile in 2000. The population of Cameron Parish was also the smallest (9,991) of the affected parishes. Calcasieu Parish had the highest population in 2000, with 183,577 persons, as well as the highest population density (171.4 persons per square mile). The population growth rates for most of the parishes within the project area were higher than the average Louisiana growth rate of 5.6 percent.

Population impacts of the proposed project would be associated with the influx of non-local personnel for construction (temporary) and operation (permanent) of the proposed facilities. As discussed

[5] For the purposes of this report, "local" refers to the parishes directly affected by the LNG terminal and pipeline facilities, with the exception of the local payroll costs discussion, which refers to the entire State of Louisiana.

further in section 4.9.2, Creole Trail expects to use a predominantly local workforce, which would reduce the number of people that would relocate to the area as a result of the project.

Creole Trail anticipates that construction of the LNG terminal would take approximately 36 to 42 months and would require an average monthly workforce of 390, including construction, administrative, and support personnel. The workforce would peak to a monthly average of about 610 workers during months 20 through 24 of the construction schedule. Based on previous contractor experience, it is anticipated that about 39 percent of the construction workforce would be non-local workers who would relocate to the project area temporarily. Given the duration of the terminal construction process, some of these workers might be accompanied by their families. Based on the average monthly workforce of 390 and applying the U.S. Census Bureau's 2000 statistic of 2.6 persons per Louisiana household, approximately 152 families comprising up to 395 people might relocate to the project area temporarily during construction of the LNG terminal. Given the small population of Cameron Parish, this approximately 4 percent increase might be noticeable if most or all of the temporary workers elected to live within the parish, but would not likely result in adverse impacts. To the extent that the non-local workers live in nearby Calcasieu Parish, the population increase would be insignificant. Potential impacts of the temporary population increase with respect to the local economy, housing, and public services are discussed in the following sections. Creole Trail anticipates hiring up to 85 full-time employees for operation of the LNG terminal and up to 8 full-time employees for facility maintenance. Only about 20 percent of these permanent employees (up to 19) are anticipated to be non-local. Therefore, operation of LNG terminal would not have a significant impact on the population.

Construction of the pipeline facilities would take approximately 5 to 6 months, followed by about a year of mitigation and cleanup activities. Construction would be conducted in four spreads, with the average number of workers per spread ranging from 300 to 400. Creole Trail anticipates that the total workforce for the first year of pipeline construction would be approximately 2,125, and the workforce during the second year (clean-up and restoration) would be about 605.[6] It is estimated that 50 percent of the workforce for pipeline construction would be non-local hires. Therefore, the temporary non-local workforce would be approximately 1,063 during the first year and 303 during the second year. Again using the 2.6 per household estimate, the maximum resulting population increases including family members could be about 2,764 and 788 during the first and second years, respectively. However, given the relatively short duration of pipeline construction activities, it is expected that most of the pipeline construction workers would not be accompanied by their families. In addition, because the pipeline facilities are spread over six parishes, any associated population increases would also likely be spread across the project area, which would reduce the impact in any particular community. Creole Trail would hire 10 permanent employees for operation and maintenance of the proposed pipeline facilities. Even if all of these positions were filled by non-local persons, they are not expected to have a significant impact on the population.

In scoping comments, the EPA indicated that the EIS should consider potential environmental impacts of the project on minority and low-income communities. An analysis of the project area by census block group (the smallest unit of classification assigned by the U.S. Census Bureau) indicates that the only area with a high minority population occurs in Allen Parish between MP 50.1 and MP 55.1 of pipeline Segment 3. This census block group has a minority population of approximately 33 percent, which is greater than the Allen Parish level of approximately 28 percent. However, only 16 percent of this census block group's population is living below the poverty level, which is less than the state average of 19.6 percent. Further, there are no residences located within 50 feet of the construction work area

[6] Creole Trail did not file revised estimates for the construction workforce after withdrawing the Hackberry Lateral from the project. However, because the Hackberry Lateral represented only a small portion of the total proposed pipeline construction, the original construction workforce estimates are considered sufficient for this discussion.

between MPs 50.1 and 55.1 of Segment 3. In addition, project-related impacts within this area would not differ from impacts at other locations along the pipeline rights-of-way. Based on our analysis, we have not identified any disproportionately high and adverse human health or environmental effects on minority and low-income communities or Native American groups.

4.9.2 Employment and Economy

All of the parishes in the project area, with the exception of Calcasieu Parish, had per capita incomes that were lower than the state per capita income of $16,912 in 1999 (see table 4.9.2-1). In 1999, the per capita income for the parishes in which the project would be located ranged from $17,710 in Calcasieu Parish to $13,101 in Allen Parish. Calcasieu Parish had the greatest civilian labor force at 85,325, while Cameron Parish had the smallest at 4,384. Unemployment rates in two of the parishes (Jefferson Davis and Allen) were equal to, or greater than, the state average of 7.3 percent, while the remaining parishes had unemployment rates lower than the state average. Generally, the major industry in the project area is educational, health, and social services. However, industry in Cameron Parish relies heavily on agriculture (timber, beef, and rice production), forestry, fishing, and hunting, which may be due to the fact that Cameron Parish is sparsely populated, lacks a significant population center, and is coastal.

TABLE 4.9.2-1

Employment Conditions in the Vicinity of the Proposed Creole Trail Project

State/ Parish	Per Capita Income 1999	Civilian Labor Force 2000	Unemployment Rate (percent)[a] 2000	Top Employment Industry 2000
Louisiana	$16,912	1,997,995	7.3	Educational, health, and social services
Cameron Parish	$15,348	4,384	4.6	Agriculture, forestry, fishing and hunting, and mining
Calcasieu Parish	$17,710	85,325	6.9	Educational, health, and social services
Beauregard Parish	$15,514	13,737	7.2	Educational, health, and social services
Jefferson Davis Parish	$13,398	12,597	7.9	Educational, health, and social services
Allen Parish	$13,101	8,622	7.3	Educational, health, and social services
Acadia Parish	$13,424	23,158	7.1	Educational, health, and social services

[a] Percentage based on civilian labor force, not total population.

Source: U.S. Census Bureau, 2000.

As noted in section 4.9.1, Creole Trail anticipates that an average of approximately 390 workers per month would be required during construction of the LNG terminal, with a peak workforce of 610. Construction of the pipeline segments would require approximately 2,125 workers, and approximately 605 workers would be required during clean-up and restoration. Creole Trail would attempt to hire local workers when possible. The actual number of local workers hired would depend on the type of contractors awarded the construction contracts (i.e., local or out-of-state, union versus non-union) and the availability of local workers possessing the necessary skills. It is estimated that about 61 percent of the construction workforce for the LNG terminal and about 50 percent of the construction workforce for the pipeline would be local hires from within about 50 miles of the project area. Non-local hires for construction of the LNG terminal are expected to include highly skilled mechanical, electrical, and instrumentation and control tradesmen.

Assuming the 61 percent local hire rate and based on the anticipated workforce size, construction of the LNG terminal would result in about 238 temporary jobs in the project area. Given the relatively

small civilian labor force in Cameron Parish, these additional jobs could have a significant positive impact in the vicinity of the LNG terminal during the 3 to 4 year construction period, particularly if most of the employees are residents of Cameron Parish. Assuming a 50 percent local hiring rate, construction of the pipeline facilities would result in about 1,063 and 303 temporary jobs for the local workforce in and around the parishes crossed by the pipeline routes for the first and second years, respectively; however, these jobs would be shorter term than those associated with the LNG terminal. In summary, although temporary, the impacts of project construction on employment would be beneficial as the local hires would most likely come from the unemployed workforce.

Creole Trail anticipates that the operation and maintenance of the LNG terminal would require between 76 and 93 full-time positions. Approximately 80 percent of the permanent positions that would be required for the LNG terminal are expected to be filled by the local workforce (Cameron Parish), resulting in 61 to 74 new permanent jobs to be filled locally. While this is not a large number of new jobs when viewed from a state perspective, it could have a noticeable impact relative to the total Cameron Parish civil workforce (4,384) and the percent of that workforce that is currently unemployed (4.6). Pipeline operations would require an additional 10 full-time positions. This small number of positions would have a minimal impact on employment.

Creole Trail anticipates that construction payroll costs associated with the proposed LNG terminal would be approximately $87 million or about $2.1 per month. In addition, Creole Trail would purchase many construction materials for the terminal locally and anticipates that expenditures for these materials would be approximately $6 million, of which about $1 million would be spent in Cameron Parish and the remainder in other nearby communities. Payroll costs for the construction of the pipeline segments are anticipated to be $22.1 million. Sales taxes anticipated to be generated from construction material purchases for the pipeline facilities are described in section 4.9.6.

Construction-related payroll and material expenditures would temporarily benefit the local economies. In addition to the direct benefits, some portion of the construction payroll would be spent locally for the purchase of housing, food, gasoline, entertainment, and luxury items. Indirect sales, jobs, and salaries could also be created in new or existing businesses and organizations that would supply goods and services to the project and the project's employees. While most of these economic benefits would be temporary, the U.S. Department of Commerce estimates that an additional 1.05 support positions would be created in the region for each full-time position at the LNG terminal. Based on this multiplier, up to 98 support positions could be created in the region.

Tax revenues associated with the construction and operation of the proposed facilities are discussed in section 4.9.6.

4.9.3 Housing

Housing statistics for Louisiana and the six parishes in which the project would be located are provided in tables 4.9.3-1 and 4.9.3-2. Table 4.9.3-1 presents an overview of the total housing units, including occupied and unoccupied units, median monthly rent rates, and the rental vacancy rates. Table 4.9.3-2 is a subset of the total unoccupied units listed in table 4.9.3-1 and breaks out the number of accommodations that are for rent, sale, or temporary (e.g., seasonal) use.

TABLE 4.9.3-1

General Housing Conditions in the Vicinity of the Proposed Creole Trail Project

State/ Parish	Total Housing Units	Total Occupied Units	Total Occupied Rental Units	Total Unoccupied Units [a]	Median Monthly Rent	Rental Vacancy Rate (percent)
Louisiana	1,847,181	1,656,053	530,918	191,128	$466	9.3
Cameron	5,336	3,592	536	1,744	$412	18.4
Calcasieu	75,995	68,613	19,507	7,382	$465	14.1
Beauregard	14,501	12,104	2,443	2,397	$383	14.0
Jefferson Davis	12,842	11,480	2,883	1,344	$353	9.9
Allen	9,157	8,102	1,940	1,055	$350	12.0
Acadia	23,209	21,142	5,882	2,067	$332	9.9

[a] Includes units for rent, for sale, rented or sold but not occupied, available for seasonal, recreational, or migratory use, or other vacant status.

Source: U.S. Census Bureau, 2000.

TABLE 4.9.3-2

Unoccupied Housing Characteristics in the Vicinity of the Creole Trail Project

State/ Parish	Vacant Rental Units	Units for Sale	Units Rented or Sold, Not Occupied	Vacant for Seasonal, Recreational, or Occasional Use	Vacant for Migrant Workers	Other Vacant
Louisiana	54,185	18,097	18,144	39,578	525	60,599
Cameron	121	52	57	1,331	0	183
Calcasieu	3,191	849	607	684	27	2,024
Beauregard	398	249	181	802	2	765
Jefferson Davis	317	210	189	223	8	397
Allen	265	100	105	248	0	337
Acadia	648	177	142	243	12	845

Source: U.S. Census Bureau, 2000, General Housing Characteristics.

There were about 141,000 total housing units in the project area in 2000, of which 75,995 were located in Calcasieu Parish (see table 4.9.3-1). Cameron Parish had the smallest number of housing units (5,336) and the highest rental vacancy rate (18.4 percent) in the project area. All six parishes in the project area had rental vacancy rates that exceeded Louisiana's rental vacancy rate of 9.3 percent in 2000. Median monthly rent in the project area is generally less than the median monthly rent in Louisiana. Acadia Parish had the lowest median monthly rent at $332, and Calcasieu Parish had the highest median monthly rent of $465. Calcasieu Parish had the greatest total number of unoccupied housing units (7,382) (see table 4.9.3-2) in 2000. Unoccupied units in the other parishes ranged from 1,055 (Allen Parish) to 2,397 (Beauregard Parish).

As discussed above, about 39 percent of the construction workforce for the LNG terminal is expected to consist of non-local workers who would relocate to the project area temporarily. Applying that percentage to a monthly average workforce of 390 and a peak workforce of 610, about 152 to 238 individuals or families could potentially move into the project area and need housing for part or all of the construction period, which could be as long as 36 to 42 months. These workers or families would likely seek unoccupied rental units or units for sale. The number of unoccupied units in Cameron Parish, where the LNG terminal would be constructed, was 1,744, of which 121 units were vacant rental units, 52 units were for sale, and 1,331 units were available for seasonal, recreational, or occasional use. Before

Hurricane Rita, Cameron Parish would have been able to accommodate the temporary construction workers who prefer to live in this parish. Nearby communities in Calcasieu Parish (e.g., Sulphur, Lake Charles) also had more than a sufficient number of rental units (3,191) and units for sale (849) to accommodate the peak workforce for the LNG terminal. Accommodating temporary construction workers is likely to be a regional priority for several years.

Creole Trail anticipates hiring up to 93 permanent full-time employees for operation and maintenance of the LNG terminal. About 20 percent of these permanent employees (up to 19) are anticipated to be non-local. Were all of the non-local permanent workers to choose to reside near the LNG terminal in Cameron Parish, a moderate impact on housing in Cameron Parish would result. This might provide additional impetus to rebuilding in this sparsely populated area.

The potential influx of 1,063 and 303 temporary workers during the first and second years of pipeline construction, respectively, could have a significant impact on the rental vacancy rates and available housing units in smaller communities such as Cameron and Hackberry in Cameron Parish (Segment 2) and Kinder in Allen Parish (Segment 3). However, because the pipeline facilities would be divided into four construction spreads, the workforce would be distributed geographically throughout the project area and would have access to larger population centers such as Lake Charles and Sulphur. Given the relatively short pipeline construction period, most workers would likely prefer temporary quarters such as hotels/motels, apartment units, and campgrounds. In addition, previous pipeline project experience indicates that about 30 percent of non-local construction workers would provide their own housing (e.g., trailers, campers). We believe that the non-local workforce associated with construction of the pipeline facilities would not unduly burden the local supply of temporary housing. Because only 10 permanent employees would be required for operation and maintenance of the pipeline facilities, no long-term impacts on housing are anticipated.

The project construction schedule could coincide with other demands for temporary housing and accommodations from rebuilding efforts, other unrelated construction projects, and travel. We assume that facilities available within the project area would be sufficient to accommodate the expected non-local workforce.

4.9.4 Infrastructure and Public Services

The majority of the project area is sparsely populated and relies on nearby population centers for public services and infrastructure. However, the entire project area is covered by emergency "911" service, and the cities of Sulphur, Lake Charles, and Lafayette have historically had a wide array of public services and infrastructure to support the project.

The LNG terminal and most of pipeline Segment 2 would be located within Cameron Parish. Cameron Parish is governed by the Cameron Parish Police Jury, which has adopted a resolution in support of the Creole Trail LNG Project. The Cameron Parish Police Jury has about 100 employees and is responsible for fire protection, hospitals, ambulance services, health units, the construction and operation of roads, and several other public and social services. The facilities for which the Cameron Parish Police Jury is responsible include but are not limited to 11 fire stations, 6 water districts, 2 hospitals, and 1 health unit (Cameron Parish Police Jury, 2005). The South Cameron Memorial Hospital in Cameron would be the closest medical facility to the LNG terminal and has 33 beds (U.S. News-Directory of American Hospitals, 2005). Law enforcement in Cameron Parish is provided by the Cameron Parish Sheriff's Department in Cameron and by the Louisiana State Police in Lake Charles. Other local emergency services include the Cameron Volunteer Fire Department, District 1 and the Holly Beach and Johnson's Bayou Volunteer Fire Department, District 10.

Calcasieu Parish, which includes the communities of Sulphur, Lake Charles, Moss Bluff, and DeQuincy, has historically had a well developed infrastructure to provide health, police, fire, emergency, and social services. Much of the project area, including the LNG terminal, pipeline Segment 2, and a significant portion of Segment 3 is in close proximity to Calcasieu Parish and would have access to these services. Medical facilities in Calcasieu Parish include 9 hospitals with a total of 902 beds (Louisiana Department of Health and Hospitals, 2005; U.S. News-Directory of American Hospitals, 2005). Law enforcement and fire protection is provided by 1 sheriff's office, 6 police departments, and 9 fire protection districts (Cameron Parish Sheriff's Office, 2005; Cameron Parish Police Jury, 2005).

To the extent that non-local workers are accompanied by their families, which is more likely to be the case for workers at the LNG terminal than for those working on the pipeline facilities, public schools in Cameron or Calcasieu Parish may be affected by construction and/or operation of the LNG terminal. There are six public schools in Cameron Parish that had 1,979 students enrolled in 2000 and Calcasieu Parish has 59 public schools that had 34,609 students enrolled in 2000 (U.S. Census Bureau, 2000). The population resulting from construction of the LNG terminal would only slightly increase student enrollment and any associated government expenditures. We note that during the scoping period, we received comments from the Cameron Parish School Board in support of the project.

The additional parishes affected by the project, including Beauregard, Allen, Jefferson Davis, and Acadia Parishes, are crossed by pipeline Segment 3. Although the route through these parishes crosses primarily rural areas, it is generally within easy access from Interstate 10, and is within close proximity to several communities that offer medical, emergency, law enforcement, and fire protection services. Hospitals, ambulance, and law enforcement services in these parishes are located in the communities of DeRidder, Kinder, Jennings, and Crowley, Louisiana. Law enforcement and/or fire departments are also located in Ragley, Reeves, Rayne, Elton, Basile, Eunice, and Iota, Louisiana. Medical and other emergency and social services are also available in Lafayette, Louisiana, which is approximately 18 miles from the terminus of Segment 3 at the east end of the project.

Construction and operation of the proposed LNG terminal and pipeline facilities are expected to have a negligible impact on public services. Short-term impacts could include the need for localized police assistance to control traffic flow during construction activities. Also, unanticipated accidents or emergencies could occur as a result of construction-related injuries. There potentially could be a need for some state or city police support for security at the LNG terminal under specific Homeland Security and Coast Guard Marine Security (MARSEC) levels. The local communities would have adequate infrastructure and community services to meet such needs. Further, Creole Trail would have safety inspectors and would establish emergency response plans. Creole Trail would also require that its construction contractors create and submit emergency response plans to local communities' emergency responders and facilities that might be affected in the event of an emergency. Creole Trail would have on-site security during construction and operation of the LNG terminal. For both the LNG terminal and the pipeline facilities, an emergency response process would be included in Creole Trail's Operations and Maintenance Plans and shared with potential responders (see section 4.12 for further discussion of safety and security requirements).

We conclude that long-term project-related impacts on police, fire, medical, and other public services would be minimal, and that the local communities have historically had adequate infrastructure and community services to meet the needs of the proposed project. Further, we do not anticipate that the project would result in additional government expenditures for public services such as road maintenance, public safety, or public utilities.

4.9.5 Transportation and Traffic

Land Transportation

LNG Terminal

The local road and highway system in the vicinity of the proposed LNG terminal consists of two state highways. State Highway 82 runs east-west along the Gulf of Mexico, south of the proposed LNG terminal site. State Highway 27 runs north-south along each side of Calcasieu Lake. State Highways 27 and 82 are joined for about 21 miles, including at the LNG terminal site location. Traffic levels on State Highway 27/82 are light due to the lack of large population centers along this route. According to the Bureau of Transportation Statistics (BTS), the average annual daily traffic levels on State Highway 27/82 ranged from about 1,502 vehicles per day at a point about 1 mile south of the proposed LNG terminal site to 4,679 vehicles per day at a point west of the Cameron city limits (LADOTD, 2004).

Construction traffic would obtain access to the LNG terminal site via State Highway 27/82. Material deliveries to the site would generate 5 to 10 deliveries via truck per day during construction, with a peak of 20 to 30 trips per day when the tank construction materials are delivered. A similar number of small, two-axle truck trips also would be expected. Heavy material delivery would occur via State Highway 27 to State Highway 82 from Lake Charles. Material delivery vehicles are not expected to exceed the load capacity of either the public roads or the State Highway 82 bridge. In addition to material deliveries, workers commuting to and from the site would increase light vehicle traffic (i.e., cars and pickup trucks). The majority of the workers are expected to commute from the Sulphur and Lake Charles areas, while some might commute from Cameron. Truck and commuter traffic during construction are expected to range from about 238 to 421 vehicle trips per day over the course of the construction period, with the higher numbers of trips occurring in 2007 and 2008.

Creole Trail would encourage ride-sharing to reduce worker commuter traffic to and from the LNG terminal site. Some delays might be experienced during the morning and evening commuting hours when motorists might be required to follow slower vehicles, but given the generally light traffic along State Highways 27 and 82, we conclude that construction-related traffic is not likely to adversely affect road traffic in the vicinity of the LNG terminal site. However, the number of vehicles going into and out of the LNG terminal would have the potential to adversely affect users of the Cameron Ferry, which loads and unloads passengers near the entrance into the LNG terminal site. Therefore, **we recommend that:**

- **Creole Trail develop a Traffic and Transportation Mitigation Plan and file this plan with the Secretary of the Commission <u>prior to beginning construction of the LNG terminal</u>. This plan should explain the measures that Creole Trail would take to prevent adverse impacts on commuters to and users of the Cameron Ferry associated with heavy construction traffic to and from the LNG terminal site via State Highway 27/82.**

During operation of the LNG terminal, the traffic generated by the 76 to 93 permanent employees would not increase traffic volumes sufficiently to result in adverse impacts on traffic. Further, the operations personnel would be divided into three shifts, which would reduce the number of vehicles approaching or leaving the site at any given time.

Pipelines

Short-term impacts on the transportation network during construction of the pipeline facilities would result from construction across roads and from the movement of construction personnel,

equipment, and materials to the pipeline rights-of-way. State Highway 27 is the only major road crossed by Segment 2, and this road would also be used during construction of these pipeline segments to obtain access to the construction areas. Segment 3 would cross U.S. Interstate 10, three U.S. Highways (90, 171, and 165), and several state routes, all of which would be used by project-related construction traffic to reach the smaller local roads that provide access to the pipeline right-of-way. Traffic levels on these highways are greatest in the areas around Sulphur, Lake Charles, Eunice, and Crowley. Segment 3 would also cross three railroads.

Creole Trail would use the boring or HDD methods to install the pipeline beneath paved roads, some unpaved roads, and railroads, which would avoid or minimize the disruption of traffic flows on these roads and would avoid interruption of rail service. Several unpaved roads would be crossed using the open-cut method, which would temporarily disrupt road traffic. To avoid or minimize delays associated with open-cut road crossings, Creole Trail would establish detours if necessary. If no reasonable detours are feasible, no more than one traffic lane of the road would be used during construction except for the brief periods when road closure is essential to lay the pipeline in the trench. Creole Trail would also avoid road closings during peak traffic hours and would coordinate construction activities with appropriate local and state officials in order to avoid or minimize any potential traffic delays/impacts. Road crossing would be conducted in accordance with applicable state and local regulations and permits and, in the case of private roads, landowner agreements. In addition, open-cut road crossings would be completed within one day.

Heavy truck traffic associated with transporting construction equipment and pipe to the project area (including the pipeline rights-of-way or the wareyards) could potentially cause delays in traffic flow, but such impacts would be temporary and short term. Once construction equipment and materials reach the construction rights-of-way, construction-related traffic would remain on the right-of-way except to cross roads. Workers commuting to the construction areas would be unlikely to significantly affect traffic patterns in the project area. Workers would be expected to leave many of their personal vehicles at a wareyard and share rides to the rights-of-way. Also, because construction would generally be scheduled to take advantage of all daylight hours, most workers would commute to and from their work sites during off-peak hours. Further, due to the linear and progressive nature of pipeline construction, workers would be dispersed along the right-of-way, and disruptions to traffic on local roads would be limited to a short period at any given location as the construction progresses along the pipeline routes.

To maintain safe conditions on roads that may be affected by pipeline construction, Creole Trial would comply with the applicable vehicle weight and width restrictions and would remove soil that is left on the road surface from crossings of construction equipment. In addition, when it is necessary for equipment to cross paved roads, mats or other appropriate measures would be used to minimize damage to the road surface. If roadways are damaged during construction of the proposed project, Creole Trail would repair or reconstruct the damaged roadway to the pre-construction condition or better.

Marine Transportation

LNG Terminal

The LNG terminal would be constructed adjacent to the Calcasieu Ship Channel about 3 miles from the entrance jetties. The ship channel is used by large vessels transiting to or from the Port of Lake Charles and by vessels transporting materials and crews to offshore oil rigs. Pleasure craft may be present near the entrance jetties or further up the channel, but are not typically present in the vicinity of the LNG terminal site.

Construction of the proposed LNG terminal would have minor, temporary impacts on marine traffic within the Calcasieu Ship Channel. Impacts would be limited to the increased barge traffic on the Calcasieu Ship Channel required to deliver construction materials to the terminal site, which Creole Trail has estimated to include 21 barge deliveries. Impacts of delivery barge traffic on other marine traffic would be minimized by the fact that the proposed LNG terminal site is located near the entrance to the channel and by the relatively small number of barges deliveries anticipated. Further, most tug and barge traffic is on the Gulf Intracoastal Waterway, which crosses the Calcasieu Ship Channel and is north of the LNG terminal site and the carrier traffic that would be associated with construction and operation of the project. The 400-foot-wide Calcasieu Ship Channel allows sufficient room for tows to pass other traffic, including deep draft vessels. The tow traffic would not hamper LNG traffic above the LNG terminal site because the tows, which have maximum drafts of 12 feet (Gulf Intracoastal Waterway project depth) can readily hold up outside the deep water channel when necessary. Inland barge traffic, such as that supporting the LNG terminal construction, does not require the services of Pilots or harbor tugs. In addition, barges delivering materials for the project would dock along the terminal site, to the west of the shipping lane, where they would not interfere with channel traffic.

During operation of the LNG terminal, impacts on marine traffic would result from the LNG vessels calling the proposed terminal. Creole Trail anticipates that 300 to 400 LNG vessels would call the LNG terminal annually. Impacts of the LNG vessels on marine traffic and marine safety issues are discussed in detail in section 4.13.5.

In a letter filed during the pre-filing period, the Lake Charles Harbor and Terminal District expressed concern about potential impacts of the project on the Cameron Ferry as a result of the additional LNG ships and the safety zones that would be imposed by the Coast Guard. The LNG terminal would be located about 0.5 mile north of the ferry crossing. The ferry normally operates on an informal 15- to 20-minute schedule, 24 hours per day, year round. Creole Trail retained Shiner Moseley and Associates, Inc. (Shiner Moseley) to assess the potential for LNG vessel traffic to affect the Cameron Ferry operations. The Shiner Moseley study concluded that the potential for the Creole Trail LNG project to adversely affect the Cameron Ferry operations is very low (Shiner Moseley, 2005). The study found that the potential delay due to LNG carrier operations would be no different than for other classes of vessels, and a maximum probable delay of 5 minutes or less would be anticipated. The study noted that the Cameron Ferry Marine Operations Supervisor, the ferry Captains, and the Lake Charles Pilots are accustomed to working together to ensure safe and efficient marine operations. Creole Trail would coordinate the arrival and departure of LNG vessels with the pilots and ferry operators to minimize delays for ferry users.

Pipelines

Construction of Segment 2 in Calcasieu Lake could have short-term impacts on commercial and recreational boats and ferries operating in the lake. Pipeline Segment 2 would cross Calcasieu Lake between MPs 3.0 and 20.1. Impacts would result directly from the in-lake construction activities (including pipeline construction and dredging of floatation channels) as described in section 2.3.2.2, and from project-related marine traffic in the form of pipe and material delivery barges and pipeline construction barges. Project-related activities would mainly affect smaller commercial vessels and recreational vessels because deep draft ship traffic cross the lake via the Calcasieu Ship Channel on the western side of the lake.

The lay barges to be used for pipeline construction would mainly operate along the pipeline construction area. Pipe and material supply barges would travel to and from the construction area mainly within two access channels. Thus, the presence of the barges, in and of themselves, would not be expected to have a significant effect on other marine traffic. During the estimated 50- to 75-day in-lake

construction period (not counting the HDD installations where the pipelines would enter and exit the lake), dredged material spoil piles would be placed along the pipeline trench, creating a barrier to vessels traveling through the lake. To allow recreational boats and other shallow-draft vessels to pass over the open trench, Creole Trail would place 50-foot-wide gaps at locations 500 feet apart along the spoil piles. The open trench, spoil mounds, and designated passages would be properly identified with buoys, lights, and other markers as required by the Coast Guard. Given the temporary and linear nature of in-lake construction, and because marine vessels would be allowed to cross the open trench at various locations along the pipeline route, direct, adverse impacts on recreational vessel traffic are anticipated to be short term and minor. In addition, Creole Trail would attempt to construct through the lake during periods when recreational and commercial fishermen are less likely to be using the lake, and would continue to work on identifying measures to minimize impacts on other lake users.

Other important navigational waterways crossed by the proposed pipelines include the Calcasieu Ship Channel and the Intracoastal Waterway. Segment 2 would cross the Calcasieu Ship Channel between MPs 0.1 and 0.3, and the Intracoastal Waterway at MP 20.5. To avoid or minimize impacts on users of the Calcasieu Ship Channel and the Intracoastal Waterway, Creole Trail would construct the pipelines across these shipping lanes using the HDD method.

The operation of the pipelines within Calcasieu Lake would not be expected to affect marine traffic as the pipelines would be buried beneath the lake bottom and would not interfere with the movement of marine vessels.

4.9.6 Tax Revenues

The project would generate tax revenues for the State of Louisiana and for the affected parishes and communities.

Sales taxes would be generated during construction of the proposed LNG terminal and pipeline facilities from Creole Trail's expenditures on construction materials purchased from the project area and from construction workers' purchases during the construction period. The State of Louisiana levies a sales tax of 4.0 percent. Parish-level sales tax rates in the parishes affected by the project range from 2.0 percent in Jefferson Davis Parish to 4.5 percent in Calcasieu and Beauregard Parishes. Cameron Parish does not levy a sales tax. As noted previously, Creole Trail anticipates spending about $6 million for materials to be purchased locally during construction of the LNG terminal, of which about $1 million would be spent in Cameron Parish and the remainder in other nearby communities. If the remaining $5 million is spent in nearby Calcasieu Parish, the associated sales tax would be about $225,000. Pipeline construction is expected to generate about $11.8 million in state sales tax, and about $8.7 million in parish-level sales taxes.

Tax revenues generated from operation of the proposed facilities mainly include state use taxes (for the LNG terminal) and property taxes. State use taxes would be levied for the LNG terminal during the 20-year taxable life of the facility. Estimated average annual state use tax for the LNG terminal are $4.9 million for years 1 through 10 and $6.2 million for years 11 through 20. No property taxes would be charges to the LNG terminal for the first 10 years; however, the estimated average annual property taxes from years 11 through 20 are $7.5 million.

Property taxes associated with the proposed pipeline facilities would be approximately $11.5 over 20 years. Property tax revenues derived by the individual parishes would range from about $3.6 million in Cameron Parish to approximately $672,000 in Beauregard Parish.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA, as amended, requires that the FERC take into account the effects of its undertakings (including the issuance of permits or Certificates) on properties listed on, or eligible for listing on, the NRHP and to provide the ACHP an opportunity to comment on the undertaking. Creole Trail, as a non-federal party, is assisting the FERC in meeting its obligations under section 106 and the implementing regulations in 36 CFR 800.

4.10.1 Results of Cultural Resources Survey

LNG Terminal

Creole Trail completed a cultural resources survey of the 772-acre leased parcel that includes the proposed LNG terminal site. No cultural resources were identified during survey of the property and no further work is recommended. In a letter dated March 21, 2005, the Louisiana State Historic Preservation Office (SHPO) concurred with the recommendations in the draft survey report for the LNG terminal site. The SHPO included technical comments and requested edits to the report (SHPO, 2005a, 2005b).

In a separate letter dated May 18, 2005, Creole Trail requested that the Louisiana SHPO review its proposed dredge material placement area alternatives. In its response dated June 8, 2006, the Louisiana SHPO concurred that no known archaeological sites or historic properties would be affected by the proposed dredge material placement area alternatives.

Pipeline Facilities

Creole Trail surveyed a 350-foot-wide corridor for the terrestrial portion of the pipeline route including modifications to the project as of August, 2005. Certain segments were not surveyed: those that would be avoided by use of the HDD construction method; areas of inundated marshland; and areas where the proposed pipeline route parallels previous cultural resources surveys.

The survey corridor for the nautical portion of the pipeline route in Calcasieu Lake was 3,000 feet wide. The nautical survey was completed with the use of magnetometer sensor, side-scan sonar, and sub-bottom profiler equipment.

<u>Segment 2</u>

One previously recorded cultural resources site with both prehistoric and historic-period components is located on the terrestrial portion of Segment 2. This site was previously determined to be not eligible for listing on the NRHP. Creole Trail has revised its pipeline alignment at this location at the request of an affected landowner and would cross the Gulf Intracoastal Waterway and the Calcasieu Ship Channel by use of the HDD method. The revised alignment would avoid impacts on this site. No other cultural resources were identified during terrestrial survey of Segment 2. Approximately 0.4 mile of Segment 2 and the temporary extra workspace associated with the HDD crossing at the Gulf Intracoastal Waterway and the Calcasieu Ship Channel have not been surveyed where landowner permission has not been obtained.

Underwater survey of the nautical portion of Segment 2 through Calcasieu Lake identified 88 magnetic anomalies. The magnetic anomalies are recommended for further investigation because they cannot be eliminated as potential shipwrecks; therefore, Creole Trail recommended that they be avoided by bottom-disturbing activities, including spudding or anchoring of equipment barges, by use of a 164-foot buffer. Eleven of the magnetic anomalies are located entirely or partially within the 350-foot-wide

construction corridor. If any of the anomalies cannot be avoided, Creole Trail recommends additional investigations (e.g., additional magnetic survey, probing the bottom sediments) to determine if they represent potential shipwrecks. In the event a potential buried shipwreck were discovered by probing, an archaeological diver would assess the site to determine its potential eligibility for listing on the NRHP.

Segment 3

Surveys of Segment 3 identified 10 cultural resources (including 2 that were previously recorded), 1 historic-period structure, and 7 isolated finds. The 10 cultural resources include four prehistoric sites, five historic-period sites, and one site with both prehistoric and historic-period components. Three of the prehistoric sites (campsites) are recommended eligible for listing on the NRHP. In its avoidance plan, Creole Trail proposed to realign its proposed pipeline route to avoid impacts on two of the sites and to avoid impacts on the other site by reducing the temporary extra workspace adjacent to the site. In addition, Creole Trail would provide buffers between the three sites and the construction work areas to limit activities near the sites, install safety fences around the buffers, and install signs stating "Do Not Enter" at the edge of the buffers. The remaining seven sites, the historic-period structure, and the seven isolated finds are recommended as not eligible for listing on the NRHP and no further work is recommended. One additional previously recorded prehistoric site is located along Segment 3 in an area where landowner permission to conduct surveys has not been obtained. In addition, approximately 6.9 miles of Segment 3 have not been surveyed where landowner permission has not been obtained.

Access Roads and Wareyards

Creole Trail completed survey of 48 proposed access roads. No cultural resources were identified during these surveys, and no further work is recommended. Three additional access roads need to be surveyed where landowner permission has not been obtained.

Creole Trail completed survey of eight wareyards. No cultural resources were identified during these surveys and no further work is recommended.

4.10.2 Consultation with Louisiana State Historic Preservation Officer

The Louisiana SHPO concurred with the recommendations in the draft survey reports for the terrestrial and underwater portions of the pipeline route and included technical comments and edits to the reports (SHPO, 2005c, SHPO, 2005d). The SHPO also stated that unsurveyed portions of the proposed route would need to be surveyed. Creole Trail subsequently provided to the FERC and the Louisiana SHPO an addendum report that documents additional surveys at various aboveground facilities and pipeline realignments. In addition, Creole Trail submitted an avoidance plan for three cultural resources sites identified along Segment 3. The Louisiana SHPO has not yet provided comments on these submittals.

4.10.3 Unanticipated Discovery Plan

As part of its application, Creole Trail provided its Unanticipated Discovery Plan for Cultural Resources and Unanticipated Discovery Plan for Unmarked Burials to be used in the event that cultural resources or human remains are discovered during construction. We find the plan acceptable.

4.10.4 Native American Consultation

Creole Trail provided information about the project to six Native American tribes who had been identified by the Louisiana SHPO or other knowledgeable parties as having a potential interest in project cultural resources impacts. These tribes included the Chitimacha Tribe of Louisiana, the Tunica-Biloxi Tribe, the Coushatta Tribe of Louisiana, the Caddo Nation, the Jena Band of Choctaw, and the Alabama-Coushatta Tribe of Texas. In addition, Creole Trail contacted the Eastern Regional Office of the Bureau of Indian Affairs (BIA). Creole Trail also sent follow-up letters on March 25, 2005 regarding additional project facilities that were added after its initial letters were sent and conducted follow-up contacts with the tribes regarding various interagency meetings and teleconferences. To date, three of the tribes (the Caddo Nation, the Coushatta Tribe of Louisiana, and the Jena Band of Choctaw) have responded to Creole Trail, providing comments that the proposed project would have no effect on traditional properties. The Chitimacha Tribe of Louisiana requested that it be provided with ongoing project information and copies of Creole Trail's survey reports. No comments have been received from the remaining two Native American tribes.

4.10.5 General Impact and Mitigation

We have not completed the process of complying with section 106 of the NHPA for Creole Trail's proposed facilities. Cultural resources surveys for about 7.3 miles of the proposed pipeline routes, three access roads, and the extra workspace associated with the HDD crossing of the Gulf Intracoastal Waterway and the Calcasieu Ship Channel have not been completed because landowner permission has not been obtained. Once cultural resources surveys and evaluations are complete, the FERC, in consultation with the Louisiana SHPO, would make determinations of NRHP eligibility and project effects. If any historic properties would be affected by the proposed project, we would seek ways to minimize or avoid adverse effects.

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

- **Creole Trail defer implementation of any treatment plans/measures (including archaeological data recovery), construction of pipeline facilities, and use of associated staging, storage, or temporary work areas and new or to-be-improved access roads <u>until</u>:**

  a. Creole Trail files with the Secretary cultural resources survey and evaluation reports, any necessary treatment/avoidance plans, and the Louisiana SHPO comments; and

  b. the Director of OEP reviews all cultural resources survey reports and plans, and notifies Creole Trail in writing that treatment plans/mitigation measures may be implemented or construction may proceed.

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

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

4.11.1.1 Regional Climate

The local climate for the project area is predominantly marine, with periods of modified continental influence during the colder months when cold fronts from the northwest reach the coast. The cold fronts that do reach the coast rarely result in severe temperatures due to the low latitude and the moderating effect of the coast. When freezing temperatures occur they are generally during November through March. Extremely high temperatures are prevented by coastal breezes except on rare occasions. Normal monthly highs range from about 61 °F in January to 92 °F in July and August. Average monthly lows range from about 43 °F in January to 74 °F in July.

Evenly distributed high normal rainfall and prevailing southerly winds from the Gulf of Mexico result in high humidity from February through August. During the colder months, September through January, the wind direction generally changes to northerly following cold fronts that reach the coast. The average wind speeds range from 8 to 12 knots (National Climatic Data Center, 1996).

The average annual rainfall is approximately 57 inches and peaks during the month of September, with the remainder of the rainfall fairly well distributed throughout the other months of the year. Summer storms originating in the Gulf of Mexico can produce periods of heavy rains. Snow or sleet rarely occurs due the average above freezing temperatures.

Hurricanes and severe tropical storms occur approximately once every 10 years, with less severe storms occurring approximately every 5 years. The tropical storm season begins June 1 and ends November 30. August and September are the primary months for tropical storms, which are strongest when they originate in the Caribbean Sea (National Climatic Data Center, 1996).

4.11.1.2 Existing Air Quality

Ambient Air Quality Standards

The EPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants for the purpose of protecting human health (primary standards) and public welfare (secondary standards). The EPA has set NAAQS for the following criteria pollutants:

- nitrogen dioxide (NO_2);
- carbon monoxide (CO);
- ozone (O_3);
- SO_2;
- lead (Pb);
- particulate matter having an aerodynamic diameter of 10 microns or less (PM_{10}); and
- particulate matter having an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).

The EPA has implemented a new 8-hour ozone standard which is now in effect. The 1-hour ozone standard was revoked on June 15, 2005. The LADEQ has adopted the NAAQS as the ambient air quality standards within the State of Louisiana in Title 33, Part III, Chapter 7 of the LAC (33:III.711.); however, this regulation has not been amended to reflect the revocation of the 1-hour ozone standard.

Air Quality Control Regions and Attainment Status

Air quality control regions (AQCRs) were established by the EPA and local agencies, in accordance with Section 107 of the CAA, as a means to implement the CAA and comply with the NAAQS through state implementation plans. The AQCRs are intra- and interstate regions such as large metropolitan areas where the improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR. Cameron Parish is located in the Southern Louisiana-Southeast Texas Interstate AQCR. This AQCR was established because air emissions from southeast Texas influence air quality in southern Louisiana and vice versa. Each AQCR, or portion thereof, is designated as "attainment," "nonattainment," or "unclassifiable" for the NAAQS. The designations are based on compliance with the NAAQS. Cameron Parish is designated "attainment" or "unclassifiable" for all criteria pollutants.

Air Quality Monitoring and Existing Air Quality

The LADEQ maintains 44 air quality monitors located throughout the state. There are two special purpose monitoring stations (SPMS), measuring NO_x and O_3 in Calcasieu Parish; there are no monitoring stations in Cameron Parish. Data from many of those monitors are reported to the EPA AirData database. The NAAQS and local background data for the project area are summarized in table 4.11.1-1.

TABLE 4.11.1-1

National Ambient Air Quality Standards and Local Background Data for the Project Area

Pollutant	Averaging Time	Primary Standard ($\mu g/m^3$)	Secondary Standard ($\mu g/m^3$)	Local Background ($\mu g/m^3$) [a]
SO_2	Annual [b]	80 (0.03 ppm)	-	40
	24-hour [c]	365 (0.14 ppm)	-	275
	3-hour [d]	-	1,300 (0.5 ppm)	1,040
PM_{10}	Annual [b]	50	50	33
	24-hour [c]	150	150	113
$PM_{2.5}$	Annual [b]	15	15	-
	24-hour [c]	65	65	-
CO	8-hour [c]	10,000 (9 ppm)	-	7,000
	1-hour [c]	40,000 (35 ppm)	-	14,000
Ozone	8-hour [d]	157 (0.08 ppm)	157 (0.08 ppm)	-
	1-hour [c, e]	235 (0.12 ppm)	235 (0.12 ppm)	-
NO_2	Annual [b]	100 (0.05 ppm)	100 (0.05 ppm)	35
Lead	Quarter [b]	1.5	-	0.1

[a] Data is based on Texas Commission on Environmental Quality (TCEQ) screening background concentrations for Jefferson County, Texas (September 4, 1998). Jefferson County is located adjacent to Cameron Parish and is in the Southern Louisiana Southeast Texas AQCR.
[b] Arithmetic mean.
[c] Block average.
[d] Rolling average.
[e] Chapter 7 of the LAC has not yet been amended to reflect the revocation of the 1-hr ozone standard.
$\mu g/m^3$ micrograms per cubic meter
ppm parts per million

4.11.1.3 Regulatory Requirements for Air Quality

The proposed Creole Trail LNG terminal and pipelines are potentially subject to a variety of federal, state, and local regulations pertaining to the construction or operation of air emission sources. The LADEQ has the primary jurisdiction over air emissions produced by the LNG terminal. The LADEQ enforces its own regulations as well as EPA's federal requirements as delegated. The following sections summarize the applicability of various LADEQ and federal regulations. Cameron Parish does not have any additional air permit requirements beyond the LADEQ and federal programs. The proposed pipelines would cross Cameron, Calcasieu, Beauregard, Allen, Jefferson Davis, and Acadia Parishes. There are no aboveground facilities subject to permitting requirements associated with the pipelines within these parishes.

Federal Air Quality Requirements

The CAA, 42 USC 7401 et seq., as amended in 1977 and 1990, and 40 CFR Parts 50 through 99 are the basic federal statutes and regulations governing air pollution in the United States. The following federal requirements have been reviewed for applicability to the proposed Creole Trail LNG terminal.

New Source Review/Prevention of Significant Deterioration

Separate pre-construction review procedures have been established for projects that are proposed to be built in attainment areas versus nonattainment areas. The pre-construction review process for new or modified major sources located in attainment areas is called New Source Review (NSR) and may include a Prevention of Significant Deterioration (PSD) review. This review process is intended to keep new air emission sources from causing existing air quality to deteriorate beyond acceptable levels codified in the federal regulations.

The proposed LNG terminal is located in a designated attainment area for the NAAQS. Therefore, new major sources and major modifications in this area are subject to the NSR/PSD rule. To be classified as a major PSD source, the potential emissions from the source must either be: 1) greater than 100 tons per year (tpy) for any pollutant regulated by the CAA for sources that are among the 28 source categories listed in section 169 of the CAA, or 2) greater than 250 tpy for any pollutant regulated by the CAA for sources that are not among the 28 source categories. The PSD requirements are codified in LAC §33.III.509. Fossil fuel fired boilers with a combined heat input greater than 250 MMBtu per hour are one of the 28 source categories listed in 40 CFR 52.21(b)(1)(i). The proposed LNG terminal would include 21 SCVs, each rated at 108 MMBtu. Therefore, the PSD threshold for the proposed facility is 100 tpy. A summary of the stationary and mobile source emissions for the LNG terminal is included in section 4.11.1.4. The emissions from the proposed facility would exceed the 100 tpy threshold so the LNG terminal would be subject to PSD permitting requirements.

One of the factors considered in the PSD permit review processes is potential impacts on protected Class 1 Wilderness areas. If a project is located within 100 kilometers (km) of a Federal Class I area, additional modeling analysis may be required to determine the potential impact on the area. The proposed project would not be within 100 km of a Class I area. The nearest Class I area is the Breton Sound National Wildlife Refuge located approximately 300 miles (483 km) east of the project site.

Another factor considered in the PSD permit review is the potential impact of facility emissions on soil, vegetation and visibility. Creole Trail will submit to the LADEQ and file with the Commission an additional impacts analysis addressing these factors under separate cover as part of the ambient air quality dispersion modeling impact analysis.

New Source Performance Standards

New Source Performance Standards (NSPS), codified at 40 CFR 60 and incorporated by reference in LAC §33.III.3003, establish requirements for new, modified, or reconstructed units in specific source categories. NSPS requirements include emission limits, monitoring, reporting, and recordkeeping. The following NSPS requirements were identified as potentially applicable to the specified sources at the facility.

Subpart Db of 40 CFR 60, *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units*, applies to fuel-fired steam-generating units with a heat input capacity of greater than 100 MMBtu per hour. The definition of an applicable unit includes sources that produce steam or heat water or any other heat transfer medium. The 21 SCVs proposed for the LNG terminal are each rated at 108 MMBtu/hr and would burn natural gas. The SCVs are therefore subject to Subpart Db. Subpart Db requirements include a NO_x emission limit of 0.1 or 0.2 pound per MMBtu (lb/MMBtu), installation and operation of a continuous emissions monitor, as well as associated reporting and recordkeeping. The proposed Creole Trail LNG terminal would meet the NO_x emission limit using low NO_x burners and water injection capable of achieving approximately 0.037 lb/MMBtu.

Subpart GG, *Standards of Performance for Stationary Gas Turbines*, lists affected sources as stationary gas turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 MMBtu) per hour, based on the lower heating value of the fuel fired. The four GE LM2500 gas turbines proposed to be installed at the LNG terminal exceed the 10 MMBtu per hour heat input trigger level and would be subject to the requirements of Subpart GG. The requirements of Subpart GG would be met by using DLE (dry low-NO_x emission) technology to mitigate the NO_x emissions.

Subpart Kb of 40 CFR 60, *Standards of Performance for Volatile Organic Liquid [VOL] Storage Vessels* lists affected emission sources as storage vessels containing VOLs. Regulatory applicability is dependent on the construction date, size, and vapor pressure of the storage vessel and its contents. Subpart Kb applies to new tanks, unless otherwise exempted, that have a storage capacity between 75 m^3 (19,813 gallons) and 151 m^3 (39,890 gallons) and contain volatile organic compounds (VOCs) with a maximum true vapor pressure greater than or equal to 15.0 kilopascals (kPa). Subpart Kb also applies to tanks that have a storage capacity greater than or equal to 151 m^3 and contain VOCs with a maximum true vapor pressure greater than or equal to 3.5 kPa. Each of the four proposed LNG storage tanks would have a working volume capacity of 160,000 m^3, which meets the volume criteria for Subpart Kb. The LNG is considered a VOL because a small portion of the LNG would consist of VOCs. The vapor pressure of the VOC (assumed to be propane) that would be stored in the LNG tanks is approximately 0.0007 kPa at the proposed storage temperature of -256 ºF (Perry et al., 1997). Therefore, the proposed LNG storage tanks are not subject to NSPS Subpart Kb.

National Emissions Standards for Hazardous Air Pollutants

The National Emissions Standards for Hazardous Air Pollutants (NESHAP), codified in 40 CFR Parts 61 and 63, regulate hazardous air pollutant (HAP) emissions. 40 CFR Parts 61 and 63 are incorporated by reference in LAC §33.III.5116 and §33.III.5122 respectively. Part 61 was promulgated prior to the 1990 Clean Air Act Amendments (CAAA) and regulates only eight types of hazardous substances (asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride).

The 1990 CAAA established a list of 189 HAPs, resulting in the promulgation of Part 63. Part 63, also known as the Maximum Achievable Control Technology (MACT) standards, regulates HAP emissions from major sources of HAP emissions and specific source categories that emit HAPs. Part 63

defines a major source of HAPs as any source that has the potential to emit 10 tpy of any single HAP or 25 tpy of HAPs in aggregate.

LNG storage and processing facilities do not fall under one of the source categories regulated by Part 61; therefore, the requirements of Part 61 are not applicable to the Creole Trail LNG terminal. Part 63 establishes HAP emission standards for marine vessel loading operations (Subpart Y); oil and gas production facilities (Subpart HH); natural gas transmission and storage facilities (Subpart HHH); industrial, commercial, and institutional boilers and process heaters (Subpart DDDDD); and reciprocating internal combustion engines (Subpart ZZZZ). All of these subparts establish requirements for major sources of HAPs only. HAP emissions (in aggregate) from the proposed LNG terminal would be approximately 5.1 tpy, and the largest single HAP emitted by the LNG terminal would be formaldehyde at a rate of approximately 3.5 tpy. Since HAP emissions from the LNG terminal would not exceed the single or aggregate thresholds, the Creole Trail LNG terminal would not be a major source of HAPs and would not be subject to the NESHAPs.

Chemical Accident Prevention Provisions

The chemical accident prevention provisions, codified in 40 CFR Part 68, are federal regulations designed to prevent the release of hazardous materials in the event of an accident and minimize potential impacts if a release does occur. 40 CFR Part 68 is incorporated by reference in Chapter 59 of the LADEQ regulations. The regulations contain a list of substances and threshold quantities for determining applicability to stationary sources. If a stationary source stores, handles, or processes one or more substances on this list in a quantity equal to or greater than specified in the regulation, the facility must prepare and submit a risk management plan (RMP). If a facility does not have a listed substance on-site, or the quantity of a listed substance is below the applicability threshold, the facility does not have to prepare an RMP. In the latter case the facility still must comply with requirements of the general duty provisions in section 112(r)(1) of the 1990 CAAA if there is any regulated substance or other extremely hazardous substance on-site.

Stationary sources are defined in 40 CFR Part 68 as any buildings, structures, equipment, installations, or substance-emitting stationary activities which belong to the same industrial group, which are located on one or more contiguous properties, which are under the control of the same person (or persons under common control), and from which an accidental release may occur. However, the definition also states that the term “stationary source” does not apply to transportation, including storage incidental to transportation, of any regulated substance or any other extremely hazardous substance. The term “transportation” includes transportation subject to oversight or regulation under 49 CFR 192, 193, or 195 or a state natural gas or hazardous liquid program for which the state has in effect a certification to DOT under 49 USC section 60105. Based on these definitions, the only substance that would be potentially applicable to the RMP regulation is the LNG that is stored incidental to transportation. Therefore, an RMP is not required for this facility. However, the facility would have to comply with the general duty provisions of the 1990 CAAA as discussed above.

Title V Operating Permit

Title V of the CAA requires states to establish an air operating permit program for “major sources.” The requirements of Title V are outlined in 40 CFR Part 70 and the permits required by these regulations are often referred to as Part 70 permits. Louisiana has incorporated this program in LAC §33.III.507.

If a facility’s actual or potential emissions meet or exceed the major source threshold for a criteria pollutant or HAP, the facility is required to obtain a Title V operating permit. The major source threshold

level for an air emission source in Cameron Parish is 100 tpy for any criteria pollutants (PM_{10}, SO_2, NO_x, VOC, or CO), 10 tpy of any single HAP, or 25 tpy of all HAPs in aggregate. The potential to emit for HAPs is below the major source thresholds, but the LNG terminal potential to emit for criteria pollutants is above the major source thresholds(see table 4.11.1-3). Therefore, the proposed LNG terminal would be required to obtain a Title V operating permit.

General Conformity

40 CFR Parts 51 and 93 define the requirements for determining conformity for federal actions to state or federal implementation plans. A conformity analysis is required for each criteria pollutant where the total of direct and indirect emissions in a nonattainment or maintenance area caused by a federal action would equal or exceed any of the rates specified in the applicable implementation plan. The proposed project would be located in an attainment area; therefore, the General Conformity requirements do not apply.

Applicable State Air Quality Requirements

The LADEQ is the air permitting authority for the proposed project. The LADEQ air quality regulations are codified in LAC Title 33, Part III. These regulations incorporate the federal requirements from 40 CFR Parts 50 through 99 and establish permit review procedures for all facilities that emit pollutants to the ambient air. As indicated above, the facility is subject to the PSD permitting requirements; therefore, the facility would be required to obtain a state construction permit with federally enforceable limits. The LADEQ permit would establish best available control technology (BACT) for the Creole Trail LNG terminal and require compliance with all applicable federal and state air regulations.

Under federal regulations (40 CFR 70.8(b)), the air permitting authority shall provide any affected state a copy of the draft operating permit for review and comment. An affected state is one whose air quality may be affected and that is contiguous to the state in which a Title V operating permit, permit modification, or permit renewal is being proposed or one that is within 50 miles of the permitted source. By definition, Texas would be an affected state. Therefore, the Texas Commission on Environmental Quality (TCEQ) will be given the opportunity to review and comment on Creole Trail LNG's draft operating permit prior to issuance by the LADEQ.

The following sections include a summary of the state air regulations potentially applicable to the Creole Trail LNG terminal project.

Chapter 9 – General Regulations on the Control of Emissions and Emission Standards

Chapter 9 includes the general rules that are applicable to all sources. Specific requirements of Chapter 9 include standards for:

- Monitoring, recordkeeping and reporting of emissions – Creole Trail would comply with the monitoring, recordkeeping and reporting requirements outlined in the PSD and Title V permits.

- Stack height configuration – The facility would not get credit for any control associated with utilizing a stack that exceeds good engineering practice (GEP) stack height.

- Notification of unauthorized emissions – Creole Trail would submit reports of the unauthorized discharge of any air pollutant as required.

- Not causing or contributing to the violation of the NAAQS or emission standards – The Creole Trail LNG terminal would not cause or contribute to the violation of any NAAQS or emission standard included in LAC 33.III.

Chapter 11 – Control of Emissions of Smoke

Chapter 11 contains regulations limiting emissions from smoke from combustion units (except for flares). Creole Trail would comply with the applicable opacity limits specified in the regulation.

Chapter 13 – Emission Standards for Particulate Matter

Chapter 13 includes the emission standards for Particulate Matter. Specific requirements of Chapter 13 include standards for:

- Provisions Governing Specific Activities – The Creole Trail LNG terminal would not emit toxic substances that need additional control, nor would it impair visibility in the area such as to affect ship traffic.

- Control of Fugitive Emissions – No fugitive particulate emissions are expected to be generated by activities associated with the operation of this facility.

  During the construction phase, fugitive dust emissions would be mitigated using one or more of the following techniques:

  - use of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, road grading or land clearing;

  - application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces which can cause airborne dust;

  - installation and use of dust collectors to enclose and vent the handling of dusty materials. Adequate containment methods shall be employed during sandblasting or similar operations; and

  - open-bodied trucks transporting materials likely to give rise to airborne dust shall be covered at all times while in motion.

- Degradation of Existing Quality Restricted – Particulate matter emitted from the processes at the Creole Trail LNG terminal would be maintained at the prescribed levels guaranteed by the equipment manufacturer and would be lower than the regulatory limits established in this regulation.

- Measurement of Concentration – If required Creole Trail LNG would measure particulate concentrations in the stack gases in accordance with LADEQ approved methods and standards.

- Emissions from Fuel Burning Equipment – This Subchapter applies to fuel burning installations utilized for the primary purpose of producing steam, hot water, hot air or other indirect heating of liquids, gases or solids where the products of combustion do not have direct contact with process materials. Particulate emissions generated by the SCVs would not exceed the limit of 0.6 lb/MMBtu of heat input.

Chapter 21 – Control of Emissions of Organic Compounds

Chapter 21 includes the emission standards for organic compounds. Specific requirements of Chapter 21 include standards for:

- Storage of VOCs – This rule outlines capture and control measures for the storage of VOCs. The Creole Trail LNG terminal is designed with LNG storage vessels which would be equipped with BOG compressors to collect and recycle LNG vapors from the tanks.

- Good Housekeeping – This rule requires best practical housekeeping and maintenance practices to minimize organic compound emissions. The Creole Trail LNG terminal would implement good housekeeping and maintenance practices.

Chapter 29 – Odor Regulations

Chapter 29 includes odor regulations. Specific requirements of Chapter 29 include standards for Odorous Substances. The Creole Trail LNG terminal would not emit odorous substances and therefore would comply with the provisions of this rule.

Chapter 56 – Prevention of Air Pollution Emergency Episodes

Chapter 56 includes regulatory requirements related to air pollution emergency episodes. Specific requirements of Chapter 56 include standards for the submittal of Standby Plans. The Creole Trail LNG terminal is not a listed source under this regulation and would be required to submit a Standby Plan only upon request.

4.11.1.4 Air Quality Impacts and Mitigation

Construction Air Pollutant Emissions

The activities that would generate air emissions during construction of the proposed Creole Trail LNG terminal include:

- site preparation (earthmoving);
- operation of vehicles and trucks during construction;
- operation of marine vessels during construction;
- installation of terminal components;
- operation of on-site concrete batch plant;
- slip excavation and dredging activities;
- dock construction; and
- worker commuting trips.

Site preparation would include stripping the top layer of earth, removal of earth from high elevation areas to level the LNG terminal site to finished grade, constructing the LNG storage tank dike, and site preparation for other facilities. Site preparation activities would generate fugitive dust from earthmoving and movement of construction equipment over unpaved surfaces as well as tailpipe emissions from construction equipment and vehicle engines. The construction equipment and vehicles would be powered by internal combustion engines that would generate PM_{10}, $PM_{2.5}$, SO_2, NO_x, VOC, and CO emissions. Site preparation equipment would include cranes, trucks, bulldozers, front-end loaders, backhoes, compactors, graders, and dump trucks.

The installation of LNG terminal components would include installation of unloading dock pile caps and beams, deck slabs, mooring and breasting dolphin caps, LNG unloading and vapor return arms, major mechanical equipment, and piping and instrumentation, as well as construction of LNG storage tanks, foundations, pipe racks, and buildings. The terminal site construction equipment would include cranes, backhoes, pile drivers, welders, and generators, which would generate tailpipe and dust emissions similar to the site preparation activities.

Creole Trail would dredge an estimated 4.1 million yd^3 of material during construction of the LNG marine basin and tugboat dock (see section 2.3.1.3). The emissions generated by these activities would be predominantly combustion emissions from the construction equipment and vehicle engines. The construction equipment would include a hydraulic dredge, tugboats, a workboat, cranes, excavator, barge, bulldozers, and trucks.

Site truck traffic and worker commuter vehicles would generate fugitive dust from travel on paved and unpaved surfaces as well as tailpipe emissions. The LNG terminal site construction would take place over a period of approximately 36 months. The internal combustion engines for most of the construction equipment would burn diesel fuel. Some of the pickup trucks and most of the commuter vehicles would burn gasoline.

Air emissions would also be generated during construction of the proposed natural gas pipelines. The pipeline construction activities would take place over a period of less than 12 months. Similar to the terminal construction emissions, the pipeline construction activities would generate fugitive dust as well as combustion emissions from construction equipment, commuter trips, and supply vehicles. Equipment that would be used for the pipeline construction activities would include earthmoving equipment, compressors, pumps, trenchers, stringing trucks, HDD equipment, welding rigs, and equipment for restoring disturbed areas. The internal combustion engines powering most of the pipeline construction equipment and vehicles would burn diesel fuel and the remaining vehicles would burn gasoline.

The estimated emissions from terminal and pipeline construction activities were based on EPA emission factors for stationary engines (for construction equipment tailpipe emissions) and EPA MOBILE 6.2 for commuter vehicle tailpipe emissions. Creole Trail indicated that it would use the diesel fuels that are commercially available in the project area at the time of construction.

The emissions from construction activities would include $PM_{2.5}$, PM_{10}, NO_x, CO, sulfur oxides (SO_x), VOCs, and HAPs. The criteria pollutant emissions from construction are summarized in table 4.11.1-2.

The primary air pollutants emitted during the construction period would be NO_x (includes NO_2), CO, SO_x (includes SO_2), PM_{10} and $PM_{2.5}$ generated by the construction equipment. Most of the predicted PM_{10} emissions are associated with fugitive dust produced during construction of the LNG terminal. Measures would be employed to reduce dust emissions including water application using best management practices and construction operations would be scheduled to avoid concurrent operations by larger emission sources when feasible. The emissions from the construction process would increase the pollutant concentrations in the vicinity of the project; however, their effect on ambient air quality would vary with time due to the construction schedule, the mobility of the sources, and the variety of emission sources. Based on the nature of the emissions it is not expected that construction activities would significantly impact air quality in the vicinity of the project.

TABLE 4.11.1-2

Estimated Emissions by Year from LNG Terminal and Pipeline Construction

Year/ Source Category	$PM_{10}/PM_{2.5}$ [a] (tons)	NO_x (tons)	CO (tons)	SO_x (tons)	VOC (tons)
2006					
Terminal Construction	0.3	3.6	0.8	0.6	0.3
Fugitive Dust	nd	nd	nd	nd	nd
Commuter Traffic	0.1	4.3	54.1	0.1	4.3
Emissions Subtotal	0.4	7.9	54.9	0.7	4.6
2007					
Terminal Construction [b]	4.6	52.7	12.7	8.6	4.4
Fugitive Dust (Terminal Construction)	nd	nd	nd	nd	nd
Commuter Traffic	0.3	6.8	89.3	0.1	7.1
Emissions Subtotal	4.9	59.5	102.0	8.7	11.5
2008					
Terminal Construction [b]	19.4	228.1	54.8	38.3	18.8
Fugitive Dust (Terminal Construction)	nd	nd	nd	nd	nd
Pipeline Construction [c] (HDD emissions only)	0.3	4.0	1.0	0.7	0.3
Fugitive Dust (Pipeline Construction)	nd	nd	nd	nd	nd
Commuter Traffic	0.2	6.2	83.0	0.1	6.4
Emissions Subtotal	19.9	238.3	138.8	39.1	25.5
2009					
Terminal Construction [b]	18.1	208.6	51.0	36.1	18.3
Fugitive Dust (Terminal Construction)	nd	nd	nd	nd	nd
Pipeline Construction [c] (Includes HDD emissions)	3.1	69.2	17.6	11.6	6.3
Fugitive Dust (Pipeline Construction)	nd	nd	nd	nd	nd
Commuter Traffic	0.1	6.2	82.9	0.1	6.5
Emissions Subtotal	21.3	284.0	151.5	47.8	31.1
2010					
Terminal Construction [b]	2.8	27.5	7.9	4.7	3.0
Fugitive Dust (Terminal Construction)	nd	nd	nd	nd	nd
Commuter Traffic	0.1	3.1	44.3	0.1	3.4
Emissions Subtotal	2.9	30.6	52.2	4.8	6.4
Total Construction Emissions	49.4	620.3	499.4	101.1	79.1

[a] It is conservatively assumed that all PM_{10} is less than 2.5 microns in diameter; therefore, the PM_{10} emissions are equal to the $PM_{2.5}$ emissions.

[b] Terminal construction emissions include both on and nonroad construction equipment emissions

[c] The annual breakout shown in this table is based on Creole Trail's initially filed construction schedule. In its comments on the draft EIS, Creole Trail indicated that its updated construction schedule contemplates commencing select HDD crossings in 2007 and constructing the remainder of the pipeline in 2008.

nd No data

Air Pollutant Emissions from Operation of the Terminal

Sources of air emissions associated with operation of the proposed Creole Trail LNG terminal would include:

- twenty-one 108 MMBtu SCVs;
- four gas turbine generator sets;

- one 2,168-horsepower (hp) standby diesel generator;
- two diesel-fired firewater pumps, one 660-hp and one 525-hp;
- fugitive emission sources (valves, flanges, sampling ports, and marine vessel offloading equipment);
- LNG carriers and tugboats; and
- worker commuter vehicles.

As requested by the LADEQ in its comments on the draft EIS, information regarding emissions sources and estimated emissions has been revised to reflect the information included in a January 2006 supplement that Creole Trail filed with the LADEQ for its pending air permit application, which Creole Trail initially filed with the LADEQ in August 2005. Although the LADEQ's comments included a copy of Creole Trail's January 2006 supplement, Creole Trail has not filed a copy of its initial air permit application with the FERC. Therefore, **we recommend that**:

- **Creole Trail file a copy of its complete air permit application as submitted to the LADEQ, including all supplemental information, with the Secretary of the Commission prior to beginning construction of the LNG terminal.**

Table 4.11.1-3 summarizes the air emissions that would be generated by stationary sources as well as mobile sources at the LNG terminal.

The proposed LNG terminal stationary sources would be subject to the federal PSD permitting requirements and would be required to install BACT as part of the LADEQ construction permitting process. The primary source of emissions for the terminal would be the LNG vaporizers. Creole Trail proposes to use low NO_x burners and water injection to reduce the NO_x and CO emissions from the LNG vaporizers. The four gas turbines would use DLE technology to mitigate NO_x and CO emissions.

Unregulated pollutants such as methane (primary component of LNG) would be emitted during operation of the LNG terminal. Some of the LNG would vaporize during storage or transfer during LNG ship unloading. The vaporized LNG is referred to as BOG. The BOG generated by the LNG terminal during operation would be minimized by using a closed system to capture the vapor which would be pumped into the LNG ship during LNG-offloading or condensed in a direct contact condenser with LNG as the contact liquid and then combined with the send out natural gas prior to the send out pumps.

The LNG ship and tugboat transit emissions represent the emissions generated by the round trip travel from state waters to the terminal for a total of 20 miles. The emissions were estimated based on approximately 300 ship calls per year with each call taking about 22 hours including offloading/hoteling. It was assumed that LNG will power the tanker at cruise and switch to marine diesel once the ship reaches the Calcasieu Pass sea buoy.

TABLE 4.11.1-3

Estimated Stationary Source and Marine Vessel Emissions for Operation of the Creole Trail LNG Terminal

Emission Source	$PM_{10}/PM_{2.5}$ (tpy)	NO_x (tpy)	CO (tpy)	SO_x [a] (tpy)	VOC (tpy)
Stationary Sources					
SCVs [b]	13.86	367.50	655.62	2.94	29.82
Turbine Generators [b]	33.96	475.20	286.39	1.40	19.36
Standby Diesel Generator [c]	0.34	18.97	6.12	0.38	0.84
Firewater Pumps [c]	0.23	4.19	0.48	0.11	0.03
Fugitive Emissions [d]	0	0	0	0	1.79
Subtotal Stationary Source Emissions	48.39	865.86	948.61	4.83	51.84
Mobile Sources					
Cruise	5.6	16.6	1.6	26.6	1.4
RSZ [e]	2.0	5.7	0.3	43.8	0.1
Maneuvering of LNG Ship	2.5	7.0	0.4	53.9	0.1
LNG Offload/Hoteling	18.2	464.5	58.2	140.1	21.8
Tugboat Operations	1.1	28.9	3.8	8.7	1.4
Subtotal Terminal Mobile Emissions	29.4	522.7	64.3	273.1	24.8
Total Emissions	77.79	1,388.56	1,012.91	277.93	76.64

[a] SO_x emissions are based on sulfur present in the fuel. Most LNG has no detectable sulfur; however, LNG from some regions may contain a nominal amount. Creole Trail LNG is not limiting the LNG source to any specific region, therefore 0.1 grain per 100 scf was assumed to be present.

[b] Total emissions are based on 21 SCVs and 4 turbines operating 8,760 hours per year. Subject to customer demand, 19 SCVs would be used routinely during normal operation of the LNG facility and the remaining 2 SCVs would serve as spares. Therefore, the total emissions shown indicate the maximum potential emissions from SCVs.

[c] Annual emissions for the diesel generator and firewater pumps are based on 500 hours per year of operation.

[d] Fugitive emissions are VOCs associated with minor equipment leaks at valves, flanges, seals etc.

[e] Reduced Speed Zone.

lb/hr pounds per hour
tpy tons per year
NA Not Applicable
nd No data

Pipeline Operations Emissions

No operational emissions from the pipeline would be regulated by LADEQ or EPA air quality regulations. Operational emissions would be limited to blowdown emissions that would occur during emergency situations and fugitive emissions during operation. Blowdowns would rarely occur and fugitive emissions would be negligible due to the small amount of natural gas emitted and the small fraction of VOC contained in the natural gas. Therefore, these emissions would not have a significant effect on air quality.

4.11.1.5 Alternative LNG Vaporization Technologies

There are a variety of vaporization processes and equipment that can be used to warm LNG to phase change to a gaseous state at ambient temperature and high pressure. During the scoping period, the TCEQ provided comments encouraging the use of Shell and Tube Vaporization (STV) technology instead of SCV technology due to concern over air emissions. The following discussion is limited to an evaluation of STV as an alternative vaporization technology to SCV for the project.

SCV systems are water bath structures filled with heated water. Submerged within the water bath are stainless steel pipe coils. As high pressure LNG enters the vaporizing coils, the heat of the

surrounding water bath is transferred through the coils to vaporize the LNG. Upon reaching the latent heat of vaporization, LNG changes phases to a gas and exits the coils as high pressure gas. The water bath is continuously warmed by the combustion of natural gas. Electric blowers provide combustion air at a head pressure sufficient to force the combustion gas through the water bath. As combustion gas bubbles upward through the bath, the moisture content in the gas condenses as heat is transferred to the surrounding cool water bath. This type of vaporizer has a very high thermal efficiency and due to the large heat bank of the water bath, it is able to accommodate wide fluctuations in LNG vaporization rates.

STV systems involve a heat exchanger in which tubes containing LNG pass through a shell containing a counter-current of heat exchange media such as a water/glycol mixture. On the opposite end of the heat exchanger loop, the water/glycol mixture is typically heated by using direct-fired combustors burning natural gas. STV systems are typically used with natural gas-fired heaters. STVs have a lower thermal efficiency than SCV and therefore use more natural gas for combustion.

In general, STVs have lower air emissions than SCVs because STVs can utilize Selective Catalytic Reduction to control NO_x emissions. However, several technologies exist that are effective in reducing NO_x emissions from SCVs. Creole Trail LNG proposes to use low NO_x burners and water injection to mitigate emissions from the SCVs. The NO_x emission rate from conventional low NO_x burners is approximately 0.033 lb NO_x/MMBtu compared to about 0.054 lb NO_x/MMBtu for the SCVs. When low NO_x burner and water injection controls are applied to the SCVs, the NO_x emissions are approximately 0.037 lb NO_x/MMBtu.

A study performed by Bechtel Corporation for the Cheniere Terminal Project located in Corpus Christi Texas compared the costs and emissions on a facility with a 2.6 Bcf send-out rate to illustrate the differences in technology. The study considered land requirements, operating costs, installed costs and emissions. The total annual utility costs for the SCV system was estimated at $57.4 million per year compared to $66.1 million per year for the STV system. The cost to install the STV system was approximately $17 million higher than the SCV largely due the extra space and equipment required for the STV system.

In summary, Creole Trail LNG has proposed control technologies on both the SCVs and turbine generators to mitigate NO_x and will have to demonstrate the use of BACT on all significant sources as required by PSD permitting.

4.11.2 Noise

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

4.11.2.1 Noise Regulations

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA, 1974). This publication evaluates

the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. The FERC has adopted this criterion for new compression and LNG facilities, and it is used here to evaluate the potential noise impact from operation of the Creole Trail Project. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise.

The State of Louisiana does not have noise regulations that would apply to the proposed project. Similarly, Cameron Parish, where the proposed LNG terminal would be located, has no local ordinance limiting construction-related noise. However, three of the parishes crossed by the proposed pipelines, Acadia, Allen, and Calcasieu Parishes, have noise ordinances limiting noise associated with construction. Following is a summary of these ordinances.

Acadia Parish

In Acadia Parish, construction must not be conducted within 500 feet of residential or commercial districts between the hours of 10 p.m. and 7 a.m. Construction projects are also subject to maximum permissible operational noise levels for industrial districts as specified below (Ord. No. 662, § M, 4-17-96; Ord. No. 735, § M, 4-14-98).

In Acadia Parish, operational noise must not exceed the following maximum allowable decibels for day (7 a.m. – 11 p.m.) and night (11 p.m. – 7 a.m.), respectively (Ord. No. 662, § L, 6-13-95; Ord. No. 680, § L, 4-17-96, Ord. No. 735, § L, 4-14-98):

- Residential Districts 50 dBA, 40 dBA;
- Commercial Districts 60 dBA, 55 dBA; and
- Industrial Districts 80 dBA, 75 dBA.

Allen Parish

Noise disturbance from construction other than between the hours of 7 a.m. – 6 p.m. on weekdays requires a permit (Ord. No. 5755 (7)).

Calcasieu Parish

No construction equipment is allowed within 165 feet of residential or noise sensitive area (NSA) zones between sunset and sunrise weekdays and Saturdays or between 9 p.m. and 8 a.m. on Sundays and holidays (Ord. No. 3874, 5-1-97).

4.11.2.2 Existing Noise Levels

Creole Trail determined, through a review of aerial photography and a site visit, that the nearest NSA to the proposed LNG terminal site is 5,050 feet northwest of the site. The five closest NSAs are depicted on figure 4.11.2-1.

Creole Trail conducted ambient noise monitoring at two locations over a 24-hour period from March 22 to 23, 2005. The measured daytime and nighttime L_{eq} levels were used to calculate the L_{dn} levels. In addition to noise level measurements, Creole Trail identified and recorded the contributing noise sources, along with the prevailing meteorological conditions.

During the noise survey, the dominant noise sources at the northwest positions were occasional helicopter overflights, industrial noises, birds, insects, and wind noise. The observed noise sources at the northeast residence consisted of industrial and commercial noise along the West Fork of the Calcasieu Pass waterway, and background noise sources at the southeast residence were waterway and automobile traffic, helicopter overflights, nearby industrial noise, birds, and wind noise.

One monitoring location was chosen to represent background noise at NSAs 1, 2, and 3, which are all located along the south bank of the West Fork of the Calcasieu Pass waterway. This monitoring location was also used as a conservative background noise estimate for NSA 4. A second monitoring location was located approximately 1,000 feet northwest of NSA 5. The monitoring locations are presented on figure 4.11.2-1 and the measured daytime and nighttime ambient L_{eq} levels and the calculated L_{dn} levels are summarized in table 4.11.2-1.

TABLE 4.11.2-1

Measured Daytime and Nighttime Noise Levels at Nearest NSA

NSA	Description	Distance and Direction	Existing L_{eq} Day (dBA)	Existing L_{eq} Night (dBA)	Existing L_{dn} (dBA)
1	Fishing Cabin	6,500 Feet Northwest	47.9	39.3	48.5
2	Fishing Cabin	6,050 Feet Northwest	47.9	39.3	48.5
3	Fishing Cabin	5,050 Feet Northwest	47.9	39.3	48.5
4	Residence	7,700 Feet Northeast	47.9	39.3	48.5
5	Residence	5,950 Feet Southeast	58.7	53.5	61.2

Non-Internet Public

ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED
CREOLE TRAIL LNG TERMINAL
AND PIPELINE PROJECT
Docket Nos. CP05-360-000, CP05-357-000,
CP05-358,000, CP05-359-000

Figure 4.11.2-1 Approximate Noise Sensitive Areas
Direction and Distance

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

Seventeen M&R stations would be constructed along the proposed pipelines. Creole Trail does not anticipate that the operation of the meter stations would generate noise that would exceed an L_{dn} of 55 dBA at the nearest NSAs. Creole Trail will conduct background noise studies adjacent to the proposed meter stations and will file the results with the Commission when available. Table 4.11.2-2 summarizes the location of the nearest NSAs to the referenced meter stations.

TABLE 4.11.2-2

Noise Sensitive Areas Near Proposed Meter Facilities

Segment/ Site Description	Direction	Nearest Occupant (feet)
Segment 2		
LRC	East	2,220
ANR	East	2,220
Sabine	East	1,800
Segment 3		
Targa	East[a]	>1,000
Varibus	Northeast[a]	>1,000
Gulf South	Southeast[a]	>1,000
Transco 1	North	1,100
Trunkline	North	1,100
Texas Eastern	North	650
Tennessee Gas	South	380
Texas Eastern Egan	East	1,120
Texas Gas	East	1,120
ANR	North	750
Florida Gas	North	450
Transco	West	1,050
Cypress	West	1,130
Columbia Gulf	West	1,130

[a] Direction of nearest NSA based on review of alignment sheets.

HDD construction would be conducted at 14 sites along the proposed pipeline routes. See section 4.11.2.3 for further discussion of noise impacts associated with the HDDs.

4.11.2.3 Noise Impacts and Mitigation

Potential impacts from the project could include short-term increases in noise during construction and long-term increases in noise during operation.

Creole Trail assessed potential noise impacts by performing a noise impact evaluation that included calculating expected increases in noise associated both with project construction and operation and comparing these levels with the FERC and local Parish standards for permissible noise at NSAs.

Construction Noise

Construction activities at the proposed LNG terminal would generate increases in sound levels over an approximate 3-year period, predominately during the day. Construction activity and associated noise impacts would vary depending on the phase of construction in progress. The first phase, consisting of excavation, filling, and grading using heavy earth-moving equipment; pile driving for docks; and dredging, would generate the highest noise levels. The second phase would include foundation preparation and concrete pouring. The third phase would consist of erection of buildings, structures, and

the LNG storage tanks, and the fourth phase would include installation of mechanical and electrical equipment.

Heavy equipment (bulldozers, loaders, dump trucks) would be the primary noise source during the excavation phase. Noise levels from construction equipment would typically range from 65 to 85 dBA at 50 feet from the source. Estimated noise levels from typical construction equipment are listed in table 4.11.2-3 (EPA, 1971). Noise generated during excavation would be primarily from operating diesel engines.

TABLE 4.11.2-3

Estimated Construction Equipment Noise

Equipment Type	Noise at 50 feet (dBA)
Heavy Equipment	85
Air Compressors	84
Welders	67
Concrete Truck	71
Miscellaneous Trucks (pick-up trucks, etc.)	65

Source: Noise From Construction Equipment And Operations, Building Equipment, and Home Appliances, EPA (1971)

Dredging activities would produce noise from the diesel dredges and associated pumps as well as tugboats used to position the dredges. Noise levels associated with the dredging activities would vary from about 80 dBA to 90 dBA at a distance of 50 feet. Predicted noise levels at the nearest NSA would be below the existing ambient noise conditions.

Pile driving would be required intermittently during construction of the unloading platforms, trestles, mooring/breasting dolphins, and LNG storage tank foundations. Noise from pile driving activities would depend on the type of pile and equipment used. Creole Trail estimates that pile driving would be completed over a 13-month period during daytime hours, unless delays dictate that nighttime work is required to meet the schedule.

Noise monitoring completed on pile driving activities at the Sabine Pass LNG facility measured pile driving noise at 75 dBA at 150 feet. During peak pile driving conditions, seven pile drivers may be used simultaneously. Pile driving operations require setup and movement time which is estimated to occur 40 percent of the time. Utilizing this data, noise calculations completed by Creole Trail determined that the estimated increase in noise at the nearest NSAs listed on figure 4.11.2-1 would not exceed 2 dBA. In general, the human ear's threshold of perception for noise change is 3 dBA. Noise impact from the pile driving is expected to be minimal.

The potential ground-borne vibration due to pile driving activity was evaluated based on the assumption that 50,000 foot-pound pile drivers would be used and the soil conditions are silty/sandy. Peak velocity vibration velocities were calculated utilizing methods described in the pile driver and construction section of the "Transportation Related Earthborn Vibrations," Caltrans Technical Advisory. Utilizing this method, and assuming all seven pile drivers would be operating simultaneously, the estimated vibrations at the NSAs would be expected to range from 0.0006 to 0.0011 inch per second which is less that the Caltrans recommendation of 0.3 inch per second for residences.

Impacts due to construction noise at the proposed LNG terminal would be limited to the 3-year construction period. Mitigation would consist of requiring that all construction equipment have working mufflers and be appropriately tuned to minimize engine noise. The predicted noise levels at the nearest

NSA during excavation, dredging, and pile driving would be below the FERC's L_{dn} of 55 dBA. Although construction activities at the LNG terminal may be audible during relatively quiet periods, noise-related impacts are expected to be minimal.

Increases in noise levels during construction of the pipeline would be limited to areas close to the construction activity. The magnitude of the impact would depend on the noise level generated by various equipment types, duration of the construction activity, and distance between the noise source and the receptor. Construction equipment would include miscellaneous trucks, bulldozers, backhoes, and side-boom tractors. Noise levels from construction equipment would be similar to those listed in table 4.11.2-3.

Impacts due to construction of the pipeline would be short term and temporary at any one place because of the assembly line method of pipeline construction. Mitigation would consist of requiring that all construction equipment have working mufflers and be appropriately tuned to minimize engine noise.

Noise associated with HDD operations would be buffered to some extent where the HDD locations are separated from NSAs by dense stands of forested vegetation. Table 4.11.2-4 presents the results of existing ambient noise surveys completed adjacent to the HDD crossings, the predicted HDD noise contribution, the expected future noise levels after adding the HDD noise to the ambient, and the increase in ambient levels as a result of adding the HDD noise.

Noise from HDD activities is a temporary impact. The increase in dBA L_{dn} as a result of HDD construction noise near the NSAs is expected to range 0.9 to 22 dBA L_{dn}.

Creole Trail would attempt to adhere to a 12-hour drilling schedule to minimize noise impacts on nearby NSAs. If a longer drilling period is required, Creole Trail would notify the affected NSAs of the anticipated additional noise levels and implement noise mitigation measures, as necessary. Noise mitigation measures may include the construction of acoustical enclosures around noise producing pumps and engines and upgrading intake and exhaust silencers on engines.

Operational Noise

Creole Trail performed computer modeling in order to calculate noise levels that would be generated by operation of the proposed LNG terminal. The model receptors are the same NSA locations where ambient noise monitoring was performed to allow a direct comparison with existing noise levels. The commercially available CadnaA model developed by Datakustik GMBH was used for the analysis.

Sound level data for the proposed equipment were obtained either from vendors or calculated using empirical formulas based on process and mechanical equipment data. Table 4.11.2-5 summarizes the predominant noise producing equipment and their sound power level.

TABLE 4.11.2-4

Predicted L_{dn} Noise Levels at Nearest Noise Sensitive Areas During HDD Operations

HDD Crossing/NSA [a]	Drill Length (feet)	12-Hour Construction Days	Distance and Direction	Existing Ambient L_{dn} (dBA)	Predicted HDD Contribution (dBA)	Ambient + HDD (dBA)	Predicted Increase in Ambient (dBA)
Calcasieu Lake Entry	4,000	26 [b]					
South Side							
NSA #1			2,320 feet west	48.5	52.9	59.6	11.1
North Side – No NSAs							
Houston River	2,920	20					
South Side							
NSA #1			850 feet northwest	39.9	53.2	50.6	10.7
NSA #2			420 feet west/ northwest	39.9	64.3	61.3	21.4
NSA #3			480 feet west	44.7	63.4	60.5	15.8
NSA #4			900 feet southwest	49.7	62.8	60.2	10.5
NSA #5			2,600 feet southwest	46.8	47.8	48.9	2.1
NSA #6			2,300 feet southeast	46.8	45.7	48.2	1.4
NSA #7			1,510 feet southeast	49.7	54.6	53.8	4.1
NSA #8			410 feet east	44.7	69.7	66.7	22.0
North Side – No NSAs							
Little River	2,162	16					
West Side							
NSA #1			1,630 feet southeast	54.3	57.0	57.2	2.9
NSA #2			2,360 feet south/ southeast	38.0	52.7	50.0	12.0
NSA #3			2,870 feet southeast	35.0	47.1	44.6	9.6
East Side – No NSAs							

TABLE 4.11.2-4 (cont'd)

Predicted L_{dn} Noise Levels at Nearest Noise Sensitive Areas During HDD Operations

HDD Crossing/NSA [a]	Drill Length (feet)	12-Hour Construction Days	Distance and Direction	Existing Ambient L_{dn} (dBA)	Predicted HDD Contribution (dBA)	Ambient + HDD (dBA)	Predicted Increase in Ambient (dBA)
West Fork Calcasieu River	3,023	20					
West Side							
NSA #1			420 feet south	38.9	61.6	58.6	19.7
NSA #2			1,010 feet north	40.0	51.3	48.9	8.9
East Side – No NSAs							
Barnes Creek	2,300	16					
West Side							
NSA #1			3,180 feet west	45.5	48.9	48.7	3.2
East Side – No NSAs							
Calcasieu River (Segment 3)	3,948	36					
West Side							
NSA #1			830 feet north/ northwest	45.4	63.4	60.5	15.1
NSA #2			790 feet north	45.4	64.0	61.1	17.7
East Side							
NSA #3			2,170 feet southwest	39.6	49.0	46.9	7.3
Serpent Bayou	1,294	Less than 16 [c]					
West Side							
– No NSAs							
East Side							
NSA #1			1,790 south	43.4[d]	49.1	48.0	4.6
Bayou des Cannes	1,767	Less than 16 [c]					
West Side							
NSA #1			1,020 feet north/northwest	44.7[d]	56.8	54.3	9.6
NSA #2			1,790 feet north/northwest	42.9[d]	51.3	49.4	6.5
NSA #3			1,660 feet north	42.9[d]	51.1	49.2	6.3
East Side							

TABLE 4.11.2-4 (cont'd)

Predicted L_{dn} Noise Levels at Nearest Noise Sensitive Areas During HDD Operations

HDD Crossing/NSA [a]	Drill Length (feet)	12-Hour Construction Days	Distance and Direction	Existing Ambient L_{dn} (dBA)	Predicted HDD Contribution (dBA)	Ambient + HDD (dBA)	Predicted Increase in Ambient (dBA)
NSA #4			2,110 feet northeast	42.9[d]	45.8	45.9	2.9
NSA #5			1,490 feet east	49.7[d]	46.4	50.6	0.9

[a] There are no NSAs within 0.5 mile on either side of the HDD crossings of the Calcasieu Ship Channel or exit from Calcasieu Lake on Segment 2, or the Gulf Intracoastal Waterway, Bayou Nezpique, Bayou Mallet, and Bayou Palquemine on Segment 3.

[b] 24-hour construction days.

[c] Estimated based on information provided for other HDDs.

[d] Sound level estimated from measurements at other nearby NSAs.

TABLE 4.11.2-5 **Equipment Quantities and Sound Power Levels Used in Noise Modeling**		
Equipment	Number in Use	Sound Power Level Per Single Item (dBA)
Boil Off Gas Compressor	3 of 3	112
Boil Off Gas Compressor Motor	3 of 3	108
Nitrogen Package	1	113
Instrument Air Packages	2 of 3	103
Vapor Return Blowers	4 of 4	98
Vapor Return Blower Motors	4 of 4	100
Submerged Combustion Vaporizer Blower	19 of 21	108
Submerged Combustion Vaporizer Blower Motor	19 of 21	103
Submerged Combustion Vaporizer Blower Intake	19 of 21	107
Sendout Pump Motors	19 of 21	108
Chilled Water Pump Motor	1 of 2	96
Chilled Water Pump	1 of 2	103
WHRU Pump Motor	1 of 2	98
WHRU Pumps	1 of 2	106
GE LM2500 Generator Sets		
Filter and Intake, Plenum, Silencer Shell (Shell and Vent Air), Combined PWL	3 of 4	97
Intake, Combustion Air Openings	3 of 4	93
Enclosure and Encl. Vents, Total PWL	3 of 4	101
Exhaust Ductwork	3 of 4	88
Exhaust, Silenced, w/Directivity	3 of 4	107

Table 4.11.2-6 presents the results of the modeling along with a comparison with existing ambient levels, the expected future noise levels after adding the facility noise to the ambient, and the increase in ambient levels as a result of adding the facility.

TABLE 4.11.2-6 **Predicted L_{dn} Noise Levels at Nearest Noise Sensitive Areas Associated with the LNG Terminal**					
NSA	Distance and Direction	Existing Ambient L_{dn} (dBA)	Predicted Facility Contribution (dBA)	Ambient + Facility (dBA)	Predicted Increase in Ambient (dBA)
1	6,500 Feet Northwest	48.5	49.6	52.1	3.6
2	6,050 Feet Northwest	48.5	50.5	52.6	4.1
3	5,050 Feet Northwest	48.5	52.8	54.2	5.7
4	7,700 Feet Northeast	48.5	45.0	50.1	1.6
5	5,950 Feet Southeast	61.2	47.3	61.3	0.2

The results of the noise impact analysis indicate that the noise attributable to the project would be lower than the FERC sound level requirement of 55 dBA L_{dn} at the nearest NSAs. Noise mitigation of the equipment would consist of manufacturer-supplied intake and exhaust mufflers/silencers, and enclosures, if required. We recognize, however, that actual results may be different from those obtained from modeling. Therefore, **we recommend that:**

- **Creole Trail make all reasonable efforts to ensure its predicted noise levels from the LNG terminal are not exceeded at the NSAs and file noise surveys with the Secretary <u>no later than 60 days</u> after placing the LNG terminal in service. However,**

if the noise attributable to the operation of the LNG terminal exceeds 55 dBA L_{dn} at a NSA, Creole Trail should file a report on what changes are needed and should install additional noise controls to meet the level <u>within 1 year</u> of the in-service date. Creole Trail should confirm compliance with these requirements by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.

4.12 RELIABILITY AND SAFETY

Three federal agencies share in the oversight of the safety and security of LNG import terminals: the Coast Guard, the DOT, and the FERC. The FERC authorizes the siting and construction of LNG import terminals and is the lead federal agency under NEPA to analyze the environmental, safety, security, and cryogenic design of proposed facilities. The Coast Guard also has authority over the safety of LNG vessels and the marine transfer area. The Coast Guard also has authority over the security of the LNG vessels and the entire LNG facility. In conjunction with this, the Coast Guard determines the suitability of waterways for LNG marine traffic by issuing a LOR. The DOT has exclusive authority to promulgate and enforce safety regulations and standards over the onshore LNG facilities beginning at the last valve immediately before the LNG storage tank.

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

The operation of the proposed Creole Trail LNG terminal poses a potential hazard that could affect the public safety without strict design and operational measures to control potential accidents. The primary concerns are those events that could lead to an LNG spill of sufficient magnitude to create an offsite hazard including events occurring during the course of but not limited to LNG vessel transits. However, it is also important to recognize the stringent requirements for the design, construction, operation and maintenance of the facility as well as the extensive safety systems to detect and control potential hazards.

With the exception of the October 20, 1944, fire at the LNG facility in Cleveland, Ohio, the operating history of U.S. LNG facilities has been free of LNG safety-related incidents resulting in adverse effects to the public or the environment. The 1944 Cleveland incident was attributed to the use of materials inadequately suited for cryogenic temperatures and the lack of spill impoundments at the site.[7] More recently, an operational accident occurred in 1979 at the Cove Point LNG facility in Lusby, Maryland, when a pump seal failed, resulting in gas vapors entering an electrical conduit and settling in a confined space. When a worker switched off a circuit breaker, the gas ignited, resulting in heavy damage to the building and a worker fatality. Lessons learned from this accident resulted in changing the national fire codes, with the participation of the FERC, to ensure that the situation would not occur again. The proposed facilities would be designed, constructed, and operated in compliance with these codes.

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

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

Although there are major differences between the equipment involved in the accident at Skikda and that of the proposal (i.e., high-pressure steam boilers that power refrigerant compressors would not be used here nor are they used at any LNG facility under FERC jurisdiction), the sequence of cascading events identifies potential failure modes that warrant further evaluation. This issue was discussed at the August 10, 2005 cryogenic design and technical review conference conducted in Sulphur, Louisiana. To ensure that all potential hazards are addressed, we have provided a recommendation in section 4.12.2, *Cryogenic Design and Technical Review*, to address this issue.

A discussion of the principal properties and hazards associated with LNG is presented in section 4.12.1. A summary of our preliminary design and technical review of the cryogenic aspects of the LNG terminal is presented in section 4.12.2. Storage and retention systems are discussed in section 4.12.3. An analysis of the thermal radiation and flammable vapor cloud hazards resulting from a credible land-based LNG spill is presented in section 4.12.4, while the safety aspects of LNG transportation by ship is discussed and summarized in section 4.12.5. A discussion on security awareness related to terrorism is presented in section 4.12.6. The reliability and safety issues related to the natural gas pipelines are discussed in section 4.12.7. Conclusions on safety issues are in section 4.12.8.

4.12.1 LNG Hazards

LNG's principal hazards result from its cryogenic temperature (-260°F), flammability, and vapor dispersion characteristics. As a liquid, LNG will neither burn nor explode. Although it can cause freeze burns and, depending on the length of exposure, more serious injury, its extremely cold state does not present a significant hazard to the public, which rarely, if ever, comes in contact with it as a liquid. As a cryogenic liquid, LNG will quickly cool materials it contacts, causing extreme thermal stress in materials not specifically designed for ultra cold conditions. Such thermal stresses could subsequently subject the material to brittleness, fracture, or other loss of tensile strength. These hazards, however, are not substantially different from the hazards associated with the storage and transportation of liquid oxygen (-296°F) or several other cryogenic gases that have been routinely produced and transported in the U.S.

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

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

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

LNG is not explosive as it is normally transported and stored. However, LNG vapors (primarily methane) can explode if contained within a confined space, such as a building or structure, or confined

space aboard an LNG ship, and ignited. There is no evidence, however, suggesting that LNG is explosive in unconfined open areas. Experiments to determine if unconfined methane-air mixtures will explode have been conducted and, to date, have all been negative. Unconfined methane-air mixtures will burn but will not explode. Nevertheless, a number of experimental programs have been conducted to determine the "amount of initiator charge" required to detonate an unconfined methane-air mixture.

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

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

4.12.2 Cryogenic Design and Technical Review

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

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

As a result of the technical review of the information provided in the submittal documents, a number of concerns were identified by staff relating to the reliability, operability, and safety of the proposed design. In response to staff's questions, Creole Trail LNG provided written answers prior to the technical conference on August 10, 2005. However, several areas of concern are noted that require additional consideration and/or action on behalf of the company. Follow up on those items requiring additional action should be documented in reports to be filed with the FERC. As a result, **we recommend that:**

The following measures should apply to the LNG terminal design and construction details. Information pertaining to these specific recommendations should be filed with the Secretary for review and approval by the Director of OEP either: prior to initial site preparation; prior to construction of final design; prior to commissioning; or prior to commencement of service as indicated by each specific recommendation. Items relating to Resource Report 13-*Engineering and Design Material* and security should be submitted as critical energy infrastructure information (CEII) pursuant to 18 CFR § 388.112 and PL01-1. Information pertaining to items such as: offsite emergency response; procedures for public notification and evacuation; and construction and operating reporting requirements would be subject to public disclosure. This information should be submitted a minimum of 30 days before approval to proceed is required.

- **A complete plan and list of the hazard detection equipment should be filed <u>prior to initial site preparation</u>. The information should include a list with the instrument tag number, type and location, alarm locations, and shutdown functions of the proposed hazard detection equipment. Plan drawings should clearly show the location of all detection equipment.**

- **Creole Trail LNG should provide a technical review of its proposed facility design that:**

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

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

  c. Creole Trail LNG should file this review <u>prior to initial site preparation</u>.

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

- **Facility plans 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 fire water system should be filed <u>prior to initial site preparation</u>.**

- **A copy of the hazard design review and list of recommendations that are to be incorporated in the final facility design should be provided <u>prior to initial site preparation</u>.**

- **The size and location of the line proposed for the accidental process spill calculation, in compliance with NFPA 59A 2.2.2.2, should be identified and the containment configuration drawings, vapor dispersion and thermal radiation calculations for the accidental spill impoundment should be filed <u>prior to initial site preparation</u>.**

- **Procedures should be developed for offsite contractors' responsibilities, restrictions, limitations and supervision of these contractors by Creole Trail LNG staff <u>prior to initial site preparation</u>.**

- **The <u>final design</u> should include spill and leak detection in the jetty isolation valve area.**

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

- **The <u>final design</u> should specify that all hazard detectors be installed with redundancy, fault detection and fault alarm monitoring.**

- **The <u>final design</u> of the hazard detection equipment should provide flammable gas and ultraviolet/infrared hazard detectors with local instrument status indication as an additional safety feature.**

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

- **The <u>final design</u> should include a spectacle blind in the vapor return line, between the vapor block valve and the connection to the LNG unloading line of the dual service unloading arm, on each platform.**

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

- **The <u>final design</u> should include a discretionary vent for each tank, to be operated through the distributed control system.**

- **The <u>final design</u> should include provisions to flare all low pressure boiloff and flash gas.**

- **The <u>final design</u> should include drawings and specifications of the spill protection system to be applied to the LNG tank roof and outer shell.**

- **The <u>final design</u> should include details of the storage tank piping support structure.**

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

- **The <u>final design</u> should include a cooldown bypass valve round the discharge control valve of each intank pump.**

- **The <u>final design</u> should include a recycle line from the end of the LNG sendout pump suction header to storage. The line should be sized to allow the BOG condenser and suction header to be stabilized prior to pump cool down.**

- **The <u>final design</u> should specify that at the maximum LNG specific gravity, specified for the design of the system and at full LNG tank conditions and maximum BOG**

condenser operating pressure, the discharge pressure of the LNG sendout pumps should not exceed 90 percent of the LNG vaporizer design pressure.

- **The final design should include installation of a check valve down stream of the minimum flow recycle line in the secondary pump discharge piping.**

- **The final design should include automatic shutoff isolation valves for the suction and discharge of the return blowers.**

- **The final design should include provisions to install temporary high pressure boiloff compression in the event that sendout operation is curtailed, or ceased for a period in excess of thirty days. Details should include plans and drawings of the BOG recovery system and specifications of the equipment and compressors to be installed.**

- **The final design should include details of the proposed installation of the liquid removal systems associated with the operation of the BOG compressor knock-out drum V-103 and liquid drain pot V-104.**

- **The final design should include provisions to alarm the condition of high liquid level in the drip leg and prevent the return blowers from operating in the event of a High-High level.**

- **The final design should include provisions to pipe unloading line relief valves and other LNG reliefs and vents directly to storage or to an intermediate vent vessel.**

- **The final design should include an LNG sample vaporization system.**

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

- **The final design should include details of the shut down logic, including cause and effect matrices for alarms and shutdowns.**

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

- **The final design should include details of the air gaps to be installed downstream of all seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap should vent to a safe location and be equipped with a leak detection device that: should continuously monitor for the presence of a flammable fluid; should alarm the hazardous condition; and should shutdown the appropriate systems.**

- **The final design should include a hazards and operability review of the completed design. A copy of the review and a list of the recommendations should be provided.**

- **All valves including drain, vent, instrument root, main and car sealed valves should be tagged in the field during construction and prior to commissioning.**

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

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

- **Operation and maintenance procedures and manuals, as well as safety procedure manuals, should be filed prior to commissioning.**

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

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

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

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

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

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least a biennial basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Creole Trail LNG 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 LNG, vaporization quantities, boil-off/flash gas, etc.), plant modifications including future plans and progress thereof. Abnormalities should include, but not be limited to: unloading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, vapor or liquid releases, fires involving natural gas and/or from other sources, negative pressure (vacuum) within a storage tank and higher than predicted boiloff rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and**

<u>December 31</u>. In addition to the above items, a section entitled "Significant plant modifications proposed for the next 12 months (dates)" also should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.

- **In the event the temperature of any region of any outer tank shell, including pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission should be notified <u>within 24 hours</u> and procedures for corrective action should be specified.**

- **Significant non-scheduled events, including safety-related incidents (i.e., LNG or natural gas releases, fires, explosions, mechanical failures, unusual over pressurization, and major injuries) and security related incidents (i.e., attempts to enter site, suspicious activities) should be reported to FERC staff. In the event an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification should be made <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 FERC staff <u>within 24 hours</u>. This notification practice should be incorporated into the LNG facility's emergency plan. Examples of reportable LNG-related incidents include:**

  a. fire;

  b. explosion;

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

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

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

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

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

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

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

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

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

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

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

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

Storm Surge and Wind Force Design Criteria

Recent hurricane activity in the Gulf Coast region has increased concerns about the possible effects of natural disasters on existing and proposed LNG facilities. The 2005 Atlantic hurricane season was the most active season on record with hurricanes Katrina and Rita directly affecting Gulf Coast port areas in which existing, under-construction, and planned terminals are located. In September of 2005, the Trunkline LNG facility in Lake Charles experienced a Category 3 hurricane with sustained winds at landfall exceeding 120 mph. The FERC staff, recognizing the recent trend in the region towards more numerous and powerful storms, has intensified its review of the design criteria for the Creole Trail LNG facility with respect to high wind speed and storm surge conditions.

Storm surge refers to water levels above normal tide levels caused by wind and pressure effects associated with hurricanes. Creole Trail LNG used available data from the FEMA as well as other national and state agencies to assess possible storm surge levels. The FEMA 100-year base flood elevation for the site is 10.8 ft MLG while storm surge models predict a storm surge level of 15 ft MLG for Category 3 hurricanes increasing up to 21 ft MLG for Category 5 hurricanes. The proposed Creole Trail LNG facility calls for a bottom elevation of critical components ranging from +17 ft to +18 ft MLG. Each storage tank would be surrounded by a dike at about +21 ft MLG. FERC staff agrees that the design is adequate for predicted storm surge and wave height levels.

49 CFR 193.2067 requires LNG facilities to be designed to withstand 150 mph sustained winds without loss of structural or functional integrity. All critical structures, including storage tanks, in the proposed Creole Trail LNG facility are designed to meet this wind speed design requirement.

4.12.3 Storage and Retention Systems

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

- Single containment cylindrical metal tanks (predominately used in the U.S. and proposed by Creole Trail LNG);
- Spherical storage tanks (predominately used in LNG carriers);
- Double containment cylindrical metal inner tank and metal or concrete outer tank (commonly thought of as an LNG tank with a high wall dike);
- Full containment cylindrical metal inner tank and metal or concrete outer tank (two authorized by the Commission; several applications currently proposed to the Commission);
- Prestressed cylindrical concrete tank with an internal metal membrane (membrane tank); there are none in the U.S.; and
- Cryogenic cylindrical concrete tank; internal cryogenic tank and prestressed concrete outer tank (one operational in the U.S.; the remainder worldwide).

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

H.1 Single containment tank

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

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

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

H.3 Double containment tank

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

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

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

H.4 Full containment tank

A tank designed and constructed so that both self supporting primary container and the secondary container are capable of independently containing the refrigerated liquid stored and for one of them its vapor. The secondary container can be a distance of 3 to 6 feet (1 to 2 meters) from the primary container.

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

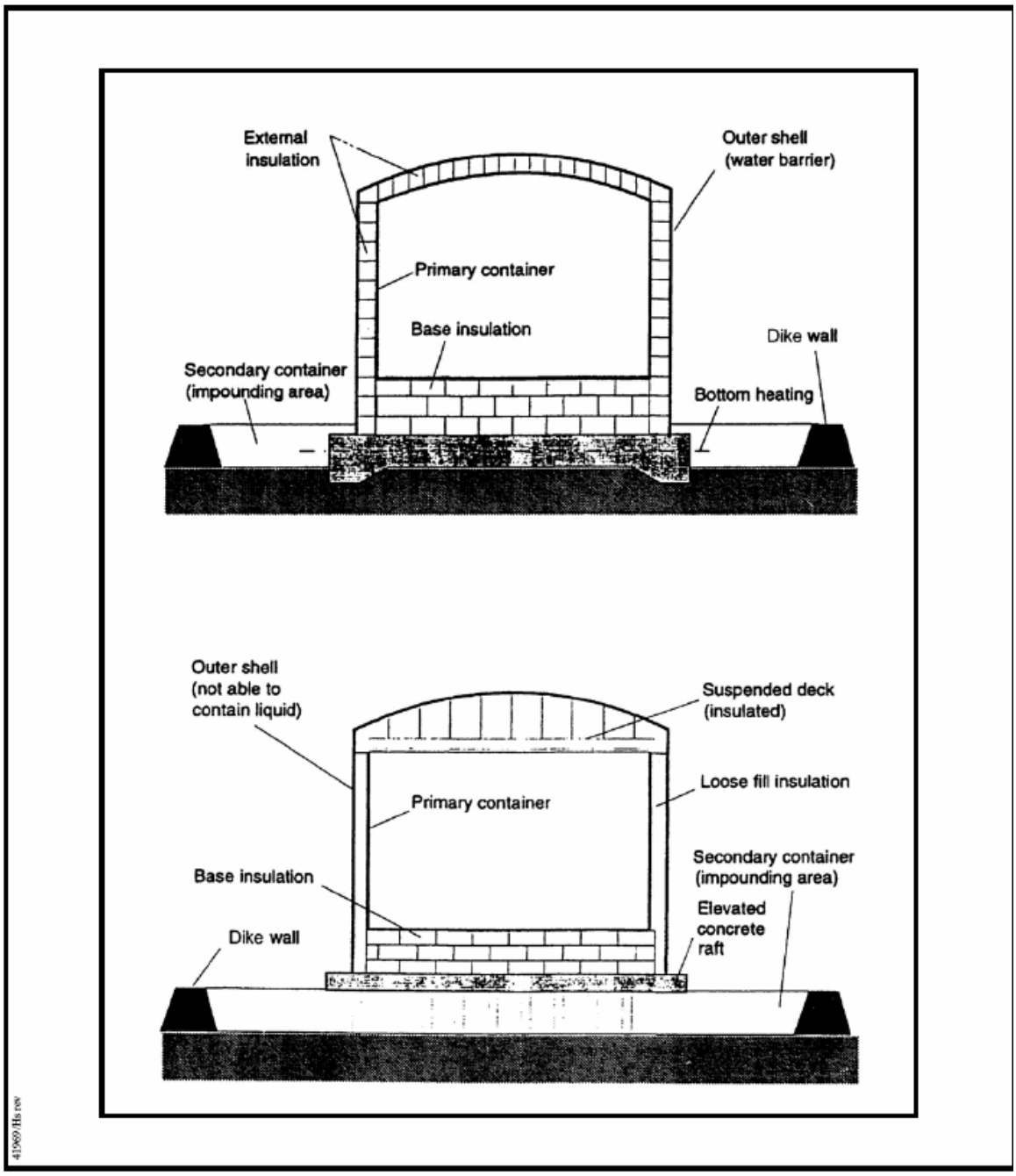

Figure H.1 Examples of Single Containment Tanks

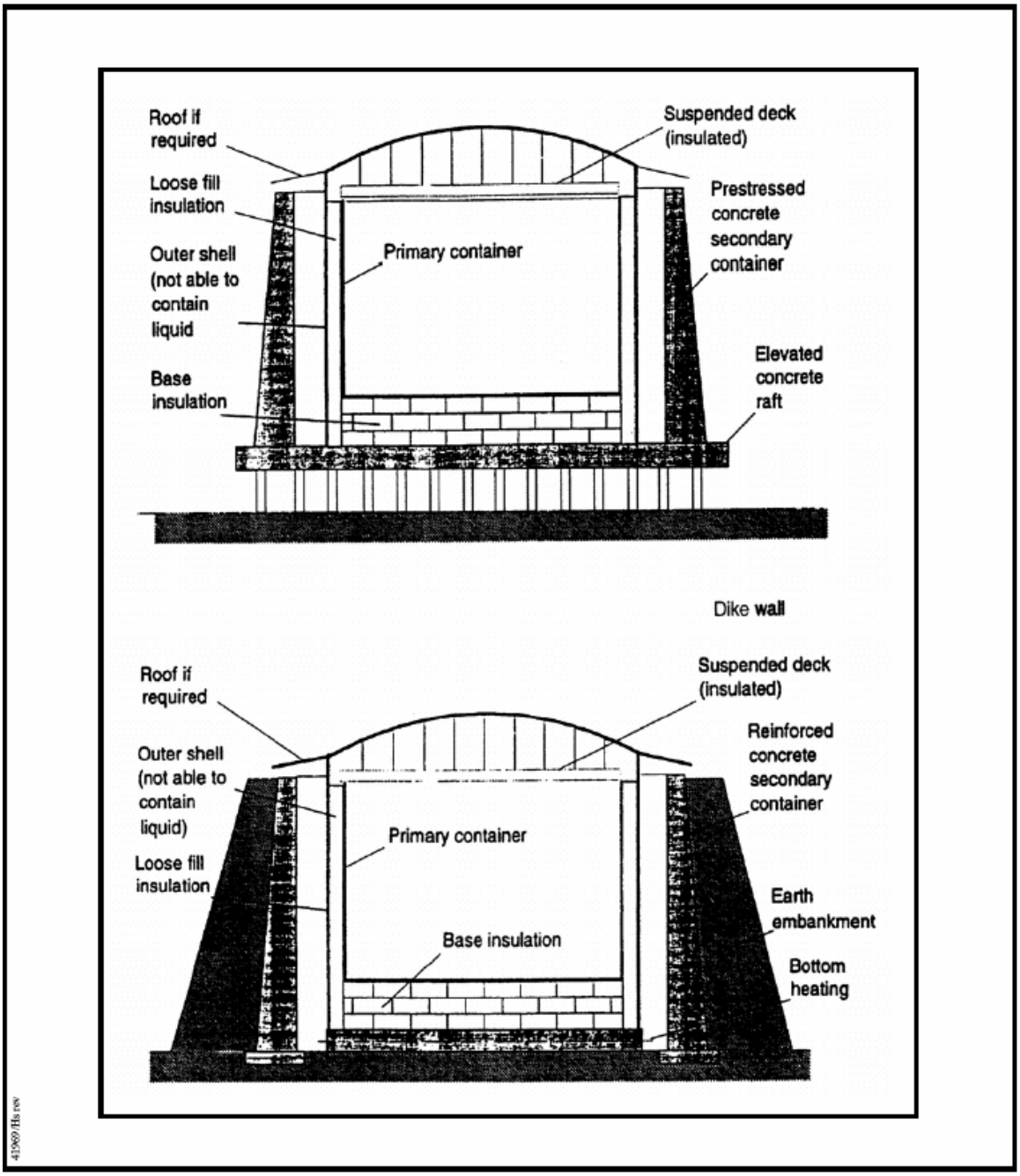

Figure H.3 Examples of Double Containment Tanks

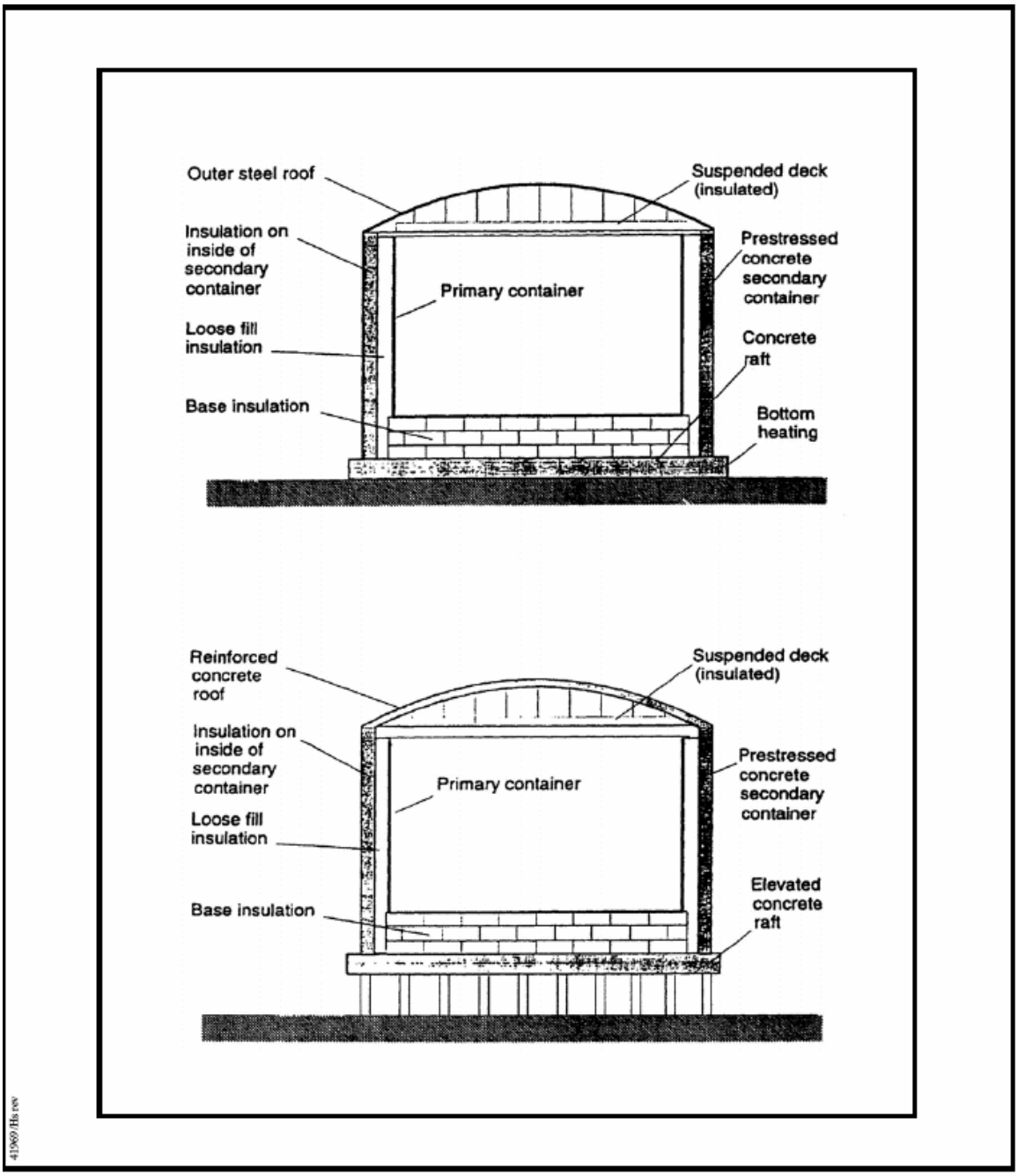

Figure H.4 Examples of Full Containment Tanks

Single-, double-, and full-containment LNG storage tanks have been authorized by the Commission for use at new LNG import facilities or expansions of existing terminals; and single- and double-containment tanks have been constructed and operated. Several full-containment tanks have started construction in the U.S., while approximately 50 have been constructed world wide.

We are not declaring a preference over any of the six tank designs (or other variations of the six) and/or which tank designer is better at designing and constructing LNG storage tanks. The applicant (Creole Trail LNG) proposes to install single containment tanks with individual earthen impoundment dikes surrounding each tank.

4.12.4 Siting Requirements – Thermal and Dispersion Exclusion Zones

4.12.4.1 Regulatory Requirements

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

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

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

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

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

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

- Four 1,006,400-barrel (160,000 m^3) LNG storage tanks - Parts 193.2057 and 2059 require the establishment of thermal and flammable vapor exclusion zones for LNG tanks. NFPA 59A section 2.2.3.2 specifies four thermal exclusion zones based on the design spill and the impounding area. NFPA 59A sections 2.2.3.3 and 2.2.3.4 specify a flammable vapor exclusion zone for the design spill which is determined with section 2.2.3.5.

- Two marine unloading berths and a cargo transfer system consisting of (for each berth) three 20-inch-diameter liquid unloading arms (one of which could be used for liquid or vapor), one 20-inch vapor return arm, and two 30-inch-diameter transfer lines - Parts

193.2001, 2057, and 2059 require thermal and flammable vapor exclusion zones for the transfer system. NFPA 59A does not address LNG transfer systems.

- Twelve 4,304 gpm in-tank pumps (three per tank) and twenty-one 1,635 gpm LNG booster pumps - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A section 2.2.3.2 specifies the thermal exclusion zone and sections 2.2.3.3 and 2.2.3.4 specify the flammable vapor exclusion zone based on the design spill determined by section 2.2.3.5.

- Twenty-one submerged combustion vaporizers - Same requirements as for LNG pumps.

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

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

The incorporation of NFPA 59A also changed the way in which design spills and impoundment capacities may be determined. Under section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume during a 10-minute period from any single accidental leakage source or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the authority having jurisdiction. Similar criteria appear in section 2.2.3.3 for determining the design spill used in thermal and flammable vapor exclusion zone calculations. Prior to the incorporation of NFPA 59A, the design spill in Part 193 assumed the rupture of a single transfer pipe with the greatest overall flow capacity, for not less than 10 minutes (old Part 193.2059(d)). As a result, the spill rate for vaporization, process, or LNG transfer areas may be assumed to be a "leakage source" rather than a full pipe rupture; however, the spill duration must be 10 minutes unless the authority having jurisdiction, i.e., DOT Office of Pipeline Safety (OPS), determines that a shorter time is acceptable. Again, given the confusion in applying the two requirements, FERC staff will continue to utilize the 10-minute spill criteria at the maximum flow possible for containment sizing. This will ensure that impoundments are sized for a catastrophic failure, while recognizing that less conservative spill scenarios may be appropriate for exclusion zone calculations. In giving recognition to the integrity of all-welded transfer piping, the determination of the single accidental leakage source should be based on an evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment, in order to determine the largest spill rate. This approach is the result of discussions with DOT OPS concerning the basis for design spills and application to exclusion zone determinations for proposals before the Commission.

4.12.4.2 Impoundment Systems and Design Spills

The calculations of thermal and flammable exclusion zones for the proposed LNG facilities are based on the dimensions of the proposed impoundment systems and the spill volumes specified by Part 193 and NFPA 59A.

Part 193.2181 specifies that the impoundment system serving a single LNG storage tank must have a volumetric capacity of 110 percent of the LNG tank's maximum liquid capacity. Creole Trail LNG proposes a single containment design for the LNG storage tanks in which each tank would be surrounded by an earthen dike to form the required impoundment, sized to contain 110 percent of the volume of the tank. The proposed dikes are to be square dikes with a bottom inside edge of 555 feet and a top inside edge of 592 feet. FERC staff calculated that the dike volume with these dimensions is only 106 percent of the nominal 160,000 m^3 (42,267,536 gallons) of tank capacity and only 98 percent of the maximum liquid capacity of the tank (172,537 m^3 or 45,579,578 gallons). Therefore, **we recommend that:**

- **Creole Trail LNG should demonstrate that the tank impoundment volume is at least 110 percent of the maximum liquid volume of the tank. All thermal radiation and flammable vapor exclusion zones related to resized dikes or impoundments should be recalculated. This information should be filed with the Commission <u>prior to initial site preparation</u>.**

All potential LNG spills from piping to and from the LNG storage tanks and the piping serving the vaporization, process, and LNG transfer areas would be collected by a series of spill collecting troughs installed beneath all the LNG piping.

The design spill for an LNG storage tank with no penetrations below the liquid level is determined in accordance with section 2.2.3.5 of NFPA 59A and is defined as the largest flow from any single line that could be pumped into the impounding area with the tank withdrawal pumps considered to be operating at full rated capacity over a 10-minute period. This design spill is used for impoundment sizing and the determination of exclusion zones for the tank area sumps. Creole Trail LNG proposes to equip each LNG storage tank with three in-tank pumps, individually rated for 4,304 gpm. The rupture of the in-tank pump discharge header would thus result in a spill rate of 12,912 gpm. For a 10-minute spill, the volume would be 129,120 gallons. This spill would be contained by one of four LNG tank dike sumps located in each tank dike, each of which would measure 60 feet by 60 feet with a useable depth of 20 feet (538,600 gallons). The volume of each sump, which need only accommodate the design spill described above, was designed to also accommodate a 10-minute spill resulting from the rupture of a 30-inch-diameter marine transfer line at the maximum unloading rate, a spill of 528,340 gallons.

NFPA 59A section 2.2.1.2 specifies that transfer areas for LNG shall be provided with impoundments in a manner that minimizes the possibility of accidental spills and leaks that could endanger important structures, equipment, or adjoining property. The Creole Trail LNG facility would include a marine transfer sump located just west of the unloading lines between the tank impoundment and the two berths. The impoundment is designed to accommodate a spill of the combined unloading line at full rate. The dimensions of the marine transfer sump would be 60 feet by 60 feet by 20 feet deep. This corresponds to a volume of 538,600 gallons which can contain a 10-minute spill with mass flowrate of 53,860 gpm. For the exclusion zone design spill, FERC staff notes Creole Trail LNG is required by NFPA 59A section 2.2.2.2 to consider a spill from any single accidental leakage source. Although Creole Trail LNG has chosen the full unloading rate as a worse case scenario, FERC staff considers the rupture of the 6-inch-diameter LNG recirculation line to be the single accidental leakage source and has

considered the design spill from this line for purposes of regulatory compliance. The design spill rate from the 6-inch-diameter line is 13,536 gpm.

The Creole Trail LNG facility would also include a process area sump located east of the vaporizers having dimensions of 25 feet by 25 feet by 20 feet deep (93,510 gallons). This sump is sized to accommodate a spill from a sendout line with a rate of 9,350 gpm. For the exclusion zone design spill from an accidental leakage source, FERC staff has considered a break in the 6-inch minimum flow recycle line for a sendout pump which would be contained by this sump. The design spill rate from this line is 1,580 gpm.

Table 4.12.4-1 presents the impounding areas and spill size volume for each of the 10-minute full-flow spills.

TABLE 4.12.4-1

Impoundment Areas

Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
Impoundment Sizing:			
LNG Storage Tanks	45,579,578	LNG Tank Dike	44,825,069
In-tank LNG Pumps	129,120	LNG Tank Dike Sump	538,600
Marine Transfer System	528,340	Marine Transfer Sump	538,600
Process Area	15,780	Process Area Sump	93,510
Exclusion Zone Design Spills:			
In-tank LNG Pumps	129,120	LNG Tank Dike Sump	538,600
Marine Transfer System	135,364	Marine Transfer Sump	538,600
Process Area	15,780	Process Area Sump	93,510

Thermal Exclusion Zone

If a large quantity of LNG is spilled in the presence of an ignition source, the resulting LNG pool fire could cause high levels of thermal radiation. Exclusion distances for various flux levels were calculated according to 49 CFR 193.2057 and section 2.2.3.2 of NFPA 59A, using the "LNGFIRE III" computer program model developed by the Gas Research Institute. Thermal radiation distances were determined for 1,600 to 10,000 British thermal units per square foot per hour (Btu/ft^2-hr) incident flux levels for a fire from the full impoundment area surrounding the tank. In addition, the thermal radiation distances were also determined for 1,600 Btu/ft^2-hr incident flux levels centered on the LNG tank dike sump, the marine transfer sump, and the process area sump.

NFPA 59A establishes certain atmospheric conditions (0 mph wind speed, 70°F, and 50 percent relative humidity) which are to be used in calculating the distances. However, Part 193.2057 supersedes these requirements and stipulates that wind speed, ambient temperature, and relative humidity which produce the maximum exclusion distances must be used, except for conditions that occur less than 5 percent of the time based on recorded data for the area. For its analysis, Creole Trail LNG selected the following ambient conditions to produce the maximum distances: wind speed of 27.6 mph; ambient temperature of 35°F; and 60 percent relative humidity. These conditions yield longer distances than the 0 mph wind speed, 70°F ambient temperature, and 50 percent relative humidity specified in NFPA 59A. FERC staff agrees with Creole Trail LNG's selection of atmospheric conditions with the exception that 50 percent relative humidity was used in the Staff's analysis.

FERC staff calculated thermal radiation distances for incident flux levels ranging from 1,600 to 10,000 Btu/ft^2-hr for an LNG storage tank dike fire. The top inside dike dimensions of 592 feet by 592

feet was used as the pool fire dimensions. Target height was set at ground level (0 feet). Thermal radiation distances were also determined for 1,600 Btu/ft^2-hr incident flux levels centered on the LNG tank dike sump, the marine transfer sump, and the process area sump.

Table 4.12.4-2 presents the calculated maximum distances for incident flux levels ranging from 1,600 to 10,000 Btu/ft^2-hr as calculated by FERC staff. The 1,600 Btu/ft^2-hr thermal radiation zones are all within the property boundaries. Therefore, the Creole Trail LNG Project meets the requirements of section 2.2.3.2 of NFPA 59A and 49 CFR 193.2057.

TABLE 4.12.4-2

Thermal Exclusion Zones

Source	Exclusion Area NFPA 59A Section 2-2.3.2(a)	Incident Flux (Btu/ft^2-hr) [a]	Exclusion Zone (feet)
LNG Tank Dike	Outdoor assembly area occupied by 50 or more people.	1,600	1,982
LNG Tank Dike	Offsite structures used for occupancies or residences.	3,000	1,640
LNG Tank Dike	Property line that can be built upon.	10,000	1,183
LNG Tank Dike Sump	Property line that can be built upon.	1,600	322
Marine Transfer Area Sump	Property line that can be built upon.	1,600	322
Process Area Sump	Property line that can be built upon.	1,600	137

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

Vapor Dispersion Zone

A large quantity of LNG spilled without ignition would form a flammable vapor cloud that would travel with the prevailing wind until it either dispersed below the flammable limits or encountered an ignition source. Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A and Part 193.2059 require that provisions be made to minimize the possibility of flammable vapors from reaching a property line that can be built upon and that would result in a distinct hazard. Part 193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (1/2 the lower flammability limit [LFL] of LNG vapor) under meteorological conditions which result in the lowest 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 an average regional temperature of 68.6°F. The section allows the use of the DEGADIS Dense Gas Dispersion Model, or the FEM3A model, to compute dispersion distances. Design spills into impounding areas serving LNG containers, transfer systems, and piping are to be determined in accordance with section 2.2.3.5 of NFPA 59A.

Creole Trail LNG's application contained a vapor dispersion analysis for the LNG spill containment sump and the troughs in the marine transfer area, LNG tank area, and the process area which all drain into the LNG spill containment sump. An average regional temperature of 68.6°F, 50 percent relative humidity, and 4.5 mph wind speed were used as input conditions. FERC staff used the same atmospheric parameters for its determination of exclusion zone distances.

The design spill for an LNG storage tank with no penetrations below the liquid level is determined in accordance with section 2.2.3.5 of NFPA 59A and is defined as the largest flow from any single line that could be pumped into the impounding area with the tank withdrawal pumps considered to

operating at full rated capacity over a 10-minute period. The impounding area for the LNG tanks would be one of the four LNG tank dike sumps located in each tank dike. While Creole Trail LNG has chosen a design spill based on the rupture of one of the 36-inch-diameter transfer lines, FERC staff based its analysis on the rupture of the withdrawal pump header in accordance with regulations. Such a spill would equal a rate of 12,912 gpm, which after 10-minutes would result in a spill of 129,120 gallons. FERC staff calculated a distance of 770 feet to the 2.5 percent average gas concentration isopleth. Based on this distance, the flammable vapor exclusion zone associated with the LNG tank dike sump would remain on-site.

As discussed earlier, Creole Trail LNG designed the process area sump and marine area sump to accommodate spills much larger than those specified by regulations. Creole Trail LNG also performed hazard analysis calculations for the determination of exclusion zones on these larger design spills. While acknowledging the merits of such a design basis, FERC staff performed the vapor dispersion analysis for these sumps based on spills from smaller lines which it considered to be a more likely accidental leakage source. Thus, for the marine area sump FERC staff calculated a distance of 781 feet to the 2.5 percent average gas concentration isopleth. Based on this distance, the flammable vapor exclusion zone associated with this sump would remain on-site. For the process area sump, FERC staff calculated a distance of 366 feet to the 2.5 percent average gas concentration isopleth. Based on this distance, the flammable vapor exclusion zone associated with this sump would also remain on-site.

Another issue is the lengthy distance from potential spill locations to the marine transfer sump. While it is an appropriate design philosophy to direct potential spills away from process equipment to remote impoundments, and it is technically correct to base exclusion zone calculations on these impoundments, it is also relevant to consider the control of vapors produced in the channels or trenches leading to the sump. Long trenches increase the surface area available for heat transfer and, correspondingly, increase vapor generation. A number of vapor control options are available including: vapor fencing; fixed high expansion foam generators; reduced trench lengths and/or surface area; and additional sumps at intermediate locations along transfer piping. As a result, **we recommend that:**

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

4.12.5 Marine Safety[8]

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

The hazards associated with the marine transportation of LNG differ from land-based hazards. Whereas the land-based facilities have features to both limit the duration of LNG spills and contain

[8] This section was written with the cooperation and assistance of the Coast Guard, Marine Safety Unit Lake Charles.

credible spill volumes, an LNG spill on water may be unconfined and would vaporize rapidly due to heat input from the water.

The history of LNG shipping has been free of major incidents, and none have resulted in significant quantities of cargo being released (see section 4.12.5.4, *History*). No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargoes being released. However, the possibility of an LNG spill from a ship over the duration of the proposed project must be considered. Historically, the events most likely to cause a significant release of LNG were a ship casualty such as:

- a vessel colliding with an LNG ship in transit;
- an LNG ship alliding[9] with the terminal or a structure in the Calcasieu Ship Channel;
- a vessel alliding with an LNG ship while moored at the terminal; or
- a grounding sufficiently severe to puncture an LNG cargo tank.

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

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

Any of the above events would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. Previous incidents with LNG ships have primarily involved grounding, and none of these have resulted in the breach of the double hull and subsequent release of LNG cargo.

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

LNG Vessels and Ocean Voyage

Imported LNG could be obtained from exporting terminals throughout the world and delivered by LNG ships to the proposed terminal. Exporting countries include Algeria, Australia, Brunei, Indonesia, Malaysia, Nigeria, Oman, Qatar, Trinidad, and United Arab Emirates. In 2003, LNG imports to the United States included: 72 percent from Trinidad, 12 percent from Nigeria, 10 percent from Algeria, 3 percent from Qatar, 2 percent from Oman, and 1 percent from Malaysia.

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

In 1993, amendments to the IMO's Code for the Construction and Equipments of Ships Carrying Dangerous Chemicals in Bulk require all tankers to have monitoring equipment with an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a cargo tank. In

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

addition, the cargo tanks are heavily instrumented, with gas detection equipment in the hold and inter-barrier spaces, temperature sensors, and pressure gauges. Fire protection must include the following systems:

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

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

For the ships, these requirements include:

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

For the port facilities, the requirements must include:

- Port facility security plan;
- Facility Security Officer (FSO); and
- Certain security equipment may be required to maintain or enhance the physical security of the facility.

Both ships and ports must include the following:

- Monitoring and controlling access;

- Monitoring the activities of people and cargo;
- Ensuring security communications and that they are readily available; and
- Completion of the Declaration of Security.

LNG Ship Transit in the Calcasieu Ship Channel

The Port of Lake Charles, located in the southwestern part of Louisiana, encompasses an area of 203 square miles located entirely within Cameron and Calcasieu Parishes. The Port's waterfront facilities are located along both sides of the Calcasieu Ship Channel. Waterfront facilities are also located along the lower portion of the Calcasieu Ship Channel at Hackberry, along Black Lake Bayou, and at Cameron in Cameron Parish.

The Calcasieu Ship Channel is 68.2 statute miles long from the entrance at the "CC" Buoy in the Gulf of Mexico to the end at Lake Charles near Interstate 10. The offshore Bar Channel is 32.2 miles from the "CC" Buoy to the jetties at MP 0. An 800-foot-wide channel for deep draft vessels is maintained in this segment. The inland portion from MP 0 to MP 36 consists of a Lower Reach, a Middle Reach, and an Upper Reach. A 400-foot-wide channel is maintained in this segment. The Calcasieu Ship Channel provides the only path for most vessels to reach the Port of Lake Charles and terminals at Hackberry and Cameron. Shallow draft barge traffic also utilizes the Gulf Intracoastal Waterway which provides a direct link between Port Arthur, Texas and New Orleans, Louisiana.

The proposed Creole Trail LNG marine terminal would be located on the west side of the Lower Reach of the Calcasieu Ship Channel at about MP 3. There are currently no major ports or facilities on the channel between the proposed LNG facility and the Gulf of Mexico.

All large ships entering the Calcasieu Ship Channel are boarded by a pilot(s) from the Lake Charles Pilots at one of four areas along the Bar Channel in the Gulf of Mexico depending on vessel draft. In general, vessels drafting over 35 feet are boarded at the "CC" Buoy in the Gulf of Mexico. The pilot(s) then directs the entire voyage through the approach channels in the Gulf and the Calcasieu Ship Channel to the proposed marine terminal. The vessel master would be on the bridge monitoring the pilot's commands and would retain overall responsibility for the safe navigation of the LNG ship. The Coast Guard may have a security boarding team onboard before and during the transit based on the current threat and risk. Other security measures during the transit would be in accordance with the measures determined in the Waterway Suitability Assessment and as required by the Coast Guard.

Creole Trail has committed to providing three tractor tugs for operations at the terminal. A *Vessel Maneuvering Simulation Study for the Creole Trail LNG Terminal, Cameron, LA* (Vessel Maneuvering Study) conducted by Waterway Simulation Technology, Inc. recommends that at least three 60-ton bollard pull tugs be provided. Lake Charles Pilots have indicated that the tugs would need to be rated at approximately 6,000 hp/70 tons of bollard pull to accommodate the larger vessels that might call on the LNG terminal. Creole Trail would determine the required power ratings for the tugs in consultation with the Pilots during the design process.

Unless specified by the charter, tugs would meet the ship at a predetermined location and help turn and berth the LNG ship. Creole Trail's three dedicated tugs would aid in the straightening and slowing of the LNG ship as it passes through the jetties and maneuvers into the berth.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, in addition to the Lake Charles Pilots, the Coast Guard would monitor the transit of the LNG vessel through

the channel and while unloading cargo. The Coast Guard currently exercises control over LNG vessels transiting the Calcasieu River ship channel through enforcement of a Regulated Navigation Area (RNA) promulgated in 33 CFR 165.805. It is expected that controls placed on LNG transits to and from the proposed Creole Trail LNG terminal would at a minimum reflect requirements contained in the current RNA. Typical Coast Guard requirements for other LNG import terminals include 96- and 24-hour advance notification of the vessel arrival at which time Coast Guard personnel may board the LNG vessel offshore for an inspection of the ship safety systems and a security sweep. Other Coast Guard requirements may include: establishment of a moving safety zone around the vessel while en route, a fixed security zone around the vessel during unloading operations; an inspection of the dock safety systems prior to commencing cargo transfer; and monitoring all operations until the vessel departs. Maintaining security of the dock and vessel would be the responsibility of the facility in cooperation with other federal, state, and local agencies as described in the Facility Security Plan (see section 4.12.6).

LNG Vessel Casualties

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the operational controls that would be imposed by the Coast Guard and the Lake Charles Pilots, as well as the characteristics of the Calcasieu Ship Channel, would minimize the possibility of an LNG cargo spill from groundings, collisions, and allisions. The Coast Guard would enforce a moving safety zone around the LNG ship that would clear the channel of all vessels in the vicinity of the LNG ship to reduce the likelihood of collisions, including those of the tonngage and speed required to cause an LNG spill (see section 4.12.5.4). The Calcasieu Bar Channel extends about 28.1 miles seaward from the entrance jetties and is maintained at a width of 800 feet and a depth of 42 feet. However, the channel is often deeper at this point due to scouring from the river. From the entrance jetties to Calcasieu Lake, the channel width is maintained at 400 feet and the depth is maintained at 40 feet. The generally even and soft sea bottom (without rocky protrusions) of the Calcasieu Ship Channel makes an LNG spill from cargo tanks highly unlikely in a grounding incident.

To minimize the potential of a transiting ship alliding with LNG ships moored at the berths at the proposed LNG terminal, the Vessel Maneuvering Study included disabled ship tests. The simulation study found that the primary cause of a disabled ship entering into the LNG terminal basin was a total and unrecoverable failure of engine loss and jammed rudder. The study indicated that this type of “double jeopardy” failure is highly unlikely. In addition to the double jeopardy failure, the worst currents and wind conditions were used during the disabled ship tests. The study also found that the location of the disabled ship when the failure occurs is critical to whether it can enter the terminal basin, including whether the disabled ship is on the centerline or near the western edge of the navigation channel. The study recommended the establishment of a day mark and a set of lighted range markers at specified locations, opening and maintaining the flare on the northern cut into the basin in case of shoaling in this area, the provision of three tugs, and pre-operation training for pilots. As stated above, Creole Trail has committed to providing three dedicated tugs.

Deliberate Attack on an LNG Vessel

In addition to addressing the potential hazards from LNG vessel casualties, the possibility of a deliberate attack on an LNG ship by a terrorist group must also be considered. Security of the LNG vessel would be the responsibility of the owner/operator and the master of the vessel. Security of the LNG facility would be the responsibility of the owner/operator of the facility. Protection of the LNG vessel and the import terminal would involve personnel from the Coast Guard, Creole Trail’s security staff and state and local law enforcement. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard would establish a moving safety zone around the LNG vessels in

transit and a security zone around the LNG vessels while docked. Only personnel or vessels authorized by the COTP or the District Commander would be permitted in the safety/security zone.

Creole Trail would provide security for the marine terminal according to a Facility Security Plan that must be prepared under 33 CFR Part 105. This plan would need to be approved by the Coast Guard and COTP (see section 4.12.6). The requirements of this plan may include:

- a Facility Security Assessment to identify site vulnerabilities, possible security threats, consequences of an attack, and facility protective measures;
- a Facility Security Plan with procedures for responding to security incidents;
- a designated FSO responsible for implementing and periodically updating the Facility Security Plan and Assessment;
- scalable security measures to provide increasing levels of security at increasing Maritime Security (MARSEC) levels;
- security exercises at least once each calendar year and drills at least every 3 months; and
- mandatory reporting of all breaches of security and security incidents.

Security at the facility would be provided by both active and passive systems. The entire site would be surrounded by a protective enclosure (i.e., a fence) with sufficient strength to deter unauthorized access. The enclosure also would be illuminated with not less than 2.2 lux between sunset and sunrise with high-pressure sodium type lighting for all outdoor locations. These areas include the process area equipment, access roadway, tank stairways, roof platforms, building exterior, and jetties. Intrusion detection systems and day/night camera coverage would identify unauthorized access. A separate security staff would conduct periodic patrols of the plant, screen visitors and contractors, and assist in maintaining security of the marine terminal during cargo unloading. Creole Trail has contacted the COTP regarding their Facility Security Plan. Creole Trail would be required to submit its Facility Security Plan to the COTP for approval 60 days prior to commencement of operations. In order to ensure that the responsibilities of Creole Trail's security staff enhance overall security, **we recommend that:**

- **Prior to commissioning, Creole Trail should coordinate, as needed, with the Coast Guard to define the responsibilities of Creole Trail's security staff in supplementing other security personnel and in protecting the LNG ships and the terminal.**

The Department of Energy (DOE) has released a study by Sandia National Laboratories entitled, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water* (Sandia Report) in December 2004. The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 square meters cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 square meters. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 square meters, which is a more appropriate range to use in calculating potential hazards from spills. These hole sizes are equivalent to circular hole diameters of 2.5 and 3 meters. In addition, a *Threat Analysis for Public Safety* was prepared by Project Technical Liaison Associates, Inc. for the Creole Trail LNG Project. These analyses provide a

basis for estimating the potential magnitude of a hazard from a successful terrorist attack, and for developing LNG vessel and waterfront security plans.

The FERC commissioned a study by ABSG Consulting Inc. (ABSG) to search and review the literature on experimental LNG spills and on consequence methodologies that are applicable to modeling incidents of LNG spills on water. The methodology described in the ABSG study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, and revised in staff's responses to comments on the report (issued June 18, 2004), was used to calculate the thermal radiation and flammable vapor dispersion distances for several holes ranging in diameter from 1 meter to 3.9 meters. Using the methodology, we have estimated distances for a nominal 2.5-meter and 3-meter diameter hole to range from 4,182 to 4,652 feet for a thermal radiation of 1,600 Btu/ft^2-hr, the level which is hazardous for persons located outdoors and unprotected; from 3,232 to 3,591 feet for 3,000 Btu/ft^2-hr, an acceptable level for wooden structures; and from 1,934 to 2,143 feet for 10,000 Btu/ft^2-hr, a level sufficient to damage process equipment for these size holes respectively.

These intentional breach scenarios provide guidance to the Coast Guard in developing the operating restrictions for LNG vessel movements in the Calcasieu Ship Channel, as well as in establishing potential impact areas for emergency response and evacuation planning. Except for the 3-mile transit through the Calcasieu Ship Channel to the LNG berth, the transit would be in the open waters of the Gulf of Mexico. Within 4,652 feet of the Calcasieu Ship Channels are low density permanent residences in the community of Cameron, Louisiana. Outdoor public use areas within 4,652 feet include the Cameron Ferry (Louisiana Route 27), Monkey Island, and St. John's Island. Assuming an LNG vessel transit through the channel between 3 and 8 knots, these areas would be exposed to a potential transient hazard of less than 20 minutes. In addition, a temporary hazard would exist around the slip during part of the 18-hour period while the LNG vessel is at the dock and unloading cargo.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the operational restrictions that would be imposed by the Lake Charles Pilots on LNG vessel movements through this area, as well as the requirements that the Coast Guard would impose in its *Liquefied Natural Gas Vessel Management and Emergency Plan* (see section 4.12.5.2) would minimize the possibility of a hazardous event occurring along the vessel transit.

Emergency Response and Evacuation Planning

Prior to commencing operations, Creole Trail would be required to prepare emergency procedures manuals, as required by 49 CFR Part 193.2509 that provide for: (a) responding to controllable emergencies and recognizing an uncontrollable emergency; (b) taking action to minimize harm to the public including the possible need to evacuate the public; and (c) coordination and cooperation with appropriate local officials. Specifically, Section 193.2059(b)(3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…"

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

On several LNG import terminal proposals, a number of organizations and individuals commented on the need to consider emergency response procedures. Subsequently, section 3A(e) of the NGA, added by section 311 of the Energy Policy Act of 2005, stipulated that in any order authorizing an

LNG terminal the Commission shall require the LNG terminal operator to develop an Emergency Response Plan in consultation with the Coast Guard and state and local agencies. The FERC must approve the Emergency Response Plan prior to any final approval to begin construction. Therefore, we recommend that**:**

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

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

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

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

  d. evacuation routes/methods for residents of Cameron and other public use areas that are within any transient hazard areas;

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

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

  The Emergency Response Plan should be filed with the Secretary for review and written approval by the Director of OEP prior to initial site preparation. Creole Trail should notify FERC staff of all planning meetings in advance and should report progress on the development of its Emergency Response Plan at 3-month intervals.

FERC has also received comments on other LNG terminal proposals expressing concern that the local community would have to bear some of the cost of ensuring the security and emergency management of the LNG facility and the LNG vessels while in transit and unloading at the berth. In addition, section 3a(e) specifies that the Emergency Response Plan shall include a Cost-Sharing Plan that contains a description of any direct cost reimbursements the applicant agrees to provide to any state and local agencies with responsibility for security and safety at the LNG terminal and near vessels that serve the facility. To allow the FERC an opportunity to review the plan, **we recommend that:**

- **The Emergency Response Plan should include a Cost-Sharing Plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. In addition to the funding of direct transit-related security/emergency management costs, this comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. The Cost-Sharing Plan should be filed with the Secretary for review and written approval by the Director of OEP prior to initial site preparation.**

4.12.5.1 Calcasieu Ship Channel

The Calcasieu Bar Channel, which extends about 28.1 miles seaward from the entrance jetties, is maintained at a width of 800 feet and a depth of 42 feet. However, the channel is often deeper at this point due to scouring from the river. From the entrance jetties to Calcasieu Lake, the channel width is maintained at 400 feet and the depth is maintained at 40 feet. However, the heavy flow from Calcasieu Lake and the Calcasieu River has scoured out the channel bed and actual depths are about 50 feet. The Lower Reach is one segment of the Calcasieu Ship Channel and is approximately 5 miles long from the shoreline on the Gulf of Mexico to the southern edge of Calcasieu Lake. The Creole Trail LNG terminal would be situated at about milepost 3 of the Lower Reach at the confluence of the East and West Branches of the Calcasieu River, immediately south of the lake. The combined flows from the river and the lake have created a deep hole immediately in front of the LNG terminal marine basin. The hole is almost 90 feet deep, and the depth for most of the width of the channel on either side of the hole is 50 feet or more.

The proposed marine basin, which would consist of two ship berths and a maneuvering basin, would be dredged to a minimum depth of 45 feet below MLG. The basin would be sized to accommodate LNG carriers with capacities up to 250,000 m^3.

Current Ship Traffic

Imports and exports moving through the Port of Lake Charles from both private and public shippers include: petrochemicals; LNG; fish oil; synthetic rubber; salt; seafood; bulk product including coke, cement, rock, and grain; wood products, roll on-roll off shipments, and passenger vessels.

A report entitled, *Vessel Traffic Congestion Study for the Calcasieu River Waterway Corridor* was prepared by Lanier and Associates in May 2005. Between 1998 and 2004, an average of 1,005 deep-draft vessels called on the various facilities in the Port of Lake Charles. The types of cargo vary and include general cargo, petroleum crude, refined petroleum and petrochemical products, bulk petroleum products, bulk ore, bulk grain, and LNG. The total of 1,091 vessels in 1998 represents the peak number of vessels in recent years; a total of 929 vessels called on the port in 2004. Twelve port facilities were responsible for 94 percent of the deep-draft vessel traffic generated along the Calcasieu Ship Channel in 2004. The four facilities with the largest percentage of traffic included:

- CITGO Refinery – 199 vessels (21 percent);
- CITGO, Clifton Ridge Terminal – 132 vessels (14 percent);
- ConocoPhillips, Clifton Ridge Terminal – 123 vessels (13 percent); and
- The Port of Lake Charles, General Cargo Docks No. 1 through 10 and 15 – 100 vessels (11 percent).

In addition to ship traffic, there are a number of facilities that handle heavy offshore equipment, drilling rigs, and other large vessels that potentially affect ship traffic movements. Among these are Global Industries, Halter Marine, Unifab, Dunham Price, and Tesaro. The total traffic generated by these facilities represents about 3 percent of current ship traffic volume, or 30 vessels in 2004. Pleasure craft may be congregated outside of the entrance jetties, but are not usually present within the channel between the jetties and the proposed LNG terminal site. Commercial shrimp boats sometimes work in the jetty area as well.

Future Ship Traffic

Three of the facilities in the Port of Lake Charles are forecasting major expansions or the introduction of new businesses. These include the CITGO Refinery, the Port of Lake Charles, and the Trunkline LNG terminal. The CITGO expansion would increase inbound crude tanker traffic by 60 to 64 ships per year, or about 5 ships per month, for an increase of 6 percent to the total ship traffic on the Calcasieu Ship Channel. The Port of Lake Charles is marketing its operational facilities at Lake Charles. The increase of ship traffic calling on its ports can be expected to continue at a rate similar to the past 4 years. Trunkline LNG is expanding its facility to accommodate additional LNG shipments. Trunkline currently handles 60 to 100 vessels per year, and this is expected to increase to about 225 ships per year after the expansion. The ConocoPhillips refinery expects its future ship traffic to be closer to levels that occurred in 2000 when 132 vessels called on its Clifton Ridge Terminal and 48 vessels called on its Westlake Refinery. The approved Cameron LNG terminal would be capable of handling 190 vessels per year when it begins operation in 2008. The Lanier and Associates report notes that the number of ships serving this facility may be fewer (about 130 per year) in the future when larger LNG vessels begin operating. Creole Trail anticipates that the proposed Creole Trail LNG terminal would receive 300 to 400 LNG ships per year.

Calcasieu Ship Channel Capacity

There are a number of factors that influence the movement of ship traffic in the Calcasieu Ship Channel. These include:

- ***Facility Location*** – The Creole Trail LNG terminal would be located at milepost 3 of the Calcasieu Ship Channel, which is approximately 15 miles downstream from the nearest LNG facility (Cameron LNG), currently under construction. Therefore, the Creole Trail LNG terminal would present the shortest distance at roughly 35.2 miles above the "CC" Buoy if it commences operation and the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic.

- ***Channel Transit Time*** – Transit time for vessels maneuvering through the channel varies depending on vessel size, vessel draft, and tide and current. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, LNG ship transit speed in the Lower Reach to the Creole Trail LNG terminal would be about 3.5 to 4 knots. On the open water to the outer bar, transit speed would be greater. The Trunkline LNG terminal, the nearest facility that actively generates ship traffic, is located about 21 miles upstream from the proposed LNG terminal. Therefore, ships calling on the Creole Trail LNG terminal would have a much shorter transit time inbound and outbound.

- ***Current Effects*** – The current varies along the Calcasieu Ship Channel and is at its maximum at or near milepost 0, which is located on the shoreside end of the jetties. At this location, the current is reported to reach a maximum of 4 knots during extreme ebb tides due to the volume of lake water being discharged. Vessel speed varies depending on the speed of the current in which it transits. A vessel transiting 7 knots in slack current would transit approximately 5 knots in 2-knot ebb current. Assuming a reduction in speed of 2 knots, the total transit time for an inbound vessel transiting upstream would be increased. Therefore, the Lake Charles Pilots attempt to move loaded inbound deep-draft vessels on a window of high tide with flood current or an ebb current not to exceed 1 knot. In addition, deep-draft loaded vessels cannot exceed approximately 7 to 8 knots in the channel due to "blockage" and "squat."

- ***Passing Vessels*** – The project width of the Calcasieu Ship Channel is 800 feet offshore and 400 feet along the inland route. However, the Lake Charles Pilots have noted that the channel rarely stays at the full 400-foot width between MPs 5.0 and 22.5. Vessels over 32 feet in draft are not allowed to meet opposing traffic within the system above the jetties if their combined beam exceeds 50 percent of the channel project width. Crude vessels constitute the majority of the ship traffic, and many of these vessels have a beam width greater than 140 feet. In addition, LNG vessels would have a moving safety zone that prohibits any passing of these vessels. However, the Lake Charles Pilots have stated that this safety zone does not include recreational vehicles, which are requested to transit along the bank furthest from the LNG vessel. The above restrictions virtually eliminate the passing of deep-draft loaded vessels when in transit on the inner reaches of the Calcasieu Ship Channel.

- ***Channel Draft Restrictions – One Way Traffic*** – Siltation that occurs in the Middle Reach of the Calcasieu Ship Channel (between MPs 5 and 23) can narrow the available width of the channel with full depth. Accordingly, wide beam vessels that are loaded to the maximum allowable draft favor the center of the channel along this reach and, therefore, are not allowed to pass within this stretch. The Lower Reach of the channel where the proposed Creole Trail LNG terminal would be located is usually not prone to siltation and is rarely dredged. However, the LNG safety zone and the restrictions regarding passing vessels described above effectively limit traffic to one way above MP 0.

- ***Convoying Traffic*** – Ship transit time is currently between 5.5 and 9 hours between the channel entrance and the various industrial ports along the channel. When combined with the one-way traffic limitation described above, a convoying system is necessary to maximize the number of vessels transiting into and out of the port. As such, all inbound traffic would transit as a group, with between 15 minutes and 1 hour between each vessel. After the last inbound vessel is in port, all outbound shipments would commence with incremental spacing until all outbounds are out of port. The cycle then repeats. The Lake Charles Pilots have stated that if Creole Trail provides dedicated tugs, there is a possibility for its vessels to transit ahead of or behind convoys without slowing them down.

- ***Inclement Weather*** – Weather restrictions in the Lake Charles area typically consist of fog and high winds. Fog is considered the primary source of weather-related traffic restrictions, and is peak between the months of November and March. The average number of heavy fog days according to the Lanier and Associates report is 28.2 days per year. Fog has the potential to eliminate all vessel movements for days at a time. The Lake Charles Pilots state that sustained winds of 20 knots or greater cause problems with navigating LNG vessels. Because of their high sail area, LNG vessels are more susceptible to delays due to wind. The Lake Charles Pilots currently limit LNG vessel movements to conditions when wind does not exceed a sustained 20 knots. The addition of tractor tugs may decrease problems with handling LNG vessels when winds exceed 20 knots.

- ***Pilot Availability*** – The Lake Charles Pilots operate with a total of 13 pilots working on a rotating schedule with 7 pilots on call from Monday to Thursday and 6 pilots on call from Friday to Sunday. One additional pilot is in training and will be available by the fourth quarter of 2005. Additional pilots would likely be required to handle increased LNG traffic and to maintain current levels of traffic service for the other industries. The Lanier

and Associates report indicate that pilot availability should not be considered a limiting factor because the Lake Charles Pilots have added pilots in the past to meet demand and expect to be able to continue to do so.

- ***Tug Availability*** – There are currently five harbor tugs providing berthing and escorting service for the Lake Charles area. The Lake Charles Pilots have stated that the current fleet of tugs would not be able to safely support the transit of any additional LNG vessels without causing significant delays in the movement of traffic throughout the remaining portions of the waterway. However, Creole Trail would provide three dedicated tugs to service its LNG vessels; therefore, the effects of harbor tug availability and response time on the traffic in the Calcasieu Ship Channel would be negligible.

Vessel Simulation Studies

As previously noted above, a Vessel Maneuvering Study was prepared for the proposed project in May 2005. The study was filed under CEII. This evaluation involved a 3-day, computer generated, ship handling simulation involving 47 simulated runs focusing on the key areas of the terminal approach channels, the turning area, and berthing area. Two active Lake Charles pilots participated in this evaluation and provided comments and recommendations to ensure that LNG carriers calling at the Creole Trail LNG terminal would be handled in a safe and prudent manner when navigating local waterways. A 140,000 m^3 and a 250,000 m^3 LNG carrier were modeled for this evaluation. The study evaluated vessel maneuvering during transit from the jetty entrance to the berth under a variety of environmental conditions including the most credible difficult tidal flows and wind conditions (20 knots) likely to be encountered. In all cases, assistance was provided by three tractor tugs.

In conclusion, the pilots found a LNG vessel of the characteristics used for this simulation can move from pilot boarding area to the LNG terminal and return in a safe manner providing some limitations are observed. The study recommended the following:

- A day mark should be placed on the southern point as near to the tow of the channel as practical to clearly define the available deep water.

- A set of lighted range markers should be established to indicate when the tanker bridge is in line with the middle of the terminal basin. In addition, an approach range above the basin on the west bank of the Calcasieu Ship Channel is needed to accurately identify the cross-channel position of the ship during approach to the terminal basin.

- To address concerns regarding the availability of deep water at the northern edge of the maneuvering basin, the flare on the northern edge of the maneuvering basin should be opened and maintained in case shoaling occurs in the area.

- At least three 60-ton bollard-pull tugs should be provided for operations.

- Several months before the first LNG ship is scheduled to arrive, further training with a ship-maneuvering simulator should be made available to the Lake Charles Pilots to develop the best strategy for making the approaches under a variety of conditions.

4.12.5.2 Requirements for LNG Ship Operations

The Coast Guard exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173; the Magnuson Act (50

USC section 191); the Ports and Waterways Safety Act of 1972, as amended (33 USC section 1221, et seq.); and the Maritime Transportation Security Act of 2002 (46 USC section 701). The Coast Guard is responsible for matters related to navigation safety, vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the receiving tanks. The Coast Guard also has authority for LNG facility security plan review, approval and compliance verification as provided in Title 33 CFR Part 105, and siting as it pertains to the management of vessel traffic in and around the LNG facility.

The Coast Guard regulations found in 33 CFR 127, apply to the marine transfer area of waterfront facilities between the LNG ship and the last manifold or valve located immediately before a storage tank. Title 33 CFR 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, fire fighting, and security of LNG waterfront facilities. The safety systems, including the communications, emergency shut down, gas detection, and fire protection must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Creole Trail LNG would be required to submit two copies of its Operations and Emergency Manual to the COTP for examination.

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

As required by its regulations (section 127.009), the Coast Guard is responsible for issuing a LOR as to the suitability of the waterway for LNG marine traffic with respect to the following items:

- Density and character of marine traffic;
- Locks, bridges, or other manmade obstruction in the waterway; and
- The following factors adjacent to the facility:
    - Depth of water;
    - Tidal range;
    - Protection from high seas;
    - Natural hazards, including reefs, rocks, and sandbars;
    - Underwater pipes and cables; and
    - Distance of berthed vessels from the channel and the width of the channel.

On June 14, 2005, the Coast Guard published a *Navigation and Vessel Inspection Circular – Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic* (NVIC). The purpose of this NVIC is to provide Coast Guard Captains of the Port/Federal Maritime Security Coordinators, members of the LNG industry, and port stakeholders with guidance on assessing the suitability of a waterway for LNG marine traffic that takes into account conventional navigation safety/waterway management issues contemplated by the existing LOI/LOR process, but in addition, will also take completely into account maritime security implications. In accordance with this guidance, each LNG project applicant is to submit a WSA to the cognizant COTP. The WSA is to address the

transportation of LNG from the LNG tanker's entrance into United States territorial waters, through its transit to and from the LNG receiving facility, including operations at the vessel/facility interface. In addition, the WSA should address the navigational safety issues and port security issues introduced by the proposed LNG operations. The NVIC 05-05 also provides specific guidance on the timing and scope of the WSA.

The process of preparing the LOR begins when an applicant submits a LOI to the local COTP. In accordance with 33 CFR 127.007, Creole Trail submitted a LOI to the Coast Guard on January 21, 2005 (see Appendix L-2). In preparation for issuance of a LOR and the completion of certain other regulatory mandates, any comments received would be incorporated into a formalized risk assessment process to assess the safety and security aspects of the facility, adjacent port areas, and navigable waterways.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the arrival, transit, cargo transfer, and departure of LNG ships in the Calcasieu Ship Channel would be required to adhere to the procedures of a *Liquefied Natural Gas Vessel Management and Emergency Plan* to be developed by the Coast Guard Lake Charles Marine Safety Unit (MSU). In addition, Creole Trail would develop Operations and Emergency manuals in consultation with the Coast Guard. These procedures would be developed to ensure the safety and security of all operations associated with LNG ship transit and unloading. The *Liquefied Natural Gas Vessel Management and Emergency Plan* would contain specific requirements for the LNG ship, pre-arrival notification, transit through the Calcasieu Ship Channel, the waterfront facility, cargo transfer operations, Coast Guard inspection and monitoring activities, and emergency operations. The Coast Guard's Lake Charles MSU would monitor each LNG ship in accordance with the *Liquefied Natural Gas Vessel Management and Emergency Plan*.

Some of the anticipated key provisions of the *Liquefied Natural Gas Vessel Management and Emergency Plan* would be the establishment of a moving safety and/or security zone for all inbound and moored LNG ships, the use of tugs to assist in the Calcasieu Ship Channel and to maneuver the ship into the berth, and the requirement that tug(s) remain with the LNG ship while moored at the berth. Additional provisions may be necessary given changing circumstances.

Creole Trail Waterway Suitability Assessment (WSA)

On August 15, 2005, Creole Trail submitted a WSA for the proposed project to the COTP for Coast Guard MSU Lake Charles. The Coast Guard, with input from various stakeholders, which included the Lake Charles Harbor and Terminal District, marine pilots, towing industry representatives, and members of the Calcasieu Area Harbor Safety Committee and Area Maritime Security Committee, has completed a review of Creole Trail's WSA in accordance with the guidance in NVIC 05-05. The WSA review focused on the navigation safety and maritime security risks posed by LNG marine traffic, and the measures needed to responsibly manage these security risks.

Coast Guard Letter to FERC

On February 27, 2006, the Coast Guard sent a letter to FERC, based on the above WSA review, providing input on the capability of the port community to implement the risk management measures necessary to responsibly manage the risks of LNG marine traffic in the port (see Appendix L-1). As described in this document, the Coast Guard has preliminarily determined that the Calcasieu River to the proposed LNG terminal in Cameron, Louisiana may be suitable for accommodating the type and frequency of LNG vessels being proposed by the applicant. This determination, however, is preliminary because the required NEPA analysis has not yet been completed. This determination is also contingent upon the port security community having the appropriate resources to implement all the measures necessary to responsibly manage the safety and security risks of LNG marine traffic in this area.

The Coast Guard's letter to FERC discusses the relevant safety and security issues from the broad viewpoint of impact on the entire port, as well as provides a detailed review of specific points of concern along the LNG tanker's proposed transit route. A detailed supplemental letter, also based on the WSA review, describing the conceptual prevention/mitigation strategies, along with resource needs, has also been sent from the Coast Guard to the FERC on February 28, 2006. Specific details of these measures have been designated Sensitive Security Information as defined in Title 49 CFR Part 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, it is not releasable to the public. Additionally, any security plan is a dynamic document that is subject to change with advances in technologies and improvements in intelligence gathering.

As a result, the Coast Guard has preliminarily identified additional resources, public and/or private, that would be needed to implement prevention and mitigation strategies necessary for LNG operations. Consequently, we have recommended that Creole Trail submit, concurrent with its Emergency Response Plan, a comprehensive plan identifying the mechanisms for funding all project-specific security/emergency management costs (see section 4.12.5 "Emergency Response and Evacuation Planning").

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the security measures outlined in the letter to FERC and the above mentioned supplemental letter will be further developed into a detailed *Liquefied Natural Gas Vessel Management and Emergency Plan*, which would become the basis for appropriate security measures for each Maritime Security threat level. This plan would clearly spell out roles, responsibilities and specific procedures for an LNG vessel transiting the Calcasieu River up to the proposed Creole Trail LNG terminal, as well as for all agencies involved in implementing security and safety during the operation. It would be required that, prior to the LNG vessel being granted permission to enter the Calcasieu River, both the vessel and facility must be in full compliance with the appropriate requirements of the Maritime Transportation Security Act and International Ship and Port Facility Security Code, and the security protocols to be established by the COTP in the *Liquefied Natural Gas Vessel Management and Emergency Plan*. The plan may include security measures such as: Coast Guard and other law enforcement agency vessels to enforce safety and security zones around the LNG vessels while in transit and moored at the terminal; shoreside surveillance and monitoring along designated sections of the transit route; and other prevention/mitigation strategies.

We recognize that the *Liquefied Natural Gas Vessel Management and Emergency Plan* would be a dynamic document that would be prepared well before import operations would commence, and that the port's overall security picture may change over that time period. New port activities may commence, infrastructure may be added, or population density may change. Improvements in technology to detect, deter and defend against intentional acts may also develop. Therefore, **we recommend that:**

- **Creole Trail should <u>annually</u> review its waterway suitability assessment relating to LNG vessel traffic for the project; update the assessment to reflect changing conditions which may impact the suitability of the waterway for LNG marine traffic; provide the updated assessment to the cognizant COTP/Federal Maritime Security Coordinator (COTP/FMSC) for review and validation and if appropriate, further action by the COTP/FMSC relating to LNG vessel traffic; and provide a copy to FERC staff.**

Impact of Vessel and Facility Security Requirements

The potential impacts of the proposed LNG vessel traffic on other commercial and recreational boaters can be addressed in relation to several general security requirements: 1) a moving safety zone for

inbound LNG vessels; 2) a security zone around a moored LNG vessel; and 3) other measures as deemed appropriate.

If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic the Coast Guard would promulgate a moving safety zone which would affect other vessels. Pursuant to such a regulation, no vessel would be allowed to enter the safety zone without first obtaining permission from the Coast Guard COTP. The COTP currently places similar restrictions on all vessels transiting the Calcasieu River ship channel by regulation in 33 CFR 165.805. Presently, the moving safety zone around LNG ships is 2 miles ahead, 1 mile astern, and to either side of an LNG vessel to the width of the ship channel. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, it is anticipated that the LNG ships would transit about 3 miles from the entrance of the Calcasieu Ship Channel to the Creole Trail LNG terminal. For the majority of this trip, an LNG vessel would travel at an average speed between 3 to 8 knots. Based on these assumed speeds, it would take less than an hour for LNG ships to complete the trip from the entrance to the Calcasieu Ship Channel jetties to the LNG terminal. Minimum visibility conditions would have to be satisfied before the LNG ship would be allowed to proceed inbound from the Gulf, ensuring that the Coast Guard could adequately monitor the safety zone.

Currently there is a 50 foot safety zone for moored LNG vessels at the existing Trunkline LNG facility in Lake Charles, Louisiana. It is important to note that the requirements of 33 CFR 165.805 were designed to apply to the Trunkline LNG facility any LNG vessel moored at that facility. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the existing *Liquefied Natural Gas Vessel Management and Emergency Plan* would need to be revised to include the Creole Trail's facility and its associated LNG vessel traffic. Pursuant to this, although a specific zone has not been determined, one for moored LNG vessels would be designated by the COTP.

If moving safety zones, security zones at the terminal, and one-way traffic were implemented, they would affect other commercial, ferry, and recreational traffic using the channel. The magnitude of the effect would also be influenced by three other factors: the amount of time it takes to obtain a pilot, other competing ship traffic in the federal navigation channel, and interaction with ferry traffic.

The moving safety zones, if implemented, may have the effect of temporarily limiting the channel to one-way traffic. This presently occurs in the project area because vessels over 32 feet in draft are not allowed to meet opposing traffic within the system above the jetties if their combined beam exceeds 50 percent of the channel project width. Crude vessels constitute the majority of the ship traffic, and many of these vessels have a beam width greater than 140 feet. In addition, LNG vessels have a moving safety zone that prohibits any passing of these vessels. It is expected that if the proposed LNG terminal is constructed, and if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, as many as 300 to 400 LNG ships for the Creole Trail LNG terminal could potentially move in and out of Calcasieu Ship Channel every year. This is a 30 to 40 percent increase over the average 1,000 vessels per year currently transiting these waterways. Although this would be a substantial increase, the length and time LNG vessels are transiting the Calcasieu Ship Channel to the Creole Trail terminal would be relatively short compared to the majority of the other ships that use the waterway.

The moving safety zone could cause impacts on recreational and other commercial vessels but the impacts would be temporary while the LNG vessel is in transit or moored at the unloading facility. Because the safety zone would be a moving zone around the ship, the impacts would be of short duration at any given point along the shipping route. In addition, the Lake Charles Pilots have stated that this safety zone does not include recreational vehicles, which are requested to transit along the bank furthest from the LNG vessel. However, a vessel attempting to travel through the channel while an LNG ship is being maneuvered into the berth may experience delays up to 60 minutes. Because of the availability of

the Calcasieu Pass around Monkey Island to recreational and smaller commercial vessels and the relatively low volume of recreational boating in the immediate project area, any impacts are expected to be minor. Moreover, the Coast Guard moving safety and moored vessel security zones would not be treated as absolute exclusion zones that would preclude all other vessel movements. Rather, other vessels may be allowed to transit through the moving safety and moored vessel security zones with the permission of the COTP.

The impact on the Cameron Ferry (Louisiana Route 27) would generally be small because the ferry only crosses the LNG ship route and conflicts could be managed by schedule coordination. The Cameron Ferry Marine Operations Supervisor, the ferry Captains, and the Lake Charles Pilots are accustomed to working together to ensure safe and efficient marine operations. Commercial fishing boats might also be affected by the moving safety zone that could be imposed by the Coast Guard as LNG ships transit the Calcasieu Ship Channel.

Additionally, any moving safety zone regulation that would be promulgated by the Coast Guard would affect a moving zone around the ship, so these impacts would be temporary and of short duration at any given point along the shipping route. In addition, depending on their individual drafts, commercial fishing boats might be able to go around the LNG ships at points in the river that are sufficiently wide for them to be outside of any moving safety zone. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, to mitigate any adverse impacts of moving safety zone, the Coast Guard would routinely provide Notice to Mariners prior to the arrival and departure of LNG ships as the Coast Guard currently does for LPG vessels and for other activities. The notification system includes broadcasts on radio frequencies used by mariners. These practices and impacts currently occur in the Calcasieu Ship Channel during LNG vessel transits to the Trunkline LNG terminal in Lake Charles.

The Coast Guard has preliminarily determined that if appropriate resources were available to implement certain necessary security measures, the Calcasieu Ship Channel could accommodate the number of LNG carriers Creole Trail has proposed to supply the LNG terminal. This determination is preliminary because the required NEPA analysis has not yet been completed. This determination is also contingent upon the port security community having the appropriate resources to implement all the measures necessary to responsibly manage the safety and security risks of LNG marine traffic in this area. If the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, in addition to the moving safety and security zones around the LNG vessels, the *Liquefied Natural Gas Vessel Management and Emergency Plan* to be developed/revised by the Coast guard Marine Safety Unit Lake Charles, would minimize impact to other ship traffic, escorts by armed law enforcement officials, and a variety of waterway and shoreline surveillance measures.

The FERC has received comments on other LNG terminal proposals expressing concern about the cost of applying additional security measures and the potential burden on local taxpayers. To meet its anticipated security responsibilities the Coast Guard most likely would need to request additional resources through its internal resource reprogramming process for inclusion in future appropriations. Additional funding for state and local resources would be provided by Creole Trail. In order to precisely determine the additional resources that would be necessary to provide the additional security to ensure safe transit of the LNG vessels, it would be necessary to develop and finalize the Coast Guard's *Liquefied Natural Gas Vessel Management and Emergency Plan*. Funding for security and management costs are discussed further in section 4.12.5 "Emergency Response and Evacuation Planning".

While the LOR would address the suitability of the Calcasieu Ship Channel for LNG ship transportation, it would not constitute a final authority to commence LNG operations. The Coast Guard's recommendation is subject to certain safety and security provisions to be developed in its *Liquefied Natural Gas Vessel Management and Emergency Plan*. This plan would be reviewed and updated as

necessary to address issues specific to the Calcasieu Ship Channel and the proposed LNG terminal. In addition, the Coast Guard may establish a safety and security zone under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the COTP would be permitted in the safety and security zone.

4.12.5.3 Environmental Impacts Associated with Coast Guard Actions

The Coast Guard's issuance of a LOR is a federal action which requires compliance with NEPA, just as the FERC's authorization for construction and operation of a LNG facility requires compliance with NEPA. Alternatives regarding these actions are discussed in section 3.

Some of the potential environmental impacts resulting from LNG vessel activities and transit would not be unique to LNG carriers and may also be addressed by previous Coast Guard NEPA analyses for existing regulations. Per the Coast Guard NVIC 05-05, all required Coast Guard NEPA analysis and documentation must be complete prior to the issuance of any LOR.

Potential impacts on wildlife and aquatic resources are discussed in sections 4.3 and 4.6. The potential impacts that result from LNG vessels in transit would be similar to those resulting from other ships using the navigation channel. Impacts include those related to prop wash, water withdrawal for ballast and cooling, invasive species, and saltwater intrusion. Turbidity from propeller wash would be minor and short-term and would decrease as the berthings of LNG ships at the facility become routine. Intake of ballast water is not expected to have a significant impact on aquatic species. No significant impacts on wildlife or aquatic resources as a result of LNG marine traffic is expected.

LNG ships and support vessels would emit criteria pollutants and VOCs during transit and while unloading at the LNG terminal. We have identified the magnitude of these emissions in section 4.11.1.

The LNG tankers would be operating in the federally approved channel en route to the terminal. Consistency with Louisiana’s CZMP would be determined by LADNR. We have recommended a condition in section 4.8.6 that Creole Trail not begin construction of any project facilities until it files with the Secretary a copy of the LADNR’s consistency determination.

The potential impacts associated with a release of LNG are discussed generally in the preceding and following sections. The establishment of temporary safety and security zones by the Coast Guard has been considered as a potential effect on recreational use of the waterway (see section 4.8.4). However, we do not expect these zones to have a significant effect on environmental resources.

The LNG transit corridor is a sparsely populated area and the shoreline along most of the corridor is uninhabited. Further, the shipping route used by LNG vessels is not discretionary. That is, the corridor was developed prior to the concept of its use for LNG traffic and alternative corridors are not available. We have not identified any disproportionately high and adverse human health or environmental effects of the project on minority and low-income communities or Native American groups. As noted above and discussed in section 4.9.5, LNG vessel traffic is not expected to adversely affect Cameron Ferry operations.

The transit corridor for the LNG carriers would traverse open water and estuarine habitats. Most of the transit route is open water. Only about 3 miles of the transit corridor, from the entrance jetties at the beginning of the Lower Reach of the Calcasieu Ship Channel to the LNG terminal site, are within confined waters where shoreline could be affected by accidental spills. Shoreline habitats adjacent to the transit corridor include tidal marsh, emergent and scrub-shrub wetlands, and coastal grassland/prairie. Some of the habitats along the Calcasieu Ship Channel are previously disturbed because of industrial,

commercial, and maritime development. The aquatic and shoreline habitats support a variety of wildlife that are described in sections 4.6 and 4.7. Figure 4.12.5-1 shows the locations of significant refuges and public recreation areas along the transit corridor.

LNG is less dense than fresh or sea water, so it floats on the surface. Immediately upon contact with any warmer substance such as water or air, it begins to evaporate. As the LNG vaporizes, a vapor cloud may form which is initially heavier than air and may be dispersed by wind. An LNG vapor cloud cannot explode in the open atmosphere, but it could burn.

Since LNG is a cryogenic liquid, the greatest threat to aquatic life from an LNG spill would be thermal stress. Any aquatic life (including plankton, fish, birds, sea turtles, marine mammals, and any federally-listed species) that came into direct contact with the LNG would probably experience a sudden cold shock, and, depending in what context that contact occurred, the exposure could be lethal, especially to non-motile species. Most mobile underwater organisms would detect the temperature change and avoid the area. Wildlife occupying the water's surface near the release could intercept the vapor cloud and suffer asphyxiation. However, the duration of this exposure is short, as noted below. Impacts on shoreline habitats and associated wildlife could occur, primarily, through the subsequent ignition of the LNG. The potential damage could involve the combustion of both vegetation and wildlife.

The accident scenarios evaluated in section 4.12.5.4 include release and ignition of natural gas formed by evaporation of spilled LNG. Natural gas combustion typically is not complete in spill scenarios. The products of incomplete combustion of natural gas include criteria pollutants, ozone precursors, toxic air contaminants and soot (carbon particulates). It should be noted that LNG fires typically do not last as long as liquid petroleum fires.

The duration of an ignited accidental LNG spill detailed in section 4.12.5.4 is approximately 48 minutes. For an ignited intentional LNG spill, the duration is approximately 11 minutes. The maximum increases in ambient pollutant concentrations due to the natural gas fire would occur downwind of the LNG spill. Ambient air pollutant concentrations in downwind areas could potentially exceed short-term NAAQS and State Ambient Air Quality Standards over the duration of the fire as well as soot deposition and diminished visibility due to soot transport. Given the distance to shore from a potential fire from most of the transit route in the Gulf of Mexico and the sparsely populated nature of the transit route within the Calcasieu Ship Channel, it is unlikely that sensitive receptors (i.e., schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) would be exposed to substantial pollutant concentrations for a significant period. There would be no long-term effects.

The pool formed from an unignited accidental LNG spill would completely evaporate in approximately 94 minutes. For an ignited intentional LNG spill, the pool would completely evaporate in approximately 7 minutes. As natural gas is not a criteria pollutant, no air quality impact would be expected from the evaporation of the LNG spill. However, methane, the primary component of LNG, is considered a greenhouse case and may contribute to global warming. (Coast Guard, 2005)

The history of LNG shipping has been free of major incidents, and none have resulted in significant quantities of LNG being released. No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargoes being released. Historically, the events most likely to cause a significant release of LNG were ship casualties such as collisions, allisions[10], or groundings. Any event causing a release of LNG would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. During the 44,000 voyages that have been completed since the inception of LNG maritime transportation, there has not been a serious

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

accident at sea or in a port which resulted in a spill due to rupturing of the cargo tanks. Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. However, the possibility of an LNG spill from a ship over the duration of the proposed project must be considered.

Given that an LNG cargo spill is highly unlikely, no significant socioeconomic impact associated with an accidental LNG release along the transit route would be expected. As described below, the duration of an LNG pool fire would be of short duration, i.e., from 1 to 2 ½ hours. If there is an LNG spill on the transit route, it may result in a temporary interruption in ship traffic in the navigation channel; however, traffic in the navigation channel would quickly resume normal operations and any economic impact on the maritime industry would be minimal.

If a pool fire occurred where the transit route is closer to shore, businesses within 2,200 feet of the center of a spill could be subject to a long-term loss of use. Vegetation and wooden structures subjected to greater than 3,000 Btu/ft^2-hr[11] may ignite. However, because the hazard area surrounding an LNG cargo vessel is transient (moving with the vessel along its route) it is not possible to accurately quantify the economic impact of an incident. Section 4.12.5.4 discusses the effects of an LNG spill in greater detail.

In accordance with Section 3a(e) of the Natural Gas Act, added by Section 311 of the Energy Policy Act of 2005, we recommend in section 4.12.5 that Creole Trail develop an Emergency Response Plan in consultation with the Coast Guard and state and local agencies that includes a Cost-Sharing Plan before any final approval to begin construction. Therefore, no long-term impact relating to emergency evacuation of communities would be expected.

The December 2004 Sandia Report, discussed in section 4.12.5 "Deliberate Attack on an LNG Vessel", included an analysis of potential LNG cargo tank breaches due to accidental causes. The report found that accidental groundings, collisions with small vessels, and low speed collisions with large vessels could cause minor ship damage but would not result in a cargo spill. This is due to the protection provided by the double hull structure, the insulation layer and the primary cargo tank of an LNG vessel. We do not believe that there would be any environmental significance attributed to these types of accidents.

High speed collisions with large vessels striking at 90 degrees were found to potentially cause cargo tank breach areas of 0.5 to 1.5 square meters. For the resulting LNG spill and pool fire on water, the Sandia Report determined that the most significant impact on public safety and property would exist within about 800 feet, with minimal impact beyond 2,400 feet. Depending on the actual size of the cargo tank breach, the duration of the spill and ensuing pool fire could range from approximately 1 to 2 ½ hours. Using the methodology in the ABSG study, FERC staff determined that the site-specific distance to the 1,600 Btu/ft^2-hr transient hazard area for an accidental cargo tank breach in the Gulf of Mexico and Calcasieu Ship Channel would be approximately 2,790 feet.

However, if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, it must also be recognized that the operational controls that would be imposed by the Coast Guard and local pilots, such as a moving LNG vessel safety zone and one-way traffic in narrow channels, would be

[11] At 3,000 Btu/ft^2-hr, an exposed person would experience burns within 10 seconds, however a wooden structure would not be expected to burn and affords protection to sheltered persons.

specifically designed to prevent the collision scenarios that could result in an LNG cargo tank breach. As a result, the likelihood of an LNG spill from accidental causes is considered to be negligible.

In the unlikely event of an LNG spill, the physical properties of LNG would limit any potential impacts. If spilled into water, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water over a period of approximately 1 to 2 ½ hours. Being less dense than water, LNG would float on the surface prior to vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water.

In the event of a collision or allision of sufficient magnitude to rupture an LNG cargo tank, it is likely that sparks or flames would ignite the flammable vapors at the spill site. In the unlikely event that ignition did not occur, an LNG spill would rapidly vaporize on water and form a potentially flammable cloud. If the flammable vapor cloud encountered an ignition source, the cloud would burn back to the spill site, rather than outward towards shoreline habitats.

Given these considerations, impacts on shoreline habitats as a result of an accidental LNG spill are unlikely to occur. A spill would be unlikely to result in significant impacts to shoreline habitats and wildlife that occur along the transit route. Hazard distances for intentional breaches are discussed in section 4.12.5.4. Although an intentional breach scenario may result in greater hazard distances, such scenarios are associated with the desire to inflict damage to major infrastructure, population and commercial centers, rather than to environmentally sensitive areas along the vessel route. Also, given the navigation controls and safety and security procedures in place to specifically prevent such accidents and intentional spill scenarios, the indirect impact associated with Coast Guard actions are not reasonably foreseeable events.

As discussed in section 4.12.5.2, if the Coast Guard issues a LOR finding the waterway suitable for LNG marine traffic, the Coast Guard may establish a moving safety zone, moored vessel security zone, and/or a regulated navigation area around the transiting LNG vessels and provide some level of escort as part of finalizing the *Liquefied Natural Gas Vessel Management and Emergency Plan*. The LNG vessels would also undergo safety and security inspections to ensure compliance with U.S. and international standards. In addition, the LNG facility would submit a facility security plan for review and approval by the Coast Guard. However, due to uncertainty in the scope, frequency, prevailing maritime security levels, and the number of resources that would be dedicated on a recurring or episodic basis, the Coast Guard would ensure the appropriate NEPA environmental documentation for such actions is complete prior to commencement of these activities rather than in this EIS.

Non-Internet Public

Non-Internet Public

ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED
CREOLE TRAIL LNG TERMINAL
AND PIPELINE PROJECT
Docket Nos. CP05-360-000, CP05-357-000,
CP05-358,000, CP05-359-000

Figure 4.12.5-1 Land Use Along The Calcasieu Ship Channel

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

4.12.5.4 LNG Ship Safety

Since 1959, LNG has been transported by ship without a major release of cargo or a major accident involving an LNG ship. Starting in 1971, LNG began arriving at the Distrigas facility in Everett, Massachusetts. To date, more than 680 cargoes, with volumes ranging from 60,000 to 125,000 m^3, have been delivered into the Port of Boston without incident. In addition, beginning in 1978, LNG began arriving at Trunkline LNG's facility in Lake Charles, Louisiana. To date, over 450 LNG cargoes have been delivered through the Calcasieu Ship Channel without incident. During 2005, an estimated total of 631 Bcf (241 cargoes) of LNG was imported into the United States. For 35 years, LNG shipping operations have been safely conducted in the United States. The world's LNG ship fleet currently exceeds 173 carriers.

Over the last 45 years, LNG ships have made over 44,000 voyages. Currently, all of the ships in the LNG fleet operate under a foreign flag with foreign crews. A foreign flag ship must have a Certificate of Compliance inspection by the Coast Guard to ensure compliance with International safety standards.

History

During the 44,000 voyages that have been completed since the inception of LNG maritime transportation, there has not been a serious accident at sea or in a port which resulted in a spill due to rupturing of the cargo tanks. However, insurance records, industry resources, and public websites identify a number of incidents involving LNG vessels, including minor collisions with other vessels of all sizes, groundings, minor LNG releases during cargo unloading operations, and mechanical/equipment failures typical of large vessels. Some of the more significant LNG vessel incidents are described below:

- ***Pollenger*** had an LNG spill onto the steel cover of cargo tank number one during unloading at Everett, Massachusetts in April 1979. The spill caused cracking of the steel plate.

- ***El Paso Paul Kayser*** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the United States. Extensive bottom damage to the ballast tanks resulted; however, the cargo tanks were not damaged, and no cargo was released. The complete cargo of LNG was subsequently transferred to another LNG ship and delivered to its United States destination.

- ***LNG Taurus*** grounded in December 1980 near the entrance to Taboata Harbor, Japan. The grounding resulted in extensive bottom damage, but the cargo tanks were not affected. The ship was refloated and the cargo unloaded.

- ***Isabella*** had LNG spill onto its deck due to a cargo tank overflow in June 1985, causing severe cracking of the steelwork. The spill had been attributed to a cargo valve failure during discharging of cargo.

- ***Tellier*** was blown from its docking berth at Skikda, Algeria in February 1989 during severe winds causing damage to the loading arms and the ship and shore piping. The cargo loading had been secured just before the wind struck, but the loading arms had not been drained. Consequently, the LNG remaining in the loading arms spilled onto the deck causing fracture of some plating.

- ***Mostafa Ben Boulaid*** had LNG spill onto its deck during loading operations in Algeria in 2002. The spill, which is believed to have been caused by overflow rather than a

mechanical failure, caused significant brittle fracturing of the steelwork. The ship was required to discharge its cargo, after which it proceeded to dock for repair.

- ***Khannur*** had a cargo tank overfill into the ships vapor handling system on September 10, 2001 during unloading at Everett, Massachusetts. Approximately 100 gallons of LNG were vented and sprayed onto the protective decking over the cargo tank dome, resulting in several cracks. After re-inspection by the Coast Guard, the Khannur was allowed to discharge its LNG cargo.

- ***Norman Lady*** was struck by the USS Oklahoma City nuclear submarine while rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 cubic meter LNG tanker, which had just unloaded its cargo at Barcelona, Spain, sustained only minor damage to the outer layer of its double hull but not to its cargo tanks.

- ***Tenaga Lima*** grounded on rocks while proceeding to open sea east of Mopko, South Korea due to strong current in November 2004. The shell plating was torn open and fractured over an approximate area of 20 feet by 80 feet, and internal breaches allowed water to enter the insulation space between the primary and secondary membranes. The ship was refloated, repaired and returned to service.

- ***Golar Freeze*** moved away from its docking berth during unloading on March 14, 2006 in Savannah, Georgia. The powered emergency release couplings on the unloading arms activated as designed and transfer operations were shut down.

Ship Construction

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

The insulation of cargo tanks on LNG carriers is a complex assembly of many layers. The relief valve capacity of LNG carriers is designed to compensate for over-pressure caused by fire. The potential that impingement by a cryogenic liquid could cause brittle fracture of the ship's hull was known to the Coast Guard in the mid-1970s when the U.S. regulation for LNG carriers in 46 CFR Part 154 were being developed. LNG carriers used in the U.S. waters must also be constructed in accordance with the IMO Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk. This standard requires that the vessel inner hull adjacent to the cargo tanks be protected against contact from liquid cargo through a combination of proper material selection, adequate insulation, and use of heating systems.

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

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

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

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

In 1995, to assist the Coast Guard in San Juan, Puerto Rico, EcoEléctrica L.P. prepared an analysis of the damage that could result from an oil tanker striking an LNG ship at berth (FERC, 1996). The analysis assumed a 125,000 m^3 LNG ship and an 82,000 dead weight ton tanker carrying number 6 fuel oil, without tug assistance. The analysis determined the minimum striking speed to penetrate the cargo tanks of an LNG ship for a range of potential collision angles. The resulting minimum striking speeds are presented in table 4.12.5-3 for the two principal cargo systems.

TABLE 4.12.5-3

Minimum Striking Speed to Penetrate LNG Cargo Tanks

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

For membrane tanks, the critical on-beam striking speed is 3.0 knots, and for spherical tanks, the critical on-beam speed is 4.5 knots. For both containment types, lower angles of impact result in much greater minimum striking speeds to penetrate LNG cargo tanks. In the July/August, 2002 issue of the "LNG Journal", the SIGTTO General Manager provides a table that shows the critical speed necessary for a 20,000-ton vessel to puncture the outer hull of an LNG carrier is 7.3 knots. For a 93,000-ton ship, the impact speed is 3.2 knots. In neither case does such an impact result in damage to the LNG cargo containment system or the release of LNG.

In December 2004, the DOE released a study by Sandia National Laboratories, Sandia Report. The Sandia Report included an LNG cargo tank breach analysis using modern finite element modeling

and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings, collisions with small vessels and low speed (less than 7 knots) collisions with large vessels striking at 90 degrees could cause minor ship damage but would not result in a cargo spill. This is due to the protection provided by the double hull structure, the insulation layer and the primary cargo tank of an LNG vessel. High speed (12 knots) collisions with large vessels striking at 90 degrees were found to potentially cause cargo tank breach areas of 0.5 to 1.5 square meters.

Hazards

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

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

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

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

Since the 2001 Quest study, there has been an emergence of studies by various parties to define the “worst case” scenario that would result from a deliberate terrorist attack on an LNG vessel and the subsequent release of cargo. Distances have been estimated to range from 1,770 to 4,200 feet for a

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

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

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

The December 2004 Sandia Report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 square meter cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 square meters. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 square meters, which is a more appropriate range to use in calculating potential hazards from spills.

The Sandia Report also included guidance on risk management for intentional spills, based on the findings that the most significant impacts to public safety and property exist within approximately 500 meters (1,640 feet) of a spill due to thermal hazards from a fire, with lower public health and safety impacts beyond 1,600 meters (5,250 feet). Large, unignited LNG vapor releases were found to be unlikely, but could extend to 2,500 meters (8,200 feet) for nominal intentional spill.

Cascading damage due to brittle fracture from exposure to cryogenic liquid or fire-induced damage to foam insulation was evaluated and while possible under certain conditions is not likely to involve more than two or three cargo tanks. Cascading events are not expected to increase the overall fire

hazard by more than 20 to 30 percent (1,920 to 2,080 meters or 6,300 to 6,825 feet), but would increase the expected fire duration. RPTs are possible for large spills but the effects will be localized near the spill source and should not cause extensive structural damage.

The methodology described in the ABSG study and revised in staff's responses to comments was used to calculate the thermal radiation and flammable vapor dispersion distances for several holes ranging in diameter from 1 meter to 3.9 meters. Based on the penetration of the largest cargo tank of a typical 140,000 cubic meter LNG ship, a potential spill of 23,000 cubic meters is estimated for the volume of LNG above the waterline. The estimated pool spread results and thermal radiation hazard distances are identified in table 4.12.5-4. Thermal radiation calculations are based on an ambient temperature of 50ºF, a relative humidity of 50 percent, and a 20-mile-per-hour wind speed.

TABLE 4.12.5-4

LNG Spills on Water

LNG Release and Spread					
Hole Diameter	1.0 meter	1.4 meters	2.5 meters	3.0 meters	3.9 meters
Hole Area	0.8 square meters	1.5 square meters	5 square meters	7 square meters	12 square meters
Spill Time	94.0 minutes	48.0 minutes	15.0 minutes	10.4 minutes	6.2 minutes
Pool Fire Calculations					
Maximum Pool Radius	341 feet	476 feet	817 feet	938 feet	1,102 feet
Fire Duration	94.1 minutes	48.1 minutes	15.2 minutes	10.7 minutes	6.5 minutes
Distance to:					
1,600 Btu/ft^2-hr	2,164 feet	2,790 feet	4,182 feet	4,652 feet	5,250 feet
3,000 Btu/ft^2-hr	1,690 feet	2,169 feet	3,232 feet	3,591 feet	4,047 feet
10,000 Btu/ft^2-hr	1,031 feet	1,312 feet	1,934 feet	2,143 feet	2,409 feet

However, Creole Trail proposes the potential use of up to a 250,000 cubic meter LNG ship. The limited information available regarding the design of future 250,000 cubic meter LNG ships suggests that the draft of the larger ships would remain the same due to the limited draft of the channel, while the length and width of the larger ships would increase. This would in effect increase the length and width of the cargo tanks, but not change the height, therefore not change the hydrostatic head. Preliminary information shows that the larger class ships would have five cargo tanks instead of four as on the 140,000 cubic meter ships. For a 250,000 cubic meter LNG ship compared to the results for a 140,000 cubic meter LNG ship, the estimated distance to the 1,600 Btu/ft^2-hr zone would be less than 5 percent farther and the fire duration would be extended by about 39 percent.

Although Creole Trail would design the terminal and unloading berth for LNG ships with capacities up to 250,000 cubic meters, detailed dimensions of these future ships and the associated cargo tanks is unavailable. FERC staff was required to make assumptions in order to analyze the LNG spills on water from these larger ships. Therefore, in order to allow the Coast Guard to determine the continued suitability of the waterway for LNG marine traffic, **we recommend that:**

- **<u>Prior to accepting</u> ships greater than 140,000 cubic meters in capacity, Creole Trail should provide the necessary information to demonstrate that the transient hazard areas identified in the final EIS are applicable. Creole Trail should file this information with the Secretary**

for review and written approval of the Director of OEP. This information should also be provided to the Coast Guard.

Flammable vapor dispersion calculations were based on an ambient temperature of 70°F, 50 percent relative humidity, a 4.5 mile per hour wind speed and atmospheric stability class F. Based on a 1-meter diameter hole, an unignited release would result in an estimated pool radius of 421 feet. The unignited vapor cloud would extend to 9,776 feet to the lower flammability limit and 14,377 feet to one half the lower flammability limit. It is important to identify certain key assumptions of conditions that must exist in order to achieve the maximum vapor cloud distances. First it would be necessary for an event to create a 1-meter diameter hole by penetrating the outer hull, the inner hull, and cargo containment without ignition. Far more credible is that the event creating a 1-meter diameter hole would also result in a number of ignition sources which would lead to an LNG pool fire and subsequent thermal radiation hazards. It is also unlikely that a flammable vapor cloud could achieve its maximum distance over land surfaces without encountering an ignition source, and subsequently burning back to the source. Flammable vapor dispersion for larger holes was not performed since, realistically, the cloud would not even extend to the maximum distance for a 1-meter diameter hole before encountering an ignition source.

The transit to the proposed Creole Trail LNG terminal is primarily in offshore waters with the exception of approximately 3 miles in the Calcasieu Ship Channel. The transit corridor would be in Cameron Parish, Louisiana. Cameron Parish is a sparsely populated parish with only 7.6 persons per square mile in 2000. Moreover, Hurricane Rita in September 2005 caused extensive damage to structures in the area, which has further diminished housing and population. Nonetheless, the communities devastated by the storm are anticipated to rebuild to original levels. Within 4,652 feet of the Calcasieu Ship Channel are low density permanent residences in the western portion of community of Cameron, Louisiana. Outdoor public use areas within 4,652 feet include: a camp ground and public boat ramp on the east side of the channel; a portion of Monkey Island; the Cameron Ferry (Louisiana Route 27); and a portion of St. John's Island. Commercial businesses along channel include oil/gas field operation and supply boat landings and the Omega Protein plant. Assuming an LNG vessel transit through the channel at 3 to 8 knots while under tug assist, these areas would be exposed to a potential transient hazard of less than 20 minutes. In addition, a temporary hazard would exist around the slip during part of the 18-hour period while the LNG vessel is at the dock and unloading cargo.

The operational restrictions to be imposed by the Lake Charles Pilots on LNG vessel movements through this area, as well as the requirements that the Coast Guard would impose in its operating plan, would minimize the possibility of a hazardous event occurring in the Calcasieu Ship Channel.

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

4.12.5.5 Conclusions on Marine Traffic Safety

The operational safety of LNG ships is under the jurisdiction of the Coast Guard. LNG ships have safely transited the Calcasieu Ship Channel in Louisiana for the past 20 years and worldwide for 50

years. The operational restrictions imposed by the Coast Guard and the Lake Charles Pilots would minimize the potential for a hazardous event occurring in the Calcasieu Ship Channel and affecting the safety of the nearby public.

The additional LNG vessel traffic should have only a minimal impact on other vessel traffic in the Calcasieu Ship Channel. Further, Creole Trail's commitment for a minimum of three tractor tugs would provide safe transit, maneuvering, and berthing for the LNG ships, and reduce vessel delays. With the mitigation measures discussed above, the operation of LNG ships should have similar impact as other large vessels, and should cause no more disruption than the vessel traffic increases planned by other channel users.

4.12.6 Terrorism and Security Issues

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

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

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

In September 2002, the DOT's OPS issued non-public guidelines to LNG operators that direct them to develop new security procedures for onshore facilities. Operators were required to prepare a security plan within 6 months that responds to the five threat levels defined by the Office of Homeland Security. OPS conducts subsequent on-site reviews of the security procedures.

On October 22, 2003, the Coast Guard issued a series of six final rules, which promulgated the maritime security requirements of the Maritime Transportation Security Act of 2002: Implementation of National Maritime Security Initiatives; Area Maritime Security; Vessel Security; Facility Security; Outer Continental Shelf Facility Security; and the Automatic Identification System. The entire series of rulemakings establishes a new subchapter H in 33 CFR. In support of the rulemakings, the Coast Guard applied a risk-based decision making process to comprehensively evaluate the relative risks of various target and attack mode combinations and scenarios for those vessel types and port facilities that pose a risk of a security incident. This approach provides a more realistic estimation of risk than a simple

"worst-case outcome" assessment. Risk management principles acknowledges that while risk generally cannot be eliminated, it can be reduced by adjusting operations to lower consequences, threats, or vulnerability, recognizing that it is easier to reduce vulnerabilities by adding security measures.

On December 29, 2003, terminal owners or operators subject to 33 CFR Part 105 were required to submit a *Facility Security Assessment and Facility Security Plan* to the Coast Guard COTP for review and approval. The Facility Security Plans were required to be implemented no later than July 1, 2004, or for facilities constructed after July 1, 2004, 60 days prior to operations. Some of the principal owner or operator responsibilities include:

- Designating a Facility Security Officer with a general knowledge of current security threats and patterns, risk assessment methodology, and the responsibility for implementing the Facility Security Plan and Assessment and performing an annual audit for the life of the project;

- Conducting a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures;

- Developing a Facility Security Plan based on the Facility Security Assessment, with procedures for responding to transportation security incidents, notification and coordination with local, state and federal authorities, prevent unauthorized access; measures and equipment to prevent or deter dangerous substances and devices, training and evacuation;

- Implementing scalable security measures to provide increasing levels of security at increasing MARSEC levels for facility access control, restricted areas, cargo handling, vessel stores and bunkers, and monitoring;

- Conducting security exercises at least once each calendar year and drills at least every 3 months; and

- Reporting of all breaches of security and security incidents.

Increased security awareness has occurred throughout the industry and the nation. President Bush established the Office of Homeland Security with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the United States. The Commission, in cooperation with other federal agencies and industry trade groups, has joined in the efforts to protect the energy infrastructure, including the more than 300,000 miles of interstate natural gas transmission pipeline and associated LNG facilities.

Safety and security are important considerations in any Commission action. The attacks of September 11, 2001 have changed the way pipeline operators as well as regulators must consider terrorism, both in approving new projects and in operating existing facilities. However, the likelihood of future acts of terrorism or sabotage occurring at the proposed Creole Trail LNG terminal, or at any of the myriad natural gas pipeline or energy facilities throughout the U.S., is unpredictable given the disparate motives and abilities of terrorist groups. The continuing need to construct facilities to support the future natural gas pipeline infrastructure is not diminished by the threat of any such unpredictable acts.

4.12.7 Pipeline Facilities

The transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000ºF and is flammable at concentrations between 5.0 percent and 15.0 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. It is buoyant at atmospheric temperatures and disperses rapidly in air.

4.12.7.1 Safety Standards

The DOT is mandated to provide pipeline safety under Title 49, U.S.C. Chapter 601. The RSPA's, OPS, administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards which set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. RSPA ensures that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level. Section 5(a) of the Natural Gas Pipeline Safety Act provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards, while section 5(b) permits a state agency that does not qualify under section 5(a) to perform certain inspection and monitoring functions. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement action. The majority of the states have either 5(a) certifications or 5(b) agreements, while nine states act as interstate agents.

The DOT pipeline standards are published in Parts 190-199 of Title 49 of the CFR. Part 192 of 49 CFR specifically addresses natural gas pipeline safety issues.

Under a Memorandum of Understanding on Natural Gas Transportation Facilities (Memorandum) dated January 15, 1993, between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a certificate is requested in accordance with federal safety standards and plans for maintenance and inspection, or shall certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards other than the DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipeline under the Commission's jurisdiction.

The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

The pipeline and aboveground facilities associated with the Creole Trail Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, and specifies more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined as follows:

Class 1	Location with 10 or fewer buildings intended for human occupancy.
Class 2	Location with more than 10 but less than 46 buildings intended for human occupancy.
Class 3	Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people on at least 5 days a week for 10 weeks in any 12-month period.
Class 4	Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock.

Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock. Class locations also specify the maximum distance to a sectionalizing block valve (e.g., 10.0 miles in Class 1, 7.5 miles in Class 2, 4.0 miles in Class 3, and 2.5 miles in Class 4). Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. The majority of the proposed pipeline routes would be in Class 1 locations, with some Class 2 pipe where required. Creole Trail has stated that it would design some Class 1 locations as Class 2 in anticipation of future development.

If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location for the pipeline, Creole Trail would be required to reduce the maximum allowable operating pressure or replace the segment with pipe of sufficient grade and wall thickness, if required, to comply with the DOT code of regulations for the new class location.

In 2002, Congress passed an act to strengthen the Nation's pipeline safety laws. The Pipeline Safety Improvement Act of 2002 (HR 3609) was passed by Congress on November 15, 2002, and signed into law by the President in December 2002. No later than December 17, 2004, gas transmission operators must develop and follow a written integrity management program that contains all the elements described in §192.911 and addresses the risks on each covered transmission pipeline segment. Specifically, the law establishes an integrity management program which applies to all high consequence areas (HCAs). The DOT (68 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 §192.903 of the DOT regulations.

OPS published a series of rules from August 6, 2002 to May 26, 2004 (69 FR 29903), that defines HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate in 49 U.S.C. 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCAs may be defined in one of two ways. In the first method an HCA includes:

- current Class 3 and 4 locations,
- any area in Class 1 or 2 where the potential impact radius[12] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle[13]; or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.[14]

In the second method an HCA includes any area within a potential impact circle which contains:

- 20 or more buildings intended for human occupancy, or
- an identified site.

Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at § 192.911. Creole Trail has identified four locations as HCAs.

The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every 7 years.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under section 192.615, each pipeline operator must also establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency shutdown of system and safe restoration of service;

[12] The potential impact radius is calculated as the product of 0.69 and the square root of the maximum allowable operating pressure of the pipeline in psi multiplied by the pipeline diameter in inches.

[13] The potential impact circle is a circle of radius equal to the potential impact radius.

[14] An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

- making personnel, equipment, tools, and materials available at the scene of an emergency; and

- protecting people first and then property, and making them safe from actual or potential hazards.

Part 192 requires that each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials. Creole Trail 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.

4.12.7.2 Pipeline Accident Data

Since February 9, 1970, 49 CFR Part 191 has required all operators of transmission and gathering systems to notify the DOT of any reportable incident and to submit a report on form F7100.2 within 20 days. Reportable incidents are defined as any leaks that:

- caused a death or personal injury requiring hospitalization;

- required taking any segment of transmission line out of service;

- resulted in gas ignition;

- caused estimated damage to the property of the operator, or others, or both, of a total of $5,000 or more;

- required immediate repair on a transmission line;

- occurred while testing with gas or another medium; or

- in the judgment of the operator was significant, even though it did not meet the above criteria.

The DOT changed reporting requirements after June 1984 to reduce the amount of data collected. Since that date, operators must only report incidents that involve property damage of more than $50,000, injury, death, release of gas, or that are otherwise considered significant by the operator. Table 4.12.7-1 presents a summary of incident data for the 1970 to 1984 period, as well as more recent incident data for 1986 through 2005, recognizing the difference in reporting requirements. The 14.5-year period from 1970 through June 1984, which provides a larger universe of data and more basic report information than subsequent years, has been subject to detailed analysis, as discussed in the following sections.[15]

[15] Jones, D.J., G.S. Kramer, D.N. Gideon, and R.J. Eiber, 1986. "An Analysis of Reportable Incidents for Natural Gas Transportation and Gathering Lines 1970 Through June 1984." NG-18 Report No. 158, Pipeline Research Committee of the American Gas Association.

TABLE 4.12.7-1 **Natural Gas Service Incidents by Cause**		
	Incidents per 1,000 miles of Pipeline (percentage)	
Cause	1970-1984	1986-2005
Outside force	0.70 (53.8)	0.10 (38.5)
Corrosion	0.22 (16.9)	0.06 (23.1)
Construction or material defect	0.27 (20.8)	0.04 (15.4)
Other	0.11 (8.5)	0.06 (23.1)
Total	1.30	0.26

During the 14.5-year period, 5,862 service incidents were reported over the more than 300,000 total miles of natural gas transmission and gathering systems nationwide. Service incidents, defined as failures that occur during pipeline operation, have remained fairly constant over this period with no clear upward or downward trend in annual totals. In addition, 2,013 test failures were reported. Correction of test failures removed defects from the pipeline before operation.

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.7-1 provides a percentage distribution of the causal factors as well as the annual frequency of each factor per 1,000 miles of pipeline in service.

The dominant incident cause is outside forces, constituting 53.8 percent of all service incidents. Outside forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards; weather effects such as winds, storms, and thermal strains; and willful damage. Table 4.12.7-2 shows that human error in equipment usage was responsible for approximately 75 percent of outside forces incidents. Since April 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "One Call" program is a service used by public utilities and some private sector companies (e.g., oil pipelines and cable television) to provide preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts. The 1986 through 2005 data show that the portion of incidents caused by outside forces has decreased to 38.5 percent.

The pipelines included in the data set in table 4.12.7-1 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

TABLE 4.12.7-2 **Outside Forces Incidents by Cause (1970-1984)**	
Cause	Percent
Equipment operated by outside party	67.1
Equipment operated by or for operator	7.3
Earth movement	13.3
Weather	10.8
Other	1.5

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed before that time have a significantly higher rate, partially due to corrosion. Older pipelines have a higher

frequency of corrosion incidents, since corrosion is a time-dependent process. Further, new pipe generally uses more advanced coatings and cathodic protection to reduce corrosion potential.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, the older pipelines contain a disproportionate number of smaller diameter pipelines, which have a greater rate of outside forces incidents. Small diameter pipelines are more easily crushed or broken by mechanical equipment or earth movements.

Table 4.12.7-3 clearly demonstrates the effectiveness of corrosion control in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of failure compared to unprotected or partially protected pipe. The data shows that bare, cathodically protected pipe actually has a higher corrosion rate than unprotected pipe. This anomaly reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 4.12.7-3

External Corrosion by Level of Control (1970-1984)

Corrosion Control	Incidents per 1,000 miles per Year
None-bare pipe	0.42
Cathodic protection only	0.97
Coated only	0.40
Coated and cathodic protection	0.11

4.12.7.3 Impact on Public Safety

The service incident data summarized in table 4.12.7-1 include pipeline failures of all magnitudes with widely varying consequences. Approximately two-thirds of the incidents were classified as leaks, and the remaining third classified as ruptures, implying a more serious failure.

Table 4.12.7-4 presents the average annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 2005. Fatalities between 1970 and June 1984 have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Of the total 5.0 nationwide average, fatalities among the public averaged 2.6 per year over this period. The simplified reporting requirements in effect after June 1984 do not differentiate between employees and nonemployees. However, the data show that the total annual average for the period 1984 through 2005 decreased to 3.6 fatalities per year. Subtracting two major offshore incidents in 1989, which do not reflect the risk to the onshore public, yields a total annual rate of 2.8 fatalities per year for this period.

TABLE 4.12.7-4

Annual Average Fatalities - Natural Gas Transmission and Gathering Systems [a, b]

Year	Employees	Nonemployees	Total
1970-June 1984	2.4	2.6	5.0
1984-2005 [c]	-	-	3.6
1984-2005 [c]	-	-	2.8 [d]

[a] 1970 through June 1984 - American Gas Association, 1986.
[b] DOT Hazardous Materials Information System.
[c] Employee/nonemployee breakdown not available after June 1984.
[d] Without 18 offshore fatalities occurring in 1989 -- 11 fatalities resulted from a fishing vessel striking an offshore pipeline and 7 fatalities resulted from explosion on an offshore production platform.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.7-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Nevertheless, the average of 2.6 public fatalities per year is relatively small considering the more than 300,000 miles of transmission and gathering lines in service nationwide. Furthermore, the fatality rate is approximately two orders of magnitude (100 times) lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

TABLE 4.12.7-5

Nationwide Accidental Deaths [a]

Type of Accident	Fatalities
All accidents	90,523
Motor vehicles	43,649
Falls	14,985
Drowning	3,488
Poisoning	9,510
Fires and burns	3,791
Suffocation by ingested object	3,206
Tornado, flood, earthquake, etc. (1984-93 average)	181
All liquid and gas pipelines (1978-87 average) [b]	27
Gas transmission and gathering lines Nonemployees only (1970-84 average) [c]	2.6

[a] All data, unless otherwise noted, reflects 1996 statistics from the U.S. Department of Commerce, Bureau of the Census, "Statistical Abstract of the U.S. 118th Edition."

[b] U.S. Department of Transportation, "Annual Report on Pipeline Safety - Calendar Year 1987."

[c] American Gas Association, 1986.

The available data show that natural gas pipelines continue to be a safe, reliable means of energy transportation. Based on approximately 301,000 miles in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines in service is 0.01 per year per 1,000 miles of pipeline. Using this rate, the Creole Trail LNG Project might result in a public fatality every 416 years. This would represent a slight increase in risk to the nearby public.

4.12.8 Conclusions on Safety Issues

Much of the recent safety debate has centered on the perceived size of worst case scenarios; the distance to various thermal radiation heat levels for LNG fires; the range of potentially flammable vapors; and the population and infrastructure that are located within the various hazard areas. These are components of a consequence analysis.

However, the evaluation of safety is more than an exercise in calculating the consequences of worst case scenarios. Rather, safety is a determination of the acceptability of risk which considers: (1) the probability of events; (2) the effect of mitigation; and (3) the consequences of events.

Accidental Causes - Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should be considered negligible.

Intentional Attacks - Unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG vessel or onshore storage facility. For a new LNG import terminal proposal, having a large volume of energy transported and stored near populated areas, the perceived threat of a terrorist attack may be considered as highly probable to the local population.

However, at the national level, potential terrorist targets are plentiful, many having national significance, while others with a large concentration of the public (major sporting events, skyscrapers, etc.) or critical infrastructure facilities. Currently, the United States has over 500 chemical facilities operating near large populations. U.S. waterways also transport over 100,000 annual shipments of hazardous marine cargo, including LPG, ammonia, and other volatile chemicals. Many of these substances pose a similar hazard to that of LNG.

Risk Management - While the risks associated with the transportation of any hazardous cargo can never be entirely eliminated, they can be managed. For potential targets where the threat is perceived to be high, resources can be directed to mitigate possible attack paths. Such efforts may deter potential attacks on one target, but shift efforts to those that are less protected. As a result, the issue is how to best direct finite resources.

For the proposed project, it may be possible to apply risk management resources to manage realistic threats; however, an even greater level of resources may be required to manage the threats as perceived at the local level. The issue for the decision makers is whether the resources required to manage the risks are justified by the benefits, while recognizing that the risks cannot be entirely eliminated.

4.13 CUMULATIVE IMPACTS

The CEQ defines cumulative impacts as "impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."[16] Although the individual impact of each individual project may be minor, the additive or synergistic impacts from multiple projects could be significant. Impacts subject to cumulative effects analysis for the Creole Trail Project were identified by determining the environmental impact issues associated with the proposed action, establishing the geographic scope of the study area, establishing the time frame of the analysis, and identifying other past, present, or future actions that have affected, or could affect, the resources of concern.

Existing environmental conditions in the project area reflect changes based on past projects and activities. For example, much of the coastal marsh and shoreline in southwestern Louisiana and along the Calcasieu Ship Channel has been disturbed by previous activities associated with the development of the Calcasieu Ship Channel and the commercial traffic associated with the Ports of Lake Charles. The project area contains multiple natural gas and oil production facilities, pipelines, and storage areas, and numerous new natural gas-related facilities have been proposed to be constructed and operated in this area. Many of the proposed pipelines are currently undergoing regulatory review and have not yet been approved.

Construction of the Creole Trail Project would result in both short- and long-term, minor to moderate environmental impacts. Impacts associated with construction of the pipelines generally are short term and minor because resources in the project area that would be affected during construction can generally be restored or allowed to revegetate back to their original condition following pipeline installation. Some long-term impacts occur, however, when resources cannot be restored back to original conditions (e.g., cleared forest lands), or when resources are permanently affected due to operational and maintenance requirements (e.g., development of the proposed LNG terminal facilities and maintenance requirements along the proposed pipeline rights-of-way).

The environmental impact analysis contained in this EIS indicates that pipeline construction and operation activities for the Creole Trail Project would result in short-term and minor impacts associated primarily with construction across waterbodies and wetlands, fish and other wildlife habitats, recreation, socioeconomics, transportation, air quality, and noise. Long-term impacts associated with construction of the LNG terminal and pipeline-related aboveground facilities are considered more significant and may include both the temporary and permanent clearing of mature forests, disruption of sensitive wetland soils, permanent loss of habitat and wetlands associated with construction of the terminal facilities and pipeline-related aboveground facilities, and maintenance of the permanent pipeline rights-of-way. Although these types of impacts were not considered significant for the Creole Trail Project, they were considered on a cumulative impact basis in association with the review of other LNG terminal and pipeline projects proposed or approved for the area. Environmental resources such as geology, soils, and cultural would not be measurably affected by the proposed project and, therefore, have not been considered in this cumulative effects analysis.

Table 4.13-1 lists ongoing activities and reasonably foreseeable future projects that could contribute to impacts on resources that also would be affected by construction and operation of the Creole Trail Project.

[16] 40 CFR 1508.7.

TABLE 4.13-1

Existing, Approved, or Proposed Activities that Could Contribute to Cumulative Impacts Associated with Construction of the Creole Trail Project

Activity	Description	Schedule
Past or Present Projects or Activities		
Manufacturing/Refining	Oil and gas extraction, processing, and transportation, both onshore and offshore.	Ongoing
Dredging	Maintenance dredging of the Calcasieu Ship Channel	Periodic
Recreation	Fishing, boating, and bird watching.	Ongoing
Shipping	Commercial ship traffic within the Calcasieu Ship Channel.	Ongoing
Transportation and Utility	Construction and maintenance of new and existing roadway and utility (e.g., powerlines) systems.	Ongoing
Commercial and Residential Development	Business and housing construction projects.	Ongoing
Agriculture and Silviculture	Agricultural practices, including animal grazing, and pine plantations and associated management practices.	Ongoing
Industrial Canal Boat Launch and Park	Development of a boat launch and park at the intersection of the Industrial Canal and the Gulf Intracoastal Waterway in Calcasieu Parish.	Completed June 2003
Reasonably Foreseeable Future Projects		
Sabine Pass LNG Project [a]	Construction of three LNG tanks along the Sabine Ship Channel with a nominal output of up to 2.6 Bcfd and a new 16-mile-long natural gas pipeline originating at the Sabine LNG terminal and terminating near Johnsons Bayou in Cameron Parish, Louisiana.	2005 to 2006
Sabine Pass LNG Project Expansion [b]	Expansion of Sabine Pass LNG Project (Phase I) to include construction and operation of three additional LNG tanks to increase sendout output up to 4.0 Bcfd.	2006 to 2010
Trunkline LNG Terminal Expansion [a]	Expansion of an existing LNG terminal in Lake Charles, Louisiana.	2005 to 2006
Cameron (Hackberry) LNG Project [a]	Construction and operation of an LNG terminal along the Calcasieu Ship Channel and associated natural gas pipeline in Louisiana.	2005 to 2006
Cameron LNG Expansion Project [b]	Expansion of Cameron (Hackberry) LNG Project to construct and operate one additional LNG storage tank and other modifications to increase sendout capacity to 2.65 Bcfd.	2007 to 2010
Cameron Parish Waterworks (District 10)	Construction of a 12.5-mile water main pipeline from Johnsons Bayou along State Highway 82 to the entrance of the Sabine Pass LNG terminal.	Undetermined
Golden Pass LNG Project [a]	Construction of up to five LNG storage tanks with a nominal output of 1 Bcfd for the first phase (three LNG tanks), increasing to 2 Bcfd in the second phase (five tanks) in Jefferson County, Texas, and about 122 miles of pipelines located in Jefferson, Orange, and Newton Counties, Texas, and Calcasieu Parish, Louisiana.	2005 to 2008
Liberty Storage Pipeline Project [a]	Construction of 23.3 miles of 30-inch-diameter pipeline and development of a salt cavern storage facility in Beauregard Parish, Louisiana.	2005 to 2006
Kinder Morgan Louisiana Pipeline [b]	Construction of about 140 miles of 24- to 42-inch-diameter pipeline in Cameron, Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana	2007 to 2010
Port Arthur LNG Project [b]	Port Arthur LNG proposes to construct and operate an LNG terminal along the Sabine-Neches Canal and associated natural gas pipeline in Texas and Louisiana.	2005 to 2010
Starks Gas Storage Pipeline Project [c]	Construction of about 35.6 miles of 16-inch and 30-inch-diameter natural gas pipeline and about 1.9 miles of 10-inch-diameter brine pipeline in Calcasieu and Beauregard Parishes, Louisiana.	2006 to 2009

[a] Projects have been approved by the FERC and are under construction.

[b] Projects are currently under review by the FERC.

[c] Projects have been approved by the FERC but construction has not begun.

Table 4.13-2 depicts the resources that would be affected by construction and operation of the projects listed in table 4.13-1. Construction schedules of the future projects depend on factors such as economics, funding, and politics, but all are expected, if approved for development, to be constructed in the same general timeframe associated with the Creole Trail Project. Projects and activities included in this analysis are generally those of comparable magnitude and nature of impact with the proposed action, and are located within the same vicinity as the proposed project.

TABLE 4.13-2

Resources of Concern that Could be Affected by Construction or Development of Existing, Approved, or Proposed Projects or Activities in the Vicinity of the Creole Trail Project

	Primary Environmental Impact									
Activity/Project	Water Resources	Wetlands	Wildlife/Vegetation	Aquatic Resources	Recreation	Socioeconomics	Land Use	Ship Traffic	Transportation	Air Quality/Noise
Present Projects or Activities										
Manufacturing/Refinery	X			X		X	X	X	X	X
Dredging	X	X	X	X	X		X	X		X
Recreation	X		X		X	X			X	
Shipping	X			X				X	X	X
Transportation and Utility	X	X	X	X	X	X	X		X	X
Commercial/Residential Development	X	X	X			X	X			X
Agriculture and Silviculture	X	X	X		X	X	X			
Reasonably Foreseeable Future Projects or Activities										
Cameron (Hackberry) LNG Pipeline	X	X	X	X	X	X	X	X	X	X
Cameron LNG Expansion Project [a]	X	X	X					X	X	X
Cameron Parish Waterworks District No. 10 Pipeline	X	X	X	X	X	X	X			
Golden Pass LNG Project	X	X	X	X	X	X	X	X	X	X
Kinder Morgan Louisiana Pipeline	X	X	X	X	X	X	X		X	X
Liberty Storage Pipeline	X	X	X	X	X	X	X			
Port Arthur LNG Project	X	X	X	X	X	X	X	X	X	X
Sabine Pass LNG Project	X	X	X	X	X	X	X	X	X	X
Sabine Pass LNG Project Expansion [b]	X	X						X	X	X
Starks Gas Storage Pipeline	X	X	X	X	X	X	X			
Trunkline LNG Terminal Expansion	X							X	X	X

[a] The proposed Cameron LNG Expansion Project would affect about 15 acres of land adjacent to the approved Cameron LNG facility within property already leased by Cameron LNG, L.L.C.

[b] No other resources were considered regarding the Sabine Pass LNG Project Expansion because it would be within the same boundaries as the existing facility.

For purposes of this analysis, a reasonable geographic area to consider for the inclusion of projects that could contribute to the cumulative effects of the proposed action is defined as the area between Lake Charles to the east and Port Arthur to the west, and from the Gulf of Mexico coast north to the Transco System. More geographically distant projects were not included in this assessment because their impact would generally be localized elsewhere and, therefore, would not contribute significantly to cumulative impacts in the immediate project area.

Of the projects that may be constructed in the project area, the Cameron LNG Project (with its expansion) would be the closest LNG terminal to the proposed Creole Trail LNG terminal. LNG ships calling on both the Cameron LNG and Creole Trail LNG terminals would use the Calcasieu Ship Channel. Further, the sendout pipeline from the Cameron LNG Project would be near the proposed Creole Trail pipelines. We have also considered the Trunkline LNG Terminal Expansion in Lake Charles. Three other LNG projects in the region that we have considered in our analysis are the proposed or approved LNG terminals on the Sabine-Neches Waterway, including the Port Arthur LNG Project (Port Arthur) and the Golden Pass LNG Terminal and Pipeline Project (Golden Pass), both in Jefferson County, Texas, and the Sabine Pass LNG and Pipeline Project (Sabine Pass Project) and the recently proposed expansion for this facility in Cameron Parish, Louisiana. Although the LNG ships that would call on these terminals would not use the same ship channel as those calling on the proposed Creole Trail LNG terminal, they are in the general vicinity of the Creole Trail Project and would contribute to marine traffic in the northern Gulf of Mexico. In addition, a portion of the proposed Port Arthur sendout pipeline would be near the proposed Creole Trail Segment 3. The Golden Pass pipeline is not close to the Creole Trail Project but would be partially located within Calcasieu Parish.

The Liberty Storage Project and Starks Gas Storage Project would involve the construction of pipelines near the proposed Creole Trail pipelines. In addition, we have considered in our analysis the pipeline that would be constructed for the Sabine Pass Project, which would involve pipeline construction within parishes affected by the Creole Trail Project (i.e., Cameron and Calcasieu), and a 12.5-mile-long water line that would be constructed by Cameron Parish Water Works along State Highway 82 in Cameron Parish between Johnson's Bayou and the Sabine Pass LNG terminal.

In February 2006, the Commission issued a Pre-Filing docket number (PF06-16-000) for the Kinder Morgan Louisiana Pipeline (Kinder Morgan) Project. The Kinder Morgan Project would consist of a total of about 140 miles of 24- to 42-inch-diameter pipeline that would extend from the Sabine Pass LNG terminal in Cameron Parish, Louisiana to various delivery points in Cameron, Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes. Draft resource reports for the Kinder Morgan Project are expected to be filed in March, 2006 and a formal application is expected to be filed in August, 2006. Because the specific environmental resources affected by with this project have not yet been filed or analyzed, the Kinder Morgan Project is considered in this cumulative impacts analysis from only a qualitative standpoint. Discussions of quantitative impacts do not include the Kinder Morgan Project.

The pipeline projects that would be geographically the closest to the proposed Creole Trail Project would be along Segment 3 and include the Cameron LNG Project pipeline between MPs 1.4 and 10.7; the Liberty Storage Project pipelines between MPs 8.9 and 10.7, MPs 26.5 and 26.8, and MPs 29.0 and 32.0; and the Port Arthur Project pipeline between MPs 26.5 and 26.8. Environmental information associated with these projects was derived from draft and final EISs or from environmental information provided with the project applications.

Figure 4.13-1 shows reasonably foreseeable future LNG and related pipeline projects that could contribute to impacts on resources that also would be affected by construction and operation of the Creole Trail Project. As shown in figure 4.13-1 and mentioned above, several of these projects involve pipelines that would be collocated within the same rights-of-way proposed by Creole Trail. Therefore, to minimize construction impacts if the Creole Trail Project is constructed after other projects, **we recommend that:**

- **For areas where the Creole Trail Project would be collocated with one or more planned pipeline(s) adjacent to an existing right-of-way, the first pipeline to be constructed should be constructed closest to the existing right-of-way. The Creole Trail pipeline should be constructed with a 25-foot offset from the nearest existing pipeline. For the Creole Trail Project, these areas include:**

MILEPOST (Segment 3)	POTENTIALLY COLLOCATED PROJECT
1.4 to 10.7	Cameron LNG Project
8.9 to 10.7	Liberty Storage Project
26.5 to 26.8	Liberty Storage Project
26.5 to 26.8	Port Arthur LNG Project
29.0 to 32.0	Liberty Storage Project

<u>Prior to construction</u>, Creole Trail should file alignment sheets and environmental information to support the new alignment with the Secretary for review and written approval by the Director of OEP.

In its comments on the draft EIS, Creole Trail acknowledged the above recommendation and stated that it would modify its alignment sheets to show the referenced pipelines as existing facilities "…if, at the time of construction, one of these projects is identified as a conflict and if one of the lines is either under construction or has been constructed prior to the [Creole Trail] pipeline within the same right-of-way." Creole Trail also stated that it would file revised alignment sheets with "…a 25 foot offset from the nearest pipeline *easement* [emphasis added] if a conflict is identified." In another comment on the draft EIS, Creole Trail stated that a 25-foot offset from the nearest pipeline would be insufficient for construction and maintenance and noted that it proposed in its application a typical offset of 50 feet from existing parallel pipelines.

It is unclear from Creole Trail's comments what is meant by a "conflict" or how such a conflict would be identified. Further, Creole Trail's comments propose an offset distance that would not comply with our recommendation, which calls for a 25-foot offset from the nearest existing pipeline (not easement) at the referenced locations. We have recognized in section 2.2.2 that where the proposed Creole Trail pipeline would be collocated with existing pipelines, the typical offset from the parallel pipeline would be 50 feet. The above recommendation pertains to specific locations where we anticipate congestion as a result of multiple proposed pipelines. Our intent is to minimize construction impacts associated with the construction of multiple pipelines; therefore, we recommend a 25-offset from the nearest pipeline at these locations. If Creole Trail determines that it cannot comply with this recommendation, it should describe its reasoning, including site-specific justification, in its Implementation Plan to be filed prior to construction.

Table 4.13-3 summarizes the major resources (e.g., wetlands, forest land) that would experience cumulative impacts from construction and operation of the other proposed LNG terminal and pipeline projects in the vicinity of the proposed Creole Trail Project.

Non-Internet Public

ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED
CREOLE TRAIL LNG TERMINAL
AND PIPELINE PROJECT
Docket Nos. CP05-360-000, CP05-357-000,
CP05-358,000, CP05-359-000

Figure 4.13-1 Reasonably Foreseeable Projects in the Cumulative Impact Analysis Area

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

TABLE 4.13-3

Environmental Resources That Would Be Cumulatively Affected During Construction and Operation of Projects in the Vicinity of the Proposed Creole Trail Project [a]

Project	Pipeline Length (miles) [b]	Open-Cut Waterbody Crossings (no.)	Dredging Required (yd^3)		Total Wetlands Disturbed During Construction (acres)		Forested Wetlands Disturbed (acres)		Forestland Cleared (acres) [c]	
			Berth Area	Lake [d]	LNG Terminal	Pipeline	LNG Terminal	Pipeline	LNG Terminal	Pipeline
Cameron (Hackberry) LNG Project[h]	35.4	97	4,900,000	NA	67.7	148.1	0.0 (const.) 0.0 (oper.)	25.9 (const.) 11.3 (oper.)	0.0 (const.) 0.0 (oper.)	148.3 (const.) 74.2 (oper.)
Cameron LNG Expansion Project[j]	NA	0	20,000	NA	1.8	NA	0.0 (const.) 0.0 (oper.)	0.0 (const.) 0.0 (oper.)	0.0 (const.) 0.0 (oper.)	0.0 (const.) 0.0 (oper.)
Cameron Parish Waterworks [e]	8.6	Unknown	none	NA	NA	49.7	NA	0.7 (const.) 0.1 (oper.)	NA	1.2 (const.) 0.4 (oper.)
Creole Trail Project [j]	116.8 [f]	81	4,100,000	2,575,596	102.9	106.8	0.0 (const.) 0.0 (oper.)	47.8 (const.) 25.4 (oper.)	54.1 (const.) 22.9 (oper.)	552.5 (const.) 299.7 (oper.)
Golden Pass LNG Project[h]	122.4	54	5,700,000	NA	108.8	290.2	0.0 (const.) 0.0 (oper.)	63.9 (const.) 63.9 (oper.)	0.0 (const.) 0.0 (oper.)	451.3 (const.) 238.7 (oper.)
Liberty Pipeline Project[h]	24.6	10	none	NA	NA	40.9	NA	32.3 (const.) 22.7 (oper.)	NA	155.5 (const.) 82.4 (oper.)
Port Arthur LNG Project[j]	73.0	34	820,000	310,088	82.5	308.3	57.5 (const.) 57.5 (oper.)	32.5 (const.) 13.1 (oper.)	0.0 (const.) 0.0 (oper.)	201.0 (const.) 87.2 (oper.)
Sabine Pass LNG and Pipeline Project[i]	16.0	5	4,569,000	NA	56.4	99.4	0.0 (const.) 0.0 (oper.)	1.2 (const.) 0.2 (oper.)	0.7 (const.) 0.7 (oper.)	2.3 (const.) 0.8 (oper.)
Sabine Pass LNG Project Expansion[j]	NA	0	NA	NA	100.3	NA	0.0 (const.) 0.0 (oper.)	0.0 (const.) 0.0 (oper.)	0.0 (const.) 0.0 (oper.)	0.0 (const.) 0.0 (oper.)
Starks Gas Storage Pipeline Project[h]	34.7	6	none	NA	NA	49.8 [g]	NA	31.8 (const.) 19.4 (oper.)	NA	149.2 (const.) 90.3 (oper.)
Trunkline LNG Terminal Expansion [i]	22.2	0	70,000	NA	0.0	NA	0.0 (const.) 0.0 (oper.)	NA	0.0 (const.) 0.0 (oper.)	NA
Cumulative Totals	453.7	287	20,179,000	2,885,684	520.4	1,093.2	57.5 (const.) 57.5 (oper.)	236.1 (const.) 156.1 (oper.)	54.8 (const.) 23.6 (oper.)	1,661.3 (const.) 873.7 (oper.)

[a] Environmental resource impacts associated the Kinder Morgan Louisiana Pipeline Project are not included in this table because such information has not yet been filed.
[b] Includes mainlines, looplines, and laterals associated with the project.
[c] Includes forested wetlands.
[d] Dredging required in Sabine Lake (Port Arthur) and Calcasieu Lake (Creole Trail) for pipeline construction.
[e] The final details of the Cameron Parish Waterworks Project are not available. As shown on figure 4.13-1, the project is anticipated to be located adjacent to the Sabine Pass Pipeline. This project would be about 7.4 miles (about 50 percent) shorter and likely to consist of smaller diameter pipeline, therefore the impacts have been assumed to be one-half of those that would be experienced by the Sabine Pass Pipeline Project.
[f] Includes dual pipeline.
[g] Includes aboveground facilities.
[h] Projects have been approved by the FERC but construction has not begun.
[i] Projects have been approved by the FERC and are under construction.
[j] Projects are currently under review by the FERC.

NA Not applicable
yd^3 cubic yards
const. construction
oper. operation

4.13.1 Water Resources

The proposed project would involve dredging for the marine facilities and, therefore, would have impacts on water resources. Increased turbidity and sedimentation from initial dredging during construction and maintenance dredging during operation of the facility would temporarily decrease water quality during those periods. If dredging associated with the proposed project was to occur concurrently with maintenance dredging of the Calcasieu Ship Channel or dredging associated with construction of the Cameron LNG Projects, a reduction in water quality could be exacerbated. However, the impact of these activities would be temporary and water quality would be expected to return to ambient conditions soon after completion of dredging.

Cumulative impacts on water quality associated with the proposed pipelines and the other pipeline projects included in the analysis would be related primarily to the effects of trenching (open-cut) across waterbodies. Creole Trail proposes to cross 26 waterbodies using the HDD method, as well as the entry and exit of Segment 2 into and out of Calcasieu Lake, which would avoid impacts on stream banks and stream beds at those crossings. Construction of the proposed Creole Trail pipelines would involve open-cutting 81 waterbodies (not including manmade waterbodies). Construction of the other approved or proposed natural gas pipelines would require the open-cut crossing of 206 waterbodies. Minor increases in turbidity could occur in a river basin if the waterbody crossings for each of these projects were to take place concurrently or within a very short time of each other. However, since each of these projects would be required to implement our Procedures when crossing waterbodies, cumulative impacts on waterbodies are expected to be short term and minor. Our Procedures include requirements for pre-construction planning, environmental inspection, waterbody crossing methods, and restoration methods that would minimize impacts on surface waterbodies crossed during pipeline construction.

Construction of the Creole Trail Project would require dredging of an estimated 2,575,596 yd^3 of lake sediments for pipeline installation across 17.1 miles of Calcasieu Lake. None of the other projects included in this analysis would involve construction across Calcasieu Lake; therefore, there would be no associated cumulative impacts on Calcasieu Lake water quality. The Port Arthur and Kinder Morgan Projects would involve dredging in Sabine Lake. However, Sabine Lake is about 25 miles west of Calcasieu Lake and activity in that lake would not contribute to the potential turbidity and sedimentation in Calcasieu Lake.

The wastewater and stormwater discharges from the proposed project also could result in a cumulative reduction in water quality when considered with other industrial and non-point discharges along the Calcasieu Ship Channel. Both the Creole Trail Project and the Cameron LNG Project (including expansion) would use SVCs to vaporize LNG at their respective terminals. The use of SCVs would result in the generation of fresh water condensate. Creole Trail would discharge about 547,200 gpd of water to its firewater ponds. The firewater ponds would then discharge excess water to the Calcasieu Ship Channel. The volume of water that would be discharged into the Calcasieu Ship Channel would vary based on daily conditions. The Cameron LNG terminal would discharge about 550,000 gpd of water to the Calcasieu Ship Channel. Both projects would comply with their respective LADEQ permits which would require discharges to meet the LADEQ's water quality standards. Therefore, project-specific discharges would not be expected to contribute to a reduction in overall water quality.

4.13.2 Wetlands

Creole Trail selected its LNG terminal site to minimize impacts on wetlands. The permanent loss of 34.5 acres of wetlands at the proposed LNG terminal site would contribute to the current natural and anthropogenic losses of coastal marsh in Louisiana. The estimated cumulative permanent loss of wetlands for the other LNG terminals included in this analysis would be approximately 308.5 acres,

including 67.7 acres for the Cameron LNG Project, 1.8 acres for the Cameron LNG Expansion Project, 108.8 acres for the Golden Pass Project, 47.7 acres for Sabine Pass Projects, and 82.5 acres for the Port Arthur Project. The Kinder Morgan Project would also likely result in impacts on wetlands, but the extent of wetland impacts is not currently known. Creole Trail and the proponents of the other projects would develop compensation plans to mitigate for the loss of these wetlands through the COE's section 404 permit process. Therefore, although construction and operation of the proposed project along with the other projects and activities in the area would result in a cumulative reduction in the amount of coastal marsh in the general vicinity of the projects, mitigation for wetlands affected by all of the projects would probably avoid a net loss of wetlands and may result in a net increase and/or improvement in the regional coastal marsh resource due to COE required mitigation.

The Creole Trail Project would involve the construction of 116.8 miles of new natural gas dual pipeline. A total of 336.9 miles of pipeline construction associated with the other projects listed in table 4.13-3, as well as the 140 miles associated with the Kinder Morgan Project, also would contribute to additional wetland impacts if these projects are approved and constructed. In general, construction of pipelines across wetlands does not result in any "net-loss" of wetlands due to draining or filling, unless aboveground facilities required for the pipelines are placed in the wetlands. However, wetland functional values may be temporarily or permanently altered, depending on the type of wetlands being affected. The most significant change in wetlands caused by pipeline construction and operation is the temporary or permanent loss of natural vegetation cover, particularly when construction affects forested wetlands. Temporary clearing is considered a long-term impact, as forest regeneration can take 35 to 75 years. Clearing forested areas to create the pipeline operational right-of-way is considered a permanent impact, or loss, because only small trees, shrubs, or emergent vegetation are allowed to grow within the operational right-of-way.

Construction of the Creole Trail Project pipelines would require disturbance of approximately 106.8 acres of wetlands, including 47.8 acres of forested wetlands. Assessment of this project indicates that about 25.4 acres of forested wetland would be permanently converted to emergent or scrub-shrub wetland habitat.

Total wetland construction impacts, in combination with the other pipelines considered in this assessment, would affect a total of 1,093.2 acres of wetlands, including 236.1 acres of forested wetlands. The combined projects would result cumulatively in a short-term and minor impact associated with construction through emergent or scrub-shrub wetlands, which would revegetate quickly (generally within 1 to 3 years) after construction and right-of-way restoration. Construction through forested wetlands, however, would contribute cumulatively to the long-term or permanent alteration of forested wetlands in southwest Louisiana and southeast Texas to shrub or emergent wetlands. Forested wetlands in this region are routinely cleared for production of forest products (e.g., paper pulp). Forested wetland clearing in the project area would represent a long-term, moderate, and adverse cumulative impact. However, cumulative impacts on forested wetlands are decreased when pipeline rights-of-way from these different projects are parallel and adjacent to each other, limiting forest fragmentation and associated edge effects created by new pipeline rights-of-way. This would be the case where Segment 3 of Creole Trail's proposed pipeline system would be parallel and adjacent to other proposed pipelines between MPs 1.4 and 10.7 (Cameron LNG Project), between MPs 8.9 and 10.7, MPs 26.5 and 26.8, and MPs 29.0 and 32.0 (Liberty Storage Project), and between MPs 26.5 and 26.8 (Port Arthur Project). Additionally, each project sponsor would be required to work with the COE and other appropriate agencies to develop site-specific wetland mitigation plans to account for all permanent impacts.

Creole Trail and the sponsors of the other projects would mitigate the loss of wetlands as required by the COE's Section 404 permit requirements. The construction and operation of the proposed project, along with the other potential projects and activities, would result in a cumulative reduction in the amount

of coastal marsh in the vicinity of the project. However, mitigation for wetlands affected by the proposed project and the other projects listed would be required by the COE and could result in a net increase and/or improvement in the regional coastal marsh resource.

4.13.3 Biological Resources

When projects are constructed at or near the same time, the combination of construction activities could have a cumulative impact on vegetation, wildlife, and aquatic organisms living in the immediate area. Clearing, grading, and other construction activities associated with pipeline construction and other similar activities in the vicinity (e.g., road and transmission line construction, silvicultural practices) would result in the removal of vegetation, alteration of wildlife habitat, displacement of wildlife, and other secondary effects such as increased population stress, predation, forest fragmentation, and establishment of invasive plant species.

The conversion of 123.7 acres of land for the proposed Creole Trail LNG terminal would have permanent impacts on the vegetation and wildlife at that location. However, the remaining 647.9 acres of the 771.6-acre tract leased by Creole Trail would remain in its existing state with the exception of a 243.5-acre area that would be used for temporary construction facilities and equipment laydown area. This area would be cleared temporarily, but allowed to revert to current conditions after construction. The Cameron and Sabine Pass LNG terminals in Louisiana and the Golden Pass and Port Arthur LNG terminals in Texas would be constructed on similarly sized sites, with similar direct and indirect effects, resulting in an estimated cumulative vegetation loss of 858.6 acres (118.5 acres for Cameron, 14.1 acres for the Cameron Expansion, 198.2 acres for Port Arthur, 205.0 acres for Golden Pass, and 322.8 acres for Sabine Pass) for construction of the proposed or approved terminals.

The construction of multiple large industrial projects at or near the same time can result in a significant amount of land clearing activities that could have a cumulative impact on forest resources in the immediate area of the projects. However, the sites proposed for the LNG terminals are largely devoid of large stands of trees. Our review indicates that there are no existing stands of forest, other than the invasive Chinese tallow tree, that would be cleared for the construction of the Cameron LNG terminal (including the proposed expansion), the Port Arthur LNG terminal, the Golden Pass terminal, or the Sabine Pass terminal. Each of these sites has some small existing trees that would be removed, but no areas that would be considered forest are present at these locations.

Loss of coastal marsh from the project and other projects could cumulatively decrease the amount of habitat available for aquatic organisms that require estuarine wetlands for foraging or nursery habitat. A total of approximately 343.0 acres of wetlands would be permanently lost as a result of construction of the Creole Trail Project and the other LNG terminals (34.5 acres for the Creole Trail Project, 67.7 acres for the Cameron LNG Project, 1.8 acres for Cameron LNG Expansion Project, 108.8 acres for the Golden Pass Project, 47.7 acres for the Sabine Pass Projects, and 82.5 acres for the Port Arthur Project). The other projects listed in table 4.13-1 also would have wetland impacts associated with them. Because projects affecting coastal marsh generally require compensatory mitigation to replace lost marsh acreage, impacts resulting from loss of marsh are generally temporary, lasting only until the newly created marsh becomes functional. Depending on the location of the wetland mitigation areas in relation to the impacted wetlands, there could be reductions in available aquatic habitat at the project sites and gains in habitat at other offsite locations. Creole Trail is working with the COE and other agencies to develop the details of a project-specific compensatory wetland mitigation plan.

Both the Creole Trail Project and the Cameron LNG Projects would require dredging in the Calcasieu Ship Channel for construction of their respective marine facilities. Although the construction schedule for the Cameron LNG Project is not known precisely at this time, the project has been approved

and dredging will likely begin in the near future. Dredging for the Creole Trail Project is proposed to begin in 2006 subject to the receipt of necessary permits and approvals. Dredging for the Cameron LNG Expansion Project could begin in late 2007. Because dredging lasts several months, it is possible that dredging for these three projects would overlap. Both the Creole Trail Project and the Cameron LNG Projects would place dredged material in approved DMPAs, with some or all of that material being put to beneficial use.

Although these dredging activities individually would affect aquatic resources, and together would be expected to have a more substantial effect on those resources, the impacts associated with the dredging activities would be temporary and largely restricted to the period of active dredging and a short period following completion.

The Golden Pass and Port Arthur Projects would require dredging for the marine terminal berths in the Sabine-Neches Waterway. The Sabine Pass Project would require dredging in the Sabine Pass Channel. Dredging for these projects would not contribute to cumulative impacts on the Calcasieu Ship Channel.

Vegetation clearing and wildlife habitat alteration associated with pipeline construction is generally short-term for open, herbaceous, or scrub-shrub areas, which often revegetate within one to several growing seasons. In areas supporting these types of cover, cumulative impacts in the project area would be short-term and minor. In forested areas, cumulative impacts associated with forest clearing would be either long-term or permanent.

The 593.7 miles of pipeline that would be constructed for the projects listed in table 4.13-3 and the Kinder Morgan Project, assuming an average of 110-foot-wide construction right-of-way (actual right-of-way widths vary by project and location), would result in a total of about 7,916 acres of vegetation disturbance. Although the total amount of vegetation that may be affected by the Creole Trail Project and other potential projects in the area may be considered substantial, much of this would occur in areas that have been previously disturbed by existing rights-of-way. Also, this disturbance, alteration, or loss of habitat would be relatively small compared to the abundance of similar resources in the project area, and the majority of it would be allowed to return to pre-construction condition.

Construction of the associated pipeline and terminal facilities considered in table 4.13-3 (including the Creole Trail Project) would affect a total of about 1,716.1 acres of forested land, of which about 1,661.3 acres would be cleared for construction of the pipeline facilities. Construction of the Kinder Morgan Project would also likely result in impacts on forest lands; however, the extent of such impacts is currently unknown. Some of these forest lands consist of stands of planted timber grown for commercial use with an expectation of harvest. Landowners would be compensated for raw timber removed from construction work areas, and would be allowed to replant areas outside of the permanent right-of-way following completion of construction. Although the total amount of forest land that may be affected by the Creole Trail Project and other potential projects in the area may be considered substantial, the linear nature of the pipelines would not require clear cutting of large areas of timber. Additionally, where the proposed pipelines would be parallel and adjacent to one another, additional forest impacts would be cumulative, but minimized by the overlapping rights-of-way. The loss of forest land in this area due to all of these projects would be relatively small compared to the abundance of similar resources in the project area and would be insignificant when compared to the forest clearing in the project area required for forest management practices.

Pipeline installation through wetlands and across waterbodies would individually adversely impact aquatic resources, and if concurrent with or sequential to other projects, could cumulatively have a more substantial effect on those resources. The corresponding effects on the fishery resources dependent

on those habitats for survival could also increase cumulatively. Aquatic resources could be affected by increased turbidity, sedimentation, loss of cover, and potential spills of hazardous materials. These impacts and their associated effects on aquatic organisms, habitats, and EFH would be largely dependent upon whether construction phases of the projects occur concurrently and in proximity to one another. However, the impacts associated with installation of the proposed pipelines on aquatic resources would be short term and largely restricted to the period of active construction and a short period following completion.

Compared to the natural freshwater flow, freshwater discharges from the proposed LNG projects into the estuary from hydrostatic testing operations would not even be detectable, other than in the near-field dilution zone. Since the hydrostatic test water discharges are essentially brief episodic events, like a passing thunderstorm, and would only occur during the construction phase, no impacts on aquatic habitat or species would be anticipated and the discharges would not be expected to affect populations of any Calcasieu estuary aquatic species.

4.13.4 Land Use, Recreation, and Visual Resources

The Creole Trail LNG Project would add incrementally to the cumulative impact on land uses in the project area. Land use impacts at the LNG terminal site would be permanent. However, a portion of the proposed LNG terminal site (and those for the Port Arthur, Golden Pass, and Sabine Pass Projects) has been used previously as a DMPA and the Cameron LNG terminal site is a former industrial site. Along the proposed pipeline routes, most land uses would revert to prior uses following construction. Some land uses would be restricted or prohibited on the new permanent pipeline rights-of-way, such as construction of aboveground structures.

Fishing, boating, and bird watching activities occur throughout the coastal marsh and Calcasieu Lake in the vicinity of the proposed project. None of the other projects included in this analysis would contribute to effects on users of Calcasieu Lake. However, the Creole Trail Project, in combination with the other projects in the project area, could negatively affect recreation, primarily during the periods of active construction. The presence and movement of construction equipment, materials, and workers may be disruptive temporarily to users of the local recreation areas, particularly if more than one project is under construction at any one time in the project area. Recreation-related cumulative impacts are expected to be localized, short-term, and minor.

The passage of large ships through the Calcasieu Ship Channel is a frequent occurrence and an expected element in the viewshed. However, there are no other existing permanent structures similar in scale to the proposed Creole Trail LNG storage tanks and the approved and proposed Cameron LNG storage tanks in the immediate area of the proposed project. The situation would be similar for the Port Arthur, Sabine Pass, and Golden Pass Projects in the area of the Sabine-Neches Waterway. Based on the anticipated size of these facilities, we believe that each would dominate its local area viewshed and result in both temporary and permanent changes to the surrounding visual landscape. Because of the size of the facilities, there are no effective measures to visually screen these major aboveground facilities.

Construction and operation of the proposed Creole Trail pipelines and the other pipeline projects in the project area may affect visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and by installing new aboveground facilities. The landscape setting along the proposed pipeline routes in the area is generally flat and views of the construction activities may extend for some distance. However, the construction work areas would be restored, as near as possible, to pre-construction contours and revegetated. Once revegetation is complete, except for new or widened pipeline corridors there would be no significant cumulative alteration of the landscape in the region. Additionally, where the proposed Segment 3 would be parallel and adjacent to other proposed

pipelines, visual resource impacts would be cumulative but minimized to the extent possible by the overlapping rights-of-way.

4.13.5 Socioeconomics

Present and reasonably foreseeable future projects and activities could cumulatively impact socioeconomic conditions in the project area. There may be both beneficial and detrimental effects on employment, housing, infrastructure, and public services.

4.13.5.1 Employment and Housing

In general, natural gas-related projects have a beneficial impact on local employment during the short construction period, but little impact during pipeline operation since most jobs associated with the projects would be temporary construction jobs and limited in number. If more than one LNG and/or pipeline project were to be constructed in the project area during the same time period, then the beneficial effects would be cumulative, but short term and minor.

The sponsors of the LNG projects considered in this analysis estimate that between 30 and 70 percent of construction workers would be local hires. If these proposed projects are built simultaneously with the Creole Trail Project, the demand for workers could exceed the local supply of appropriately skilled labor. On the beneficial side, the increased demand for workers could reduce current unemployment and perhaps lead to higher wages for the duration of construction. Other indirect employment benefits could include temporary service jobs in the local area (e.g., restaurants, motels, and convenience stores).

The Trunkline LNG Terminal Expansion Project would not require additional permanent workers. The proposed Creole Trail Project would add up to 95 full-time permanent positions, of which 85 would be associated with the LNG terminal and 10 with the pipeline facilities. About 80 percent of these positions would be filled with local hires. The Cameron LNG Project would add 33 permanent positions for the LNG terminal and 2 full-time positions for the pipeline facilities, the Cameron LNG Expansion Project would add 26 permanent positions for the LNG terminal, and the Sabine Pass Project would add 75 full-time positions for the LNG terminal and 5 full-time positions for operation of the pipeline. While this is not a large number of new jobs when viewed from a state perspective, it could have a noticeable impact in the nearby area relative to the total Cameron Parish civil workforce (4,384) and the percent of that workforce that was reported as unemployed (4.6) prior to Hurricane Rita. The other pipeline projects listed in table 4.13-3 would require similar numbers of temporary personnel during construction, but usually do not require hiring of more than 2 or 3 full-time employees for operation.

Prior to the occurrence of Hurricane Rita in September 2005, Cameron Parish would have been able to accommodate temporary construction workers who preferred to live in that parish (most likely, workers associated with the Sabine Pass, Creole Trail, and Cameron LNG Projects), particularly if the projects were not all under construction simultaneously. As a result of the hurricane, accommodating temporary construction workers is likely to be a regional priority for several years. Nevertheless, given the vacancy rates in the area and the number of hotel/motel rooms in larger population centers around the project areas, construction crews should not encounter difficulty in finding temporary housing. The degree of cumulative impact on the housing resources would depend upon the number of other projects being constructed simultaneously and the season, specifically when construction coincides with periods of peak recreation and tourism activity. If construction occurs concurrently with other projects and during the peak recreation and tourism periods, temporary housing would still be available but may be more difficult to find and/or more expensive to secure. Regardless, these effects would be temporary, lasting only for the duration of construction, and there would be no long-term cumulative effect on housing.

4.13.5.2 Vehicular Traffic

Due to the limited number of roads to the proposed LNG terminal site, the addition of workers' cars and construction vehicles could contribute to the traffic congestion during construction of the proposed project. If other large construction projects were concurrently undertaken near the project site and also required the use of State Highway 27/82, cumulative impacts on traffic could be expected during peak period of construction. However, most of the other projects considered in this analysis would not require the use State Highway 27/82 in the vicinity the Creole Trail Project site to access their respective LNG terminal sites. The Sabine Pass Project would require the use of State Highway 82 for access at a location about 25 miles west of the Creole Trail LNG terminal site. Also, to the extent that personnel would commute from the Hackberry area to the site of the Cameron LNG Projects, they would use State Highway 27/82. However, these workers and those using State Highway 27/82 on their way to or from the Creole Trail LNG terminal site would likely be going in opposite directions. Construction traffic associated with the Trunkline LNG Terminal Expansion would not likely use State Highway 27/82 in the vicinity of the Creole Trail Project.

It is possible that the construction schedules of the pipelines listed in table 4.13-1 could overlap with construction schedule of the Creole Trail pipeline. If construction schedules for the any of the pipeline projects overlap, there could be increased congestion on local roads during the construction period. Impacts on local traffic could occur during pipeline construction on local roads north of Interstate 10, where the Cameron, Golden Pass, Liberty, Kinder Morgan, Starks Gas Storage, and Port Arthur pipelines would be constructed immediately adjacent to or in the general vicinity of the Creole Trail pipeline for varying distances. Because pipelines are constructed in a linear fashion, the chance of having construction equipment or workers from different projects near each other is fairly low. Further, to the extent that construction occurs simultaneously in a given area, traffic impacts would be localized and short term.

4.13.5.3 Infrastructure and Public Services

The cumulative impact of the Creole Trail LNG Project and other projects in the vicinity on infrastructure and public services would depend on the number of projects under construction at one time. The small incremental demands of several projects occurring at the same time could become difficult for police, fire, and emergency service personnel to address. This problem would be temporary, and occur only for the length of construction. No long-term effects on infrastructure and public services are expected.

4.13.5.4 LNG Ship Traffic

The Creole Trail LNG Project would be expected to add another 300 to 400 LNG ships per year on the Calcasieu Ship Channel. Of the other LNG projects considered in the analysis, only the Cameron LNG and Trunkline LNG Projects would affect ship traffic in the Calcasieu Ship Channel. Trunkline LNG is expanding its facility to accommodate additional LNG shipments. Trunkline currently handles 60 to 100 vessels per year, and this is expected to increase to about 225 ships per year after the expansion. The approved Cameron LNG terminal would be capable of handling 190 vessels per year; the expanded Cameron LNG terminal would be capable of handing 233 to 346 vessels per year, depending on ship size and capacity. Planned expansions of other facilities in the Port of Lake Charles are under review. They would also increase marine traffic in the Calcasieu Ship Channel. A report entitled, *Vessel Traffic Congestion Study for the Calcasieu River Waterway Corridor* prepared by Lanier and Associates in May 2005, concluded that the infrastructure of the Calcasieu Ship Channel is adequate to handle all of the ship traffic associated with industry growth, including the Creole Trail, Cameron LNG, and Trunkline LNG Expansion Projects. The additional LNG vessel traffic is expected to have only a minimal cumulative

impact on other vessel traffic in the Calcasieu Ship Channel. Further, the location of the Creole Trail LNG terminal near the beginning of the channel would minimize the extent to which the project contributes to cumulative impacts on other user of the navigation channel.

The Coast Guard would impose a safety zone around LNG ships transiting the Calcasieu Ship Channel. This could disrupt other users of the Calcasieu Ship Channel transiting between the Gulf of Mexico and the Port of Lake Charles. This impact could be alleviated by coordinating the arrival of LNG ships and other large ships through the waterway (convoying traffic) and by increasing the number of pilots that move the large ships to port.

4.13.6 Shoreline Erosion

The Louisiana and Texas Gulf Coast is experiencing the highest rate of coastal erosion and wetland loss in the United States (Ruple, 1993). Average coastal erosion rates are 4.2 meters per year in Louisiana and 1.8 meters per year along the northern Gulf of Mexico shoreline. However, the most serious erosion and land loss are occurring in the eastern part of the coastal area, east of Atchafalaya Bay (USGS, 2003). The banks of the Calcasieu Ship Channel that border the project area also experience erosion from the wakes of ships that regularly use the channel.

There are a number of factors that contribute to overall shoreline erosion. The most commonly acknowledged are: hurricanes, natural effects from currents, wave action, and tides; number of and size of ships using the channel; the proportions of the ship hull (for example, a long, thin hull form has greater displacement effect than a hull with short and fat proportions); ship draught; ship speed (probably the largest single factor); proximity to the shore; and propeller action (rapidly rotating propellers, changing propeller actions, and water jets cause a higher level of wash). The most significant factors in the generation of wash energy are ship size, speed, and frequency. Mitigation measures to reduce wash and resultant shoreline erosion would include: 1) reducing the overall number of ships, ship speeds, and propeller action; 2) widening and deepening the ship channels; and 3) reinforcing the banks.

Typical existing LNG ships have an overall length of 920 feet, a beam width of 142 feet, draughts of about 37.4 feet, and cargo capacities of between 125,000 and 140,000 m^3. Future ships are expected to have an overall length of up to 1,130 feet, a beam width of 180 feet, draughts of about 39 feet, and a cargo capacity of 250,000 m^3. Although large, LNG ships have a higher under keel clearance that reduces the wash effect in comparison to ships of similar overall size. This, in combination with the wide and deep Calcasieu Ship Channel and slow speeds required for LNG ships, would reduce the potential for shoreline erosion from LNG ship traffic along the Calcasieu Ship Channel.

The proposed Creole Trail Project is the only project in the geographic area of analysis to involve construction across Calcasieu Lake. Erosion and land loss have been documented in the Calcasieu Lake area and interior marshes, where erosion-related breaching of the shorelines and levees can expose the fragile interior marshes to increased water exchange and saltwater intrusion, and result in the loss of surface layers of organic material (National Wetlands Research Center, 2005). To avoid disturbing the shoreline of Calcasieu Lake, Creole Trail's pipelines approaches to Calcasieu Lake and the crossings of the Calcasieu Ship Channel would all be constructed using the HDD method.

4.13.7 DMPAs

If all of the LNG projects were constructed, dredging for the marine basins would total approximately 20.2 million yd^3 (4.1 million yd^3 for the Creole Trail Project, see table 4.13-1 for other projects). About 9.2 million yd^3 of this dredging would occur within or adjacent to the Calcasieu Ship Channel for the Creole Trail, Cameron, and Trunkline Projects. Each project sponsor would dispose of

dredged material at approved DMPAs. These combined needs of the projects could potentially result in a shortage of viable DMPAs over the life of the projects and may result in the need to create new DMPAs.

4.13.8 Air Quality and Noise

Construction of the Creole Trail Project and some of the reasonably foreseeable projects and activities listed in table 4.13-1 would involve the use of heavy equipment that produces noise, air contaminants, and dust. Operation of the proposed Creole Trail LNG terminal and the other LNG terminals included in the analysis would all contribute to air emissions and noise.

Over the long term, the project would not contribute significantly to current air pollution levels. Although the proposed LNG terminal would emit PM_{10}, SO_2, NO_x, CO, and VOCs, the terminal would not be a major source of air emissions under the PSD regulations for any of these pollutants. NO_x and VOC emissions from the proposed project would contribute to the regional ozone concentrations. Cameron Parish is designated "attainment" or "unclassifiable" for all criteria pollutants.

Emissions from the LNG ships would be generated from both the main engines and the on-board electric generators at various stages of operations related to transit, maneuvering, hoteling, and unloading activities. Emissions from LNG ships calling on any of the LNG facilities included in this analysis would comply with state and federal air standards and have a minimal impact on air quality.

Additional noise produced during construction of the proposed project and other projects could create short-term annoyances to nearby residences and could disrupt nesting birds and other wildlife in the project area. These noise impacts would be localized and would attenuate quickly as the distance from the noise source increases. Therefore, cumulative noise impacts associated with construction would be unlikely unless two or more of the projects occur at the same time and in the same location. However, these impacts would be temporary and would only occur during construction of the projects.

4.13.9 Reliability and Safety

Impacts on reliability and public safety would be mitigated through the implementation of applicable federal, state, and local rules and regulations for each individual project. The specific rules and regulations that apply to each individual project would ensure that the applicable design standards are implemented to protect the public and to prevent accidents and failures. The LNG terminal facilities would be sited, designed, constructed, operated, and maintained in compliance with the federal safety standards summarized in table 2.7.1-1. The pipelines and aboveground facilities associated with the Creole Trail Project would be designed, constructed, operated, and maintained in accordance with DOT Minimum Federal Safety Standards in Title 49 CFR Part 192.

Several of the present or reasonably foreseeable future projects, including the proposed project, would involve cargo terminals that could be expected to ship hazardous materials. Accidents involving such materials represent a potential impact on public safety. Continued growth in international commerce is likely to result in increased quantities of hazardous materials being shipped to and from the region.

It is difficult to evaluate the cumulative risk that such growth represents or has represented. In addition, it is difficult to measure the cumulative risk for an intentional attack on the LNG facility. The addition of the LNG facility and its associated LNG ships would not significantly change the risk of an intentional attack on the Port of Lake Charles or the Calcasieu Ship Channel. It is reasonable to assume that the rate of ship accidents (including those involving the release of hazardous materials) is likely to rise with more vessel traffic, which could cumulatively increase the risk of an accident having an impact on public safety. As discussed in section 4.12.5, the Lake Charles Pilots manage vessel traffic to insure

safe transit in the Calcasieu Ship Channel. The Coast Guard would also enforce a moving safety zone and moored vessel security zone around LNG ships. These and other operational controls by the Coast Guard and Lake Charles Pilots would minimize the risk of accidents involving LNG ships. Furthermore, the implementation of federal, state, and local rules and regulations concerning security and the results of the WSA with its associated operations and Emergency Response Plan would minimize the risk to the LNG ship and terminal.

Emergency response time is a key aspect of public health and safety. No significant cumulative impacts on emergency services are expected because sufficient emergency services and facilities exist in the area to accommodate the cumulative projects. No significant cumulative impacts on emergency services are expected during operation of the proposed project. Section 4.12.5 includes our recommendation that Creole Trail prepare an Emergency Response Plan and coordinate procedures with local emergency planning groups, fire departments, state and local law enforcement, the Coast Guard, and other appropriate federal agencies to be used in the event of an incident. Creole Trail would be required to prepare a comprehensive plan that identifies the cost sharing mechanisms for funding these emergency response costs. With the implementation of the coordination procedures in the Emergency Response Plan and the funding of additional emergency management equipment and personnel, no cumulative impacts would be expected on emergency response services during operation of the proposed project.