

EXHIBIT 17



Federal Energy
Regulatory
Commission

Office of
Energy
Projects

May 2019

FERC/EIS – 0286F

FINAL ENVIRONMENTAL IMPACT STATEMENT
for the
Plaquemines LNG and Gator Express
Pipeline Project



Venture Global Plaquemines LNG, LLC
Venture Global Gator Express, LLC

Docket Nos. CP17-66-000
CP17-67-000

Federal Energy Regulatory Commission
Office of Energy Projects
Washington, DC 20426

Cooperating Agencies:



U.S. Environmental
Protection Agency



U.S. Army
Corps of Engineers



U.S. Coast Guard



Pipeline and Hazardous
Materials Safety
Administration



U.S. Department
of Energy

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas Branch 2
Venture Global Plaquemines LNG,
LLC and Venture Global Gator
Express, LLC
Docket Nos. CP17-66-000 and
CP17-67-000

TO THE INTERESTED PARTY:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a final environmental impact statement (EIS) for the Plaquemines LNG and Gator Express Pipeline Project, proposed by Venture Global Plaquemines LNG, LLC and Venture Global Gator Express, LLC in the above-referenced dockets. Venture Global requests authorization to construct and operate a new liquefied natural gas (LNG) export terminal and associated facilities along the west bank of the Mississippi River in Plaquemines Parish, Louisiana (Terminal) and to construct and operate two new 42-inch-diameter natural gas pipeline laterals that would connect to the Terminal. The new liquefaction facilities would have a nameplate production capacity of 20.0 million metric tons per annum (MTPA) of LNG and peak production capacity of 24 MTPA.

The final EIS assesses the potential environmental effects of the construction and operation of the Plaquemines LNG and Gator Express Pipeline Project in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the proposed project, with the mitigation measures recommended in the EIS, would have some adverse environmental impacts. These impacts would be reduced to less-than-significant levels with the implementation of Venture Global's proposed mitigation measures and the additional measures recommended in the final EIS.

The U.S. Army Corps of Engineers, U.S. Coast Guard, U.S. Department of Energy, U.S. Environmental Protection Agency, and U.S. Department of Transportation participated as cooperating agencies in the preparation of the EIS. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by the proposal and participate in the NEPA analysis. Although the cooperating agencies provided input to the conclusions and recommendations presented in the EIS, the agencies will present their own conclusions and recommendations in their respective Records of Decision for the project.

The final EIS addresses the potential environmental effects of the construction and operation of the following project facilities:

- **LNG Terminal:** Construction and operation of various liquefaction, LNG distribution, and appurtenant facilities within the boundaries of the site leased by Venture Global on the Mississippi River, including:
 - six pretreatment facilities (three in each phase);
 - a liquefaction plant with 18 integrated single-mixed refrigerant blocks and support facilities (otherwise referred to as liquefaction blocks or blocks) to be constructed in two phases (nine blocks in each phase);
 - four 200,000-cubic-meter aboveground LNG storage tanks;
 - three LNG loading docks within a common LNG berthing area; and
 - air-cooled electric power generation facilities.
- **Pipeline System:** Construction and operation of two parallel 42-inch-diameter natural gas pipelines that share one right-of-way corridor for the majority of their respective routes and appurtenant aboveground facilities, including the following:
 - 15.1-mile-long Southwest Lateral Tennessee Gas Pipeline, LLC (TGP) Pipeline;
 - 11.7-mile-long Southwest Lateral Texas Eastern Transmission, LP (TETCO) Pipeline;
 - TGP metering and regulation station; and
 - TETCO metering and regulation station.

The Commission mailed a copy of the *Notice of Availability* to federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American tribes; potentially affected landowners and other interested individuals and groups; and newspapers and libraries in the project area. The final EIS is only available in electronic format. It may be viewed and downloaded from the FERC's website (www.ferc.gov), on the Environmental Documents page (<https://www.ferc.gov/industries/gas/enviro/eis.asp>). In addition, the final EIS may be accessed by using the eLibrary link on the FERC's website. Click on the eLibrary link (<https://www.ferc.gov/docs-filing/elibrary.asp>), click on General Search, and enter the docket number in the "Docket Number" field, excluding the last three digits (i.e., CP17-66 or CP17-67). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FercOnlineSupport@ferc.gov or toll free at (866) 208-3676, or for TTY, contact (202) 502-8659.

Additional information about the project is available from the Commission's Office of External Affairs, at **(866) 208-FERC**, or on the FERC website (www.ferc.gov) using

the [eLibrary](#) link. The eLibrary link also provides access to the texts of all formal documents issued by the Commission, such as orders, notices, and rulemakings.

In addition, the Commission offers a free service called eSubscription that allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries, and direct links to the documents. Go to www.ferc.gov/docs-filing/esubscription.asp.

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TECHNICAL ACRONYMS AND ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
μPA	micropascal
$\mu\text{PA}_{\text{RMS}}$	micropascal root mean square
ACHP	Advisory Council on Historic Preservation
AOI	area of influence
APE	Area of Potential Effect
API	American Petroleum Institute
applicant	Venture Global Plaquemines LNG, LLC, and Venture Global Gator Express, LLC; <i>also</i> Venture Global
AQCR	Air Quality Control Regions
AQRV	Air Quality Related Value
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ATWS	additional temporary workspace
BA	biological assessment
BACT	Best Available Control Technology
BAHX	brazed aluminum heat exchanger
BCC	Birds of Conservation Concern
bcf/y	billion cubic feet per year
bcfd	billion cubic feet per day
BCR	Bird Conservation Region
b.e.g.	below existing grade
BGEPA	Bald and Golden Eagle Protection Act
BLEVE	boiling liquid expanding vapor explosion
BMP	best management practice
BOG	boil-off gas
BPVC	Boiler and Pressure Vessel Code
BTU	British thermal unit
$\text{Btu}/\text{ft}^2\text{-hr}$	British thermal units per square foot per hour
CAA	Clean Air Act of 1970
CAMx	Comprehensive Air Quality Model with Extension
CCGT	Combined cycle gas turbine
CEQ	Council on Environmental Quality

Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
CH ₄	methane
CI ICE	Compression Ignition Internal Combustion Engines
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalents
COI	Certificate of Inspection
Commission	Federal Energy Regulatory Commission; <i>also</i> FERC
COTP	Captain of the Port
CPRA	Coastal Protection Restoration Authority
CPT	cone penetration test
CUP	Coastal Use Permit
CWA	Clean Water Act
CZMA	Coastal Zone Management Act of 1972
CZMP	Coastal Zone Management Program
DAT	deposition analysis threshold
dB	decibel
dBA	A-weighted decibel
DE	design earthquake
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DOTD	Louisiana Department of Transportation and Development
E1UB	estuarine subtidal unconsolidated bottom (wetland)
EA	environmental assessment
EDMS	Electron Data Management System
EEM	estuarine emergent (wetland)
EFH	essential fish habitat
EI	Environmental Inspector
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPAct 2005	Energy Policy Act of 2005
ERIC	Emissions Reporting and Inventory Center
ERP	Emergency Response Plan
ESA	Endangered Species Act of 1973

ESD	emergency shutdown
ESS	estuarine scrub/shrub (wetland)
FAA	Federal Aviation Administration
FE	Office of Fossil Energy
FEED	front-end engineering and design
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission; <i>also</i> Commission
FLM	Federal Land Manager
FLNGV	Floating Liquefaction and Storage Vessel
FSA	Facility Security Assessment
FSP	Facility Security Plan
FTA	Free Trade Agreement
FWS	United States Fish and Wildlife Service
g	factor of gravity
Gator Express Pipeline	Venture Global Gator Express, LLC
GHG	greenhouse gas
GIS	geographic information system
GMD	geomagnetic disturbances
GWP	global warming potential
H ₂ S	hydrogen sulfide
HAP	hazardous air pollutant
HAZOP	hazard and operability review
HCA	high consequence area
HDD	horizontal directional drill
HP	Brake horsepower
HRSG	heat recovery steam generator
HUC	hydrologic unit code
HVAC	heating, ventilating, and air conditioning
I-#	Interstate
IBC	International Building Code
ICW	Intracoastal Waterway
IMO	International Maritime Organization
ISA	International Society for Automation
ITEP	Industrial Tax Exemption Program
JPA	Joint Permit Application
KOP	key observation point

LAC	Louisiana Administrative Code
LDEQ	Louisiana Department of Environmental Quality
Ldn	Day-Night Average Sound Level
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
Leq	Equivalent Sound Level
LNG	liquefied natural gas
LNHP	Louisiana Natural Heritage Program
LOD	Letter of Determination
LOI	Letter of Intent
LOR	Letter of Recommendation
LPDES	Louisiana Pollutant Discharge Elimination System
LRS	Louisiana Revised Statutes
M&R	metering and regulation
m/s	meters per second
MAOP	maximum allowable operating pressure
MARAD	Maritime Administration
MBTA	Migratory Bird Treaty Act of 1918
MEOW	maximum envelope of water
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MLV	mainline valve
MMBtu	million British thermal units
MMPA	Marine Mammal Protection Act
MOF	material offloading facility
MOU	Memorandum of Understanding
MP	milepost
mph	miles per hour
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	mean sea level
MTPA	million metric tons per annum
MTSA	Maritime Transportation Security Act of 2002
MW	megawatt
N ₂ O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988

NEP	National Estuary Program
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFIA	National Flood Insurance Act of 1968
NFPA	National Fire Protection Association
NGA	Natural Gas Act
NHPA	National Historical Preservation Act
nm	nautical miles
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NO _x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
NVIC	Navigation and Vessel Inspection Circular
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
O ₃	ozone
OBE	operating basis earthquake
OCM	Office of Coastal Management
OEP	Office of Energy Projects
P&ID	piping and instrument diagram
Parish Plan	Plaquemines Parish Comprehensive Master Plan
PEM	palustrine emergent (wetland)
PFD	process flow diagram
PFO	palustrine forested (wetland)
PGA	peak ground acceleration
PHMSA	Pipeline and Hazardous Materials Safety Administration
pipeline system	Venture Global Gator Express, LLC's lateral pipelines that will connect the Venture Global Plaquemines LNG, LLC, terminal to the existing U.S. natural gas transmission grid
Plaquemines LNG	Venture Global Plaquemines LNG, LLC

PM _{2.5}	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM ₁₀	particulate matter with an aerodynamic diameter less than or equal to 10 microns
PNR	potential noise receptor
ppb	parts per billion
ppm	parts per million
ppmv	parts per million volume
ppt	parts per thousand
Project	the combined Venture Global Plaquemines LNG, LLC, and Venture Global Gator Express, LLC, actions and facilities
Project-specific Plan	project-specific <i>Upland Erosion Control, Revegetation, and Maintenance Plan</i>
Project-specific Procedures	Project-specific <i>Wetland and Waterbody Construction and Mitigation Procedures</i>
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PSS	palustrine scrub-shrub (wetland)
Q/D	emission to distance
RHA	Rivers and Harbors Act
RICE	Reciprocating Internal Combustion Engines
RMP	Risk Management Program
RMS	root-mean square
ROI	radius of influence
RSRIS	Road Safety and Reliability Impact Study
RV	recreational vehicle
SAV	submerged aquatic vegetation
SCR	selective catalytic reduction
SCPT	seismic cone penetration tests
SEL _{cum}	cumulative sound exposure level
SH #	State Highway
SHPO	State Historic Preservation Office
SIL	Significant Impact Level
SIP	State Implementation Plan
SIS	safety instrument system
SLOSH	Sea, Lake, and Overland Surge from Hurricanes
SMC	significant monitoring concentration

SO ₂	sulfur dioxide
SOLAS	<i>Safety of Life at Sea</i>
SONRIS	Strategic Online Natural Resources Information System
SPCC	Spill Prevention, Control, and Countermeasures
SSE	safe shutdown earthquake
SSURGO	Soil Survey Geographic Database
SWEL	still water elevation
SWPPP	Stormwater Pollution Prevention Plan
TAP	toxic air pollutant
terminal	Venture Global Plaquemines LNG, LLC's proposed liquefied natural gas terminal on the west bank of the Mississippi River in Plaquemines Parish, Louisiana
TETCO	Texas Eastern Transmission, LP
TGP	Tennessee Gas Pipeline, LLC
tpy	tons per year
TTS	temporary threshold shift
TWIC	Transportation Worker Identification Credential
U.S.C.	United States Code
US #	U.S. Highway
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
Venture Global	Venture Global Plaquemines LNG, LLC, and Venture Global Gator Express, LLC; <i>also</i> applicants
VOC	volatile organic compound
WEG	wind erodibility group
WSA	Waterway Suitability Assessment

EXECUTIVE SUMMARY

INTRODUCTION

On February 28, 2017, Venture Global Plaquemines LNG, LLC (Plaquemines LNG) filed an application with the Federal Energy Regulatory Commission (Commission, *also* FERC) for authorization pursuant to section 3(a) of the Natural Gas Act (NGA) and part 153 of the Commission's regulations. Also on February 28, 2017, Venture Global Gator Express, LLC (Gator Express Pipeline) filed an application with FERC for a Certificate of Public Convenience and Necessity (Certificate) pursuant to section 7(c) of the NGA and part 157 of the Commission's regulations.

In Docket Nos. CP17-66-000 and CP17-67-000, Plaquemines LNG and Gator Express Pipeline request authorization to site, construct, and operate natural gas liquefaction, storage, and export facilities at a proposed liquefied natural gas (LNG) terminal on the west bank of the Mississippi River, and authorization to construct and operate pipelines to transport feed gas to the LNG terminal, all located in Plaquemines Parish, Louisiana. The combined Plaquemines LNG and Gator Express Pipeline actions and facilities are referred to herein as the Project, and the applicants are collectively referred to as Venture Global.

The purpose of the environmental impact statement (EIS) is to inform FERC decision-makers, the public, and the permitting agencies about the potential adverse and beneficial environmental impacts of the Project and its alternatives, and recommend mitigation measures that would reduce adverse impacts to the extent practicable. As part of the Commission's consideration of these applications, we¹ prepared this EIS to assess the potential environmental impacts resulting from the construction and operation of the Project in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA). Our analysis was based on information provided by Venture Global, and further developed from data requests; field investigations; scoping; literature research; communications with federal, state, and local agencies; and individual members of the public.

FERC is the lead agency for the preparation of the EIS. The U.S. Army Corps of Engineers (USACE), U.S. Coast Guard (USCG), U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and U.S. Department of Transportation (DOT) are participating in the NEPA review as cooperating agencies and provided comment on this EIS.

PROPOSED ACTION

The Project consists of two main components: 1) the development of natural gas liquefaction and LNG export capabilities through construction of a new facility (LNG terminal) in Plaquemines Parish, Louisiana; and 2) the construction of facilities necessary to provide natural gas supplies to the LNG terminal, including two new pipelines, six mainline valves, three pig launchers, two pig receivers, and two metering and regulation stations. The Project is expected to produce at a rate up to 24 million metric tons per annum of LNG for export.

¹ "We," "us," and "our" refer to the environmental and engineering staff of FERC's Office of Energy Projects.

The proposed LNG terminal would include six pretreatment facilities; a liquefaction plant with 18 integrated single-mixed refrigerant blocks and support facilities to be constructed in two phases (nine blocks in each phase); four 200,000-cubic-meter aboveground LNG storage tanks; three LNG loading docks within a common LNG berthing area; and air-cooled electric power generation facilities. The proposed pipeline system would consist of two parallel 42-inch-diameter natural gas pipelines with aboveground appurtenant facilities, the 15.1-mile-long Southwest Lateral Pipeline (Southwest Lateral TGP) and the 11.7-mile-long Southwest Lateral Pipeline (Southwest Lateral TETCO) that share one right-of-way corridor for the majority of their respective routes.

PUBLIC INVOLVEMENT

On July 2, 2015, FERC began its pre-filing review of the Project and established pre-filing Docket No. PF15-27-000 to place information related to the Project into the public record. The pre-filing process ended on February 28, 2017, when Venture Global filed its applications with FERC. The pre-filing review process provides opportunities for interested stakeholders to become involved early in Project planning, facilitates interagency cooperation, and assists in the identification and resolution of issues prior to a formal application being filed with FERC.

On October 5, 2015, FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Plaquemines Liquefied Natural Gas Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting* (NOI). This notice was sent to nearly 370 interested parties including federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; federally recognized tribes (tribes); affected property owners; other interested parties; and local libraries and newspapers. On September 14, 2016, FERC issued a *Supplemental Notice of Intent to Prepare an Environmental Impact Statement for the Planned Plaquemines Liquefied Natural Gas Project*. This Supplemental NOI was sent to eight new landowners in the vicinity of Project facilities based on the revised pipeline route. Publication of each NOI established a 30-day public comment period. We received a total of eight comment letters in response to the NOIs. Substantive environmental issues identified through this public review process are addressed in this EIS.

On November 13, 2018, we issued a *Notice of Availability of the Draft Environmental Impact Statement for the Proposed Plaquemines LNG and Gator Express Pipeline Project*. This notice, which was published in the Federal Register, listed the date and location of a public comment session and established a closing date of January 7, 2019 for receiving comments on the draft EIS. Copies of the notice were mailed to 486 stakeholders. The EPA noticed the draft EIS in the Federal Register on November 23, 2018.

During the public comment period for the draft EIS we received 91 comments. At the comment session, the FERC received written and verbal comments from 11 individuals. The verbal comments were recorded and transcribed by a court reporter. Transcripts and all written comments that we received on the draft EIS are part of the public record for the Project. In addition to receiving written and verbal comments at the draft EIS comment sessions, the FERC received six comment letters from various parties including federal, state, and local agencies; interested parties; tribes; businesses; and elected officials. All comments directly pertaining to the draft EIS, the transcripts of verbal comments presented at the draft EIS comment sessions, and responses to comments are presented in appendix H.

ENVIRONMENTAL IMPACTS AND MITIGATION

We evaluated the potential impacts of construction and operation of the Project on geology; soils and sediments; water resources; wetlands; vegetation; wildlife and aquatic resources; threatened, endangered, and other special status species; land use, recreation, and visual resources; socioeconomics; cultural resources; air quality and noise; reliability and safety; cumulative impacts, and alternatives. Where necessary, we recommend additional mitigation measures to minimize or avoid impacts. Sections 5.1 and 5.2 of the EIS contain our conclusions and a compilation of our recommended mitigation measures, respectively.

Construction of the LNG terminal facilities would disturb 648.1 acres of land, and 80.6 acres of water. Of this total, 625.8 acres of land would be impacted by operation and maintenance of the LNG terminal facilities, and 10.7 acres of water would be affected by operation and maintenance of the turning basin. The remaining 22.3 acres of land would be temporarily affected during construction. An additional 77.0 acres would be leased by Venture Global at the LNG terminal site, but would not be affected by construction.

The land requirements for the pipeline system and its aboveground facilities include 953.9 acres during construction and 137.3 acres during operation. An 80-foot-wide permanent easement would be required where the two pipelines are collocated, and a 50-foot-wide permanent easement would be required where the Southwest Lateral TGP would be located alone.

Based on our analysis, Project scoping, agency consultations, and public comments, the major Project construction and operational issues are impacts on waterbody and wetlands; vegetation; wildlife and aquatic resources; federally listed species; land use, recreation, and visual resources; socioeconomics; air quality and noise; reliability and safety; and cumulative impacts.

WATER AND WETLAND RESOURCES

Construction of the pipeline system would primarily occur in open water and inundated wetlands. The pipelines would be installed by the barge lay method in areas of open water and by direct push in areas of inundated wetlands/marsh. Venture Global would conduct two horizontal direction drilling (HDD) operations along the pipelines for installation under wetlands, a canal, and the proposed floodwall. Use of the HDD method would avoid disturbance to wetlands near the LNG terminal. In the event of an inadvertent release of drilling mud during an HDD crossing, Venture Global would implement its HDD Contingency Plan that includes measures to minimize drilling mud impacts. No active public or private drinking water supply wells are within 150 feet of the pipeline.

Construction of the LNG terminal would result in the permanent loss of 368.1 acres of wetlands as a result of permanent fill placement. All permanent wetland loss would occur to palustrine emergent wetlands and are a result of construction at the terminal site. Additionally, Venture Global would require 2.8 acres of wetland conversion from palustrine forested wetlands at the LNG terminal to palustrine emergent wetlands. Venture Global designed the terminal facilities to minimize wetland impacts and would follow its Project-specific *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) to further reduce impacts on wetlands. To mitigate unavoidable impacts on wetlands, Venture Global would comply with its

Compensatory Mitigation Plan (CMP) which would identify the acreage and type of mitigation as required by the USACE for Section 404 compliance.

Construction of the pipeline facilities would affect a total of 70.8 acres of wetlands by construction of the pipeline, aboveground facilities (meter stations and mainline valves [MLV]), additional temporary workspace (ATWS) areas, contractor yards, and access roads. Approximately 0.4 acre of this impact would result in permanent wetland loss as a result of fill placement for MLVs, permanent road to MLVs, and portions of the pipe trestle over the levee near Lake Hermitage Road. Following construction, the remaining disturbed areas would be restored and the permanent right-of-way maintained, in accordance with Venture Global's Project-specific Procedures.

With implementation of the HDD method, HDD Contingency Plan, Venture Global's CMP, Project-specific *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and Procedures, and our recommendations, we conclude that impacts on water and wetland resources due to construction and operation of the Project would be minimized to the extent practicable and would not be significant.

VEGETATION

Construction and operation of the LNG terminal facilities would permanently affect approximately 624.3 acres of vegetation, resulting in the loss or conversion to developed area of palustrine emergent wetlands, palustrine forested wetlands, forested scrub/shrub uplands, and herbaceous uplands.

Construction of the pipeline system would affect about 74.9 acres of vegetation, of which 2.2 acres would be permanently lost as it would be associated with aboveground facility sites and permanent access roads. The primary impacts on vegetation from construction would be the cutting and clearing of existing vegetation within the construction work areas. Impacts resulting from operation of the facilities would include conversion of some scrub-shrub vegetation to herbaceous vegetation due to maintenance of the pipeline right-of-way, and conversion of vegetation within new aboveground facilities to non-vegetated land. Impacts on vegetation within the pipeline right-of-way and ATWS would be temporary and short-term because these areas would revegetate within one to two growing seasons.

One vegetation community of special concern (Coastal Live Oak-Hackberry Forest natural community, also known as a Chenier) was identified by the Louisiana Department of Natural Resources as potentially present in the Project area. During field surveys, 4.0 acres of Coastal Live Oak-Hackberry Forest were found within the footprint of the pipeline system. Of the 4.0 acres, 1.6 acres would be avoided by HDD, 0.7 acre would eventually recover after construction, and 1.7 acres would be permanently converted from Coastal Live Oak-Hackberry Forest to herbaceous uplands. This vegetation community is in proximity to the non-federal levee, and the non-federal levee would be crossed with a pipe bridge. The location of the HDD entry site is limited by the proximity to the pipe bridge. Therefore, impacts on this vegetation community cannot be avoided. This represents a relatively small percentage of the remnants of this natural community.

To minimize impacts of the Project on vegetative communities, Venture Global would construct and operate the LNG terminal and pipeline system in accordance with its Project-specific Plan and Procedures. With the implementation of the proposed mitigation measures we conclude that construction and operation of the Project would not have a significant impact on vegetation communities in the Project area.

WILDLIFE AND AQUATIC RESOURCES

Wildlife Resources

Although construction of the LNG terminal and pipeline system could cause displacement, stress, and direct mortality of some individuals, construction and operation of the LNG terminal would not have significant long-term impacts on wildlife species due to the degraded wildlife habitat value provided at the site and the proposed mitigation for wetland impacts. Operation of the LNG terminal would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to the existing heavy ship traffic and other industrial uses along the Mississippi River, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities. In addition, the pipeline system operations require little lighting, activities, or other disturbances that would affect wildlife. We conclude that the LNG terminal and pipeline system's operational impacts on wildlife would be minimized and not significant. Venture Global would implement the Project-specific Plan and Procedures to restore habitat in the temporary workspace following construction.

The vegetative communities in the Project area provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. Much of the approximately 650 acres of habitat associated with the LNG terminal site was previously disturbed by cattle grazing and past fill activities that reduce nesting habitat value. However, the undisturbed areas contain higher quality nesting habitat that would be more attractive to breeding bird species. Much of the habitat along the pipeline system consists of wetlands, which provide habitat for waterfowl and other migratory birds. At the LNG terminal site, and where practicable along the pipelines, Venture Global would conduct clearing in potential nesting habitat outside the nesting season from March 1 to July 31, as recommended by U.S. Fish and Wildlife Service (FWS). Where clearing cannot occur outside of the nesting window, Venture Global has committed to conduct preconstruction surveys of the Project area and if active nests are detected, they would be avoided until young have fledged.

Colonial waterbird nesting colonies occur within the Project area, specifically within 600 to 1,800 feet of the pipelines. The Louisiana Department of Wildlife and Fisheries (LDWF) and FWS provided guidelines for preconstruction site visits and, if warranted, distance and timing restrictions. In the draft EIS, we recommended that Venture Global conduct surveys and consult with the LDWF regarding nesting colony bird surveys and additional mitigation measures for rare wildlife species with potential habitat in the LNG terminal and pipeline system area, and file that information for review and approval prior to construction. Venture Global committed to the implementation of the measures recommended by the FWS and LDWF and, therefore, we conclude that impacts on wildlife, including migratory birds and colonial waterbirds, would be less than significant.

Aquatic Resources and Essential Fish Habitat

Construction of the LNG terminal marine facilities, berthing area and turning basin would not require dredging/excavation of the Mississippi River. However, marine facility construction would require driving concrete pilings in water with vibratory and impact pile drivers to install docks and berthing structures. Potential impacts from these activities include increased sedimentation, turbidity, and noise levels, which could adversely affect aquatic resources. During construction of the two meter stations along the pipeline system in Barataria Bay, multiple 12-inch-diameter steel piles would be installed during construction, as well.

Impacts on aquatic resources due to increased turbidity and suspended sediment levels would vary by species; however, the aquatic resources within the Project area are likely accustomed to regular fluctuations in turbidity levels from industrial activity and regular maintenance dredging within the Mississippi River. Substrates within the Mississippi River are considered early successional due to frequent disturbance from maintenance dredging, propeller wash, and vessel traffic. The soft bed substrates that characterize the Project vicinity are prone to dynamic patterns of sediment scour and deposition, favoring organisms that are adapted to a dynamic bed environment, and, therefore, would recover quickly after construction. We conclude that sedimentation and turbidity impacts on aquatic resources from pile driving and other intrusive activities would be localized, temporary, and minor.

Underwater noise impacts from pile driving may result in injury or trauma to fish, sea turtles, and other aquatic species if measures are not implemented to avoid and minimize these potential impacts. Venture Global is implementing noise attenuation measures to substantially reduce underwater sound pressure levels produced by pile driving, thereby reducing the extent of potential behavioral and injury level effects on aquatic species. Venture Global has developed an Underwater Noise Mitigation Plan through consultation with the National Marine Fisheries Service (NMFS) and the FWS, which would reduce impacts to acceptable levels.

Venture Global would construct the majority of its pipelines using the barge lay and push lay methods as well as the two HDDs (one for each pipeline lateral in the same location), to cross wetlands, a canal, and proposed floodwall. This would avoid or minimize impacts on fisheries, fish habitat, and other aquatic resources. The majority of fish species present within the waterbodies at the time of construction activities would likely be displaced to similar adjacent habitats; however, stress, injury, or death of individual fish may occur. Increased suspended sediment and turbidity levels may also cause degradation of benthic and spawning habitat and decreased dissolved oxygen levels within the crossing location. Venture Global would implement the measures outlined in its Project-specific Procedures to minimize impacts on waterbodies and aquatic resources during pipeline system construction. In addition, Venture Global has received permission from LDWF to conduct year-round construction if necessary in regard to the agency's proposed in-water construction windows. Once construction of the pipeline system is complete, beds and banks would be restored to their preconstruction conditions and contours to the maximum extent practicable. Operation of the pipeline system would not affect aquatic resources. With implementation of the mitigation measures described above, we anticipate that the construction and operation of the pipeline system would have minimal, localized, and no significant impacts on aquatic resources.

NMFS concluded that the Project area is located along a portion of the Mississippi River that does not provide essential fish habitat (EFH) and thus LNG terminal construction for the marine facilities would not affect EFH. Approximately 775.4 acres of estuarine open water mapped as EFH and 423.9 acres of estuarine open water not mapped as EFH (in Lake Laurier, Barataria Bay, and Wilkinson Bay), along with approximately 64.5 acres of estuarine emergent wetlands that can function as EFH, would be temporarily modified by dredging, excavation, and related activities within the workspace required for pipe installation, meter station construction, and barge access channels. However, no submerged aquatic vegetation was identified during Venture Global's field surveys at proposed dredging/excavation locations. Therefore, no impacts on submerged aquatic vegetation are expected. Construction impacts of the pipeline system, including increased turbidity, loss of benthic habitat, and habitat modification, are expected to be minor or of short duration, as populations of EFH species and their food sources would be expected to recover quickly following construction. These impacts would also be minimized through implementation of the Project-specific Procedures, Venture Global's *Spill Prevention, Control, and Countermeasures* (SPCC) Plan, and the HDD Contingency Plan. Therefore, we conclude that construction of the pipeline system would adversely affect EFH, but these adverse effects would be temporary.

THREATENED AND ENDANGERED SPECIES

The FWS Louisiana Ecological Services list of endangered, threatened, and candidate species by county identified 10 species as potentially present in Plaquemines Parish, including the West Indian manatee (*Trichechus manatus*), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), pallid sturgeon (*Scaphirhynchus albus*), and five species of sea turtles. NMFS identified 12 federally listed threatened and endangered species that may occur in the Project area, including three fish, five sea turtles, and four whales. In October 2018, the FWS proposed the eastern black rail black rail (*Laterallus jamaicensis jamaicensis*) for listing as threatened under the Endangered Species Act of 1973, and there is appropriate habitat for the eastern black rail within the project area. Potential impacts on aquatic and terrestrial habitats and species have been described above, and those same impact types apply to threatened and endangered species. We determined that the Project *is not likely adversely affect* federally listed threatened and endangered species *is not likely to jeopardize the continued existence* of the proposed-threatened eastern black rail. As required by section 7 of the Endangered Species Act of 1973, we request that the FWS and NMFS accept the information provided in this EIS as the Biological Assessment for the Project. We also recommend that Venture Global should not begin any Project construction until FERC staff completes Endangered Species Act consultation for the Project.

LAND USE, RECREATION, AND VISUAL RESOURCES

The Project would be within the Louisiana Coastal Zone. All activities or developments that may affect Louisiana's coastal zone require a federal consistency review under the National Coastal Zone Management Program and must obtain a Coastal Use Permit from the Louisiana Department of Natural Resources. To ensure compliance with this federal requirement, we recommend that Venture Global file the consistency determination, prior to any LNG terminal and pipeline system construction.

The majority of the LNG terminal facilities would be within cultivated crop land, which encompasses active cropland, pasture, and hayfields. Forested land, wetlands, developed commercial/industrial land, open water, herbaceous land, and scrub-shrub are the other U.S. Geological Survey land use classifications that would be affected. The proposed LNG terminal is entirely on private lands, and no federal or state-managed public lands are within 0.25 mile of the site. There are currently no existing or planned residential or commercial developments within 0.25 mile of the LNG terminal. There are both existing and planned industrial developments within the vicinity of the LNG terminal.

The Plaquemines Parish developed a Comprehensive Master Plan in 2012 for the LNG terminal site (as well as other lands within Plaquemines Parish). The Project would be consistent with the Parish Plan for development because most of it would be constructed on properties identified in the Parish Plan for “port/terminal” and “major industries.”

There are no wildlife refuges, preserves, or conservation areas located within 16 miles of any Project workspace. The three wildlife refuges located in Plaquemines Parish—Breton National Wildlife Refuge, Delta National Wildlife Refuge, and Pass A Loutre State Wildlife Refuge—are all located over 35 miles from any Project workspace and would not be affected by Project construction or operation activities. A private conservation area, Woodland Trail and Park, and a preserve, Jean Lafitte National Historic Park and Preserve, are both located over 16 miles from any Project workspace and would not be affected by Project construction or operation.

The Barataria-Terrebonne National Estuary is located between the Mississippi and Atchafalaya Rivers in south Louisiana. The estuary’s watershed includes the LNG terminal site and pipeline system right-of-way. Construction of the pipelines would require dredging of channels within the Barataria-Terrebonne estuary to provide temporary access for pipeline lay barges and support vessels. Recreational boaters in the Barataria-Terrebonne estuary may be temporarily prevented from using channels during these dredging operations. Users may also observe a temporary increase in barge traffic during construction of the pipeline system. These impacts on boaters would be temporary and minor.

Four restoration areas, Lake Hermitage Marsh Creation (BA-42), Fringe Marsh Repair, West Pointe à la Hache Siphon Diversion, and Bayou Grande Cheniere Marsh and Ridge Restoration are located between 3.0 miles and 7.7 miles from any Project component. No impacts are anticipated at these restoration areas from either direct contact or indirect tidal influences.

West Pointe à la Hache Marina is located 0.4 mile northeast of the terminal site. The marina is located off of the Back Levee Canal that parallels the east bank of the Mississippi River. Lake Hermitage Marina is located 1.8 miles to the east of the Southwest Lateral TGP. St. Jude Hump Public Boat Launch is located 1.8 miles southeast of the LNG terminal site. Woodland Plantation is located 2.8 miles east of the LNG terminal site. None of these facilities are expected to be affected by the Project aside from alteration of the viewshed. We have determined the Project would have some adverse impacts on recreation, including boating and fishing along the Mississippi River and Barataria Bay.

The presence of the LNG terminal and associated increased lighting from exterior plant lighting, air navigation lighting, LNG storage tanks, electric power generation facilities, liquefaction heat exchangers, air coolers, and the flare stack would have a minor adverse influence on visual resources. The location of the LNG terminal would be in the viewshed of local residents, drivers, and visitors travelling along State Highway 23 and other nearby road. Therefore, the LNG facility could have a minor adverse impact on the residents, drivers, and recreational/commercial users of the area.

Construction and operation of the pipeline system may affect visual resources through the removal or alteration of existing vegetation as well as earthwork and grading scars associated with heavy equipment tracks, trenching, and dredging. A pipe bridge over State Highway 23 and other new aboveground facilities also would be built that would be visible to outside viewers. As much of the pipeline system would be located in rural or industrial areas, the pipeline system would be anticipated to cause minor impacts with regard to visual resources and permanent but minor impacts from the meter stations. Existing vegetation would help to provide some visual buffers from the operation of the pipeline system. In areas where vegetation would be removed or altered, pre-Project conditions would be restored along the pipeline system according to the Project-specific Plan and Procedures.

SOCIOECONOMICS

Construction of the Project would stimulate local economies by generating construction jobs and sales and payroll taxes and increasing demand for local goods, services, and equipment, including in the study area parishes of Plaquemines, Jefferson, and Orleans. The Project would increase economic activity along supply chains and increase consumer spending through workforce compensation, contributing to a moderate or more substantial local benefit over the 4.5 years of construction and a year or two after construction ends. Venture Global estimates 10 percent of the total estimated Project cost of \$8.5 billion would be spent locally or regionally.

Economic impacts and employment benefits during operation would be permanent as Venture Global would hire 250 workers with average salaries of \$75,000 to \$90,000, excluding benefits, with combined annual payroll of \$21 million. It would spend approximately \$20 million annually on materials, land leases, and utilities (water, sewer, waste disposal). Initially, its operational tax contributions would be a minor benefit at the local and state levels, consisting of payroll, income, and sales taxes and ad valorem taxes on the pipeline system. Venture Global has been awarded a Louisiana Industrial Tax Exemption Program waiver on ad valorem taxes on the LNG terminal for up to 5 years with the opportunity to renew for an additional 5 years.

Neither construction nor operation would have significant adverse impacts on housing supply or provision of community services, though effects on temporary housing could be noticeable and minor in specific locations within the study area. Neither construction nor operation would have disproportionately high or adverse environmental and human health impacts on low-income and/or minority populations.

Given the width of the Mississippi River and the volume of vessel traffic it handles currently, the vessel traffic contributed by the Project during construction or operation would be unnoticeable. During construction, vehicle traffic congestion on State Highway 23 during peak commute hours would be minimized through Venture Global's multiple mitigation measures,

including limiting worker parking passes to induce carpooling, constructing turning lanes along State Highway 23 at its intersection with the terminal entrance, and stationing a police officer to control traffic during rush hours.

AIR QUALITY AND NOISE

Air quality would be affected by construction and operation of the Project. Air pollutant emissions would be generated by operation of equipment during construction of the Project facilities, a combination of construction emissions and interim operating emissions would occur for an approximately 4-year period, followed by long-term operational emissions. The highest level of emissions associated with the Project would result from the combination of construction and interim operation of the LNG terminal. Plaquemines Parish is designated as unclassifiable/attainment for all criteria pollutants (ozone [O₃], particulate matter less than 2.5 microns in aerodynamic diameter, particulate matter less than 10 microns in aerodynamic diameter, carbon monoxide and nitrogen dioxide).

The Project would not lead to impacts above standards or other thresholds on any special national (Class I) or regional natural, scenic, recreational, or historic value areas for which the Prevention of Significant Deterioration regulations provide special protection. As a new facility, the Project must obtain an air quality permit from the Louisiana Department of Environmental Quality, who is the lead air permitting authority for the Project, prior to initiating construction.

Emissions from construction equipment would be temporary and depend on the duration and type of construction activity, together with the number and type of vehicles and equipment in use at any point in time. Pipeline construction would have short-term and localized construction emissions as equipment and activities move sequentially along the route, and would depend on the equipment being operated at any given time. Venture Global has identified the specific measures it would implement to control fugitive dust emissions during construction at the LNG terminal and pipeline system in a Fugitive Dust Control Plan.

Operation of the Project would result in long-term air pollutant emissions from stationary equipment at the LNG terminal site, including combustion turbines, duct burners, diesel engines for backup generators, and fugitive emissions from various components. In addition, the LNG terminal marine facility would be a source of emissions, as well as fugitive emissions from various onshore components. Stationary emissions sources associated with the pipeline system would include pig launcher/receivers, meter stations, mainline valves, and fugitive emissions from various components.

Mobile sources of operational emissions would include cars, trucks, and marine vessels associated with the LNG terminal facility. Marine vessels that would produce operational emissions would include LNG carriers at berths, LNG carriers underway, escort tug boats, and security vessels.

Venture Global estimated ambient pollutant concentrations in the vicinity of the Project. The analysis for all pollutants except O₃ used the EPA's AERMOD to predict maximum short-term and annual concentrations. The modeling analysis and "culpability analysis" in the cumulative modeling study showed that the Project would not significantly contribute to any of the modeled National Ambient Air Quality Standard (NAAQS) exceedances, and is shown to be in compliance with the NAAQS.

Venture Global performed additional assessments, based on the results of the NAAQS, of potential impacts from air emissions on Class I areas (Breton National Wildlife Refuge); soils, vegetation, and wildlife; and effects on development growth. The Project would not have a significant impact on pollutant concentrations or visibility impairment in any Class I areas or result in significant impacts on soils, vegetation, or wildlife as a result of air emissions.

Venture Global performed another air quality modeling analysis to quantify the potential impact of the Project on O₃ concentrations in the surrounding area, relative to the 8-hour O₃ NAAQS. The analysis determined that the addition of the modeled Project impact on background concentrations would not exceed the 70 parts per billion 2015 O₃ NAAQS. Therefore, the Project would not cause or contribute to a violation of the O₃ NAAQS.

During the construction period, residents in the vicinity of the Project would experience local impacts on air quality. Concurrent emissions from staged construction, commissioning and start-up, and operation of the LNG terminal would temporarily impact local air quality, and could result in exceedances of the NAAQS in the immediate vicinity of the LNG terminal during these construction years. These exceedances would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities within a day, week, or month. During operation, extensive modeling has indicated that the Project would not have significant impacts on the local and regional air quality and Class I areas.

Pile driving, both land-based and marine-side, and internal combustion engines associated with LNG terminal construction would generate noise. Pile driving could produce peak sound levels perceptible above the background sound levels at the nearest noise-sensitive areas (NSAs). Construction operating hours would be from 7:00 a.m. to 7:00 p.m., Monday through Saturday. Land-based and marine-side pile driving, which is the loudest construction activity, is expected to also occur six days per week starting at 7:00 a.m., as well, but would end at 5:00 p.m. Pile driving activities could occur for 16 months. Venture Global has committed to implementing mitigation measures to reduce land-based and marine-side pile-driving noise impact on NSAs.

With implementation of the mitigation measures identified in the noise analysis, the resulting noise at the NSAs would meet our criteria of a day-night average sound level (L_{dn}) of 55 dBA. In order to ensure implementation of these measures, we recommend that Venture Global file a noise survey after placing each phase of liquefaction blocks into service and after placing the entire LNG terminal into service to confirm that the criteria would be met.

With the exception of the HDD activities, normal pipeline construction would be limited to daytime hours, minimizing any impacts on nearby residences. Construction noise from barge access channel dredging would last approximately 1 month and would vary as dredging progresses along the corridor. Twenty-five structures and potential residences are located near a barge access

dredging location. Venture Global would engage owners of any occupied residences to implement suitable mitigation if dredging activities increase noise at the potential NSAs to no greater than 10 dBA above ambient noise levels. Venture Global has also committed to implement a sound curtain enclosure (height to be determined during installation) as necessary around the HDD drilling rig and other stationary equipment to minimize noise impacts at NSAs to under 10 A-weighted scale (dBA) above ambient noise levels.

Impacts associated with pipeline HDD and dredging activities would be temporary and minor at NSAs and potential noise receptors. Further implementation of sound curtains or acoustic barriers, as necessary, would further minimize this temporary impact.

Based on the analyses conducted and our recommendations, we conclude that operation of the LNG terminal and pipeline system would not result in significant noise impacts on NSAs.

RELIABILITY AND SAFETY

As part of the NEPA review, Commission staff assesses the potential impact on the human environment in terms of safety and assess whether the proposed facilities would be able to operate safely, reliably, and securely.

As a cooperating agency, the DOT assists FERC staff in evaluating whether Venture Global's proposed design would meet the DOT's 49 Code of Federal Regulations (CFR) 193 Subpart B siting requirements. The DOT provided a Letter of Determination confirming the Project's compliance with 49 CFR 193 Subpart B on April 3, 2019. This determination was provided to the Commission for its consideration on whether to authorize or deny the Project. If the Project is authorized and constructed, the facility would be subject to the DOT's inspection and enforcement program and final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the DOT staff.

As a cooperating agency, the USCG reviewed the proposed LNG terminal and the associated LNG carrier traffic. The USCG reviewed a Water Suitability Assessment (WSA) submitted by Venture Global that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On January 23, 2017, the USCG issued a Letter of Recommendation to FERC indicating the Lower Mississippi River would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this Project, based on the WSA and in accordance with the guidance in the USCG's NVIC 01-11. If the Project is authorized and constructed, the facility would be subject to the USCG's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

We conducted a preliminary engineering and technical review of the Venture Global design, including potential external impacts based on the site location. Based on this review, we recommend the Commission Order include a number of mitigation measures prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the facility to enhance the reliability and safety of the facility. With the incorporation of these mitigation measures, we conclude that the Venture Global Project design would include acceptable layers of protection or

safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

CUMULATIVE IMPACTS

During the cumulative impact analysis, we identified 16 permitted or proposed actions, including the Project that warranted careful consideration based on geographic and temporal criteria we established for each environmental resource. Six major industrial developments, including the Project, planned on the banks of the Mississippi River in Plaquemines Parish presented the highest potential for creating cumulative adverse effects. These industrial developments, all within 21 miles of each other, include two methanol manufacturing facilities; three LNG manufacturing facilities and export terminals, including the Project; an oil blending, storage, and distribution facility; and a container shipping terminal.

Based on our evaluations of resources affected by the Project and the proposed activities associated with the other actions, the following resources would not sustain significant adverse cumulative impacts: geology; soils; surface waters and aquatic wildlife and habitat; wetlands; vegetation and wildlife; land use; visual resources; socioeconomic; vessel traffic; roadway traffic, cultural resources; and the noise environment. Our analysis did consider in detail whether the Project could result in cumulative impacts on air quality in the geographic area as discussed below.

The Clean Air Act and implementing regulations establish limits on pollutant emissions from major industrial developments, among others. Venture Global prepared a modeling study of the LNG terminal's future effects on air quality that includes emissions from the permitted, as-yet-unconstructed Braithwaite Methanol Manufacturing Plant and NOLA Oil Terminal and demonstrated that their combined emissions would not exceed the NAAQS. Gulf Coast Methanol Park was issued an air permit in January 2018, and Venture Global updated its cumulative modeling to include Gulf Coast Methanol Park. Emissions from vessels, vehicles, and other mobile sources associated with operation of the foreseeable industrial facilities along the Mississippi River could contribute to an adverse effect on air quality. Vessel emissions are not addressed in Louisiana Department of Environmental Quality regulations and air permit application requirements, but the International Maritime Organization, of which the U.S. is a member, promulgates emissions standards limiting sulfur oxides and nitrogen oxide. Also, the EPA adopted emission standards on engines installed on U.S. vessels. Thus, the resulting cumulative effect of vessel emissions on air quality in the geographic scope of the Project is not likely to be significant. Although cumulative modeling showed the potential for NAAQS exceedances, the modeling indicates that the Project would not contribute above significant levels and therefore would not contribute to an adverse combined effect of the Project and other existing and foreseeable actions.

ALTERNATIVES CONSIDERED

We evaluated several alternatives to the Project, including the No Action Alternative, system alternatives for the proposed LNG terminal, alternative LNG terminal sites, alternative LNG terminal configurations, alternative pipeline system routes, and alternative aboveground facility sites. While the No Action Alternative would eliminate the short- and long-term environmental impacts identified in the EIS, the stated objectives of the proposed action would not be met.

System alternatives evaluated for the LNG terminal included 10 existing LNG import/export terminals with approved, proposed, or planned expansions to provide liquefaction capabilities and 12 approved, proposed, or planned stand-alone LNG Projects. We cannot speculate or conclude that excess capacity would be available to accommodate the Project's purpose and need. Therefore, construction of this Project as part of another site would likely require an expansion or new facilities similar to the proposed facilities, resulting in environmental impacts similar to the Project. Therefore, these systems alternatives would not offer a significant environmental advantage over the Project.

Using a set of selection criteria, six potential sites were evaluated by Venture Global to determine the preferred location for the LNG terminal. Of the alternative terminal locations, we conclude that the proposed site (Mississippi River Mile 55-West Bank) represents an acceptable site for the LNG terminal. The proposed site is currently zoned for heavy industrial use, is sufficiently sized to allow optimal facility layout design, and has available the necessary water frontage for three LNG carrier berths. The proposed site is also well separated from population centers and most permanent residences. The proposed site is the only alternative that satisfies all of the selection criteria. From a visual impact perspective, the LNG terminal would be consistent with existing and foreseeable industrial development along this portion of the Mississippi River.

We evaluated the proposed LNG terminal configuration and Project specifications relative to impacts on wetlands and other sensitive resources. We did not find any alternative configurations that would meet the required regulations, codes, and guidelines and at the same time further avoid or reduce environmental impacts associated with the Project.

One alternative pipeline system design and two major route alternatives were evaluated during the early stages of the Project application process. Initially, at the start of the pre-filing process, the planned Venture Global pipeline system consisted of three pipelines on three routes that would supply feed gas to the Venture Global terminal facility: the 21.2-mile-long Northwest lateral, 12.1-mile-long Southeast lateral, and 11.1-mile-long Southwest lateral pipelines. During the pre-filing process, Venture Global continued to evaluate and further its Project design. When Venture Global filed its application for the proposed pipeline system with FERC, it had removed the Northwest lateral and Southeast lateral from the Project. It also modified and renamed the Southwest Lateral pipeline route so that it now includes two collocated pipelines identified as Southwest Lateral TETCO and Southwest Lateral TGP. Venture Global proposes to construct and operate these two parallel pipelines in one right-of-way corridor.

The two route alternatives for the pipeline system are both over 11 miles long and generally trend in the same direction as the preferred route. These two alternatives did not offer any environmental advantages over the preferred route.

Proposed aboveground facilities for the pipeline system would include six MLVs, three pig launchers, two pig receivers, and two metering and regulation stations. All of these facilities would occur within or adjacent to the Southwest laterals pipeline route right-of-way. These facilities are small, would only affect environmentally sensitive areas to a minimal extent, are not located near residences, and their locations are tied to the locations of the required interconnect pipeline facilities. We did not identify any environmental concerns that require the need to identify and evaluate alternative sites for these minor aboveground facilities, nor were any alternatives

suggested during the public scoping period. Therefore, we concluded that the proposed aboveground facility sites are the preferred alternative.

CONCLUSIONS

We determined that construction and operation of the Project would result in adverse environmental impacts, but all of these impacts would be reduced to less-than-significant levels. From a cumulative impact perspective, we determined, based on cumulative air quality modeling results, that the Project would not contribute significantly to combined air quality impacts with other projects in the geographic scope that may result in exceedance of the NAAQS. This determination is based on a review of the information provided by Venture Global and further developed from data requests; field investigations; scoping; literature research; alternatives analysis; and contacts with federal, state, and local agencies as well as Indian tribes and individual members of the public.

Although many factors were considered in this determination, the principal reasons are:

- The HDD method would be used for the installation of the pipeline system to avoid direct affects to a canal and large wetland area and most of the pipelines would be installed in open water, which would minimize impacts on sensitive wetland resources.
- Venture Global would mitigate wetland impacts associated with the construction and operation of the proposed LNG terminal and the pipeline system with the implementation of its CMP and in accordance with USACE permit regulations.
- FERC staff would complete the process of complying with section 7 of the Endangered Species Act prior to construction.
- FERC staff would complete consultation under Section 106 of the National Historic Preservation Act and its implementing regulations at 36 CFR 800 prior to construction.
- Venture Global would minimize impacts on environmental resources during construction and operation of the Project by implementing, as applicable, their Project-specific Plan and Procedures; HDD Contingency Plan; and SPCC Plan.
- The siting requirements of DOT for the LNG terminal, the Letter of Recommendation issued by the USCG for the LNG marine traffic in the Mississippi River, FERC staff's preliminary engineering review and recommendations for the LNG terminal, and the regulatory requirements for the pipeline system and LNG terminal would avoid a significant increase in public safety risks.
- An environmental inspection program would be implemented to ensure compliance with the mitigation measures that become conditions of FERC authorization.

We developed recommendations that Venture Global should implement to further reduce the environmental impacts that would otherwise result from construction and operation of the Project. We determined that these measures are necessary to reduce adverse impacts associated

with the Project and, in part, are basing our conclusions on implementation of these measures. Therefore, we recommend that these mitigation measures be attached as conditions to any authorization issued by the Commission. These recommended mitigation measures are presented in section 5.2 of the EIS.

1.0 INTRODUCTION

The staff of the Federal Energy Regulatory Commission (FERC or Commission) prepared this environmental impact statement (EIS) to describe our assessment of the potential environmental impacts that may occur from constructing and operating the projects proposed by Venture Global Plaquemines LNG, LLC (Plaquemines LNG) and Venture Global Gator Express, LLC (Gator Express Pipeline) in Plaquemines Parish, Louisiana.

On February 28, 2017, Plaquemines LNG filed an application with the Commission for authorization pursuant to section 3(a) of the Natural Gas Act (NGA) and part 153 of the Commission's regulations. In Docket No. CP17-66-000, Plaquemines LNG requests authorization to site, construct, and operate natural gas liquefaction, storage, and export facilities at a liquefied natural gas (LNG) terminal on the west bank of the Mississippi River in Plaquemines Parish, Louisiana (the LNG terminal).

Also on February 28, 2017, Gator Express Pipeline filed an application with FERC for a Certificate of Public Convenience and Necessity (Certificate) pursuant to section 7(c) of the NGA and part 157 of the Commission's regulations. In Docket No. CP17-67-000, Gator Express Pipeline requests authorization to construct and operate associated lateral pipelines that would connect the LNG terminal to the existing U.S. natural gas transmission grid (pipeline system). The pipeline laterals would be located within Plaquemines Parish, Louisiana.

The combined Plaquemines LNG and Gator Express Pipeline actions and facilities are referred to herein as the Project, and the applicants are collectively referred to as Venture Global. As part of the Commission's consideration of these applications, we¹ prepared this draft EIS to assess the potential environmental impacts resulting from the construction and operation of the Project in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA).

The vertical line in the margin identifies text that is new or modified in the final EIS and differs materially from corresponding text in the draft EIS. Changes were made to address comments from cooperating agencies and other stakeholders on the draft EIS, incorporate modifications to the Project after publication of the draft EIS, update information included in the draft EIS, and incorporate information filed by Venture Global in response to our recommendations in the draft EIS. As a result of the changes, nine of the recommendations identified in the draft EIS are no longer applicable to the Project and do not appear in this final EIS. In addition, eight recommendations identified in the draft EIS have been substantively modified in the final EIS, and nine new recommendations have been added to the final EIS.

¹ "We," "us," and "our" refer to the environmental and engineering staff of FERC's Office of Energy Projects.

The LNG terminal would be located on an approximately 632-acre parcel of land on the west bank of the Mississippi River, about 20 miles south of Belle Chasse, Louisiana. This would be a new facility and would include 18 integrated single mixed-refrigerant blocks and support facilities (otherwise referred to as liquefaction blocks or blocks) with a nameplate production capacity of 20.0 million metric tons per annum (MTPA) of LNG and peak production capacity of 24 MTPA. Natural gas would be delivered to the LNG terminal via the pipeline system, which would connect the terminal with two existing interstate pipeline systems. Specifically, construction of the pipeline would consist of the Southwest Lateral Texas Eastern Transmission, LP (TETCO) pipeline (11.7 miles) and the Southwest Lateral Tennessee Gas Pipeline, LLC (TGP) pipeline (15.1 miles).

Subject to the receipt of FERC authorization and all other applicable permits, authorizations, and approvals, Venture Global anticipates it would commence a two-phased construction approach for the liquefaction facility after receiving the FERC authorization. Phase I is anticipated to last approximately 35 months. Phase II would commence 12 months after the start of Phase I and also last 35 months. The Southwest Lateral TGP pipeline would be installed during the Phase I construction process, while the Southwest Lateral TETCO pipeline would be constructed concurrently with Phase II facilities.

Section 3 of the NGA, as amended, requires that authorization be obtained from the U.S. Department of Energy (DOE) prior to importing or exporting natural gas, including LNG, from or to a foreign country. For applicants that have, or intend to have, a signed gas purchase or sales agreement/contract for a period of time longer than 2 years, long-term authorization is required. Under section 3 of the NGA, FERC considers, as part of its decision to authorize natural gas facilities, all factors bearing on the public interest. Specifically, regarding whether to authorize natural gas facilities for importation or exportation, FERC shall authorize the proposal unless it finds that the facilities will not be consistent with the public interest.

Under section 7 of the NGA, the Commission determines whether interstate natural gas transportation facilities are in the public convenience and necessity and, if so, grants a Certificate to construct and operate these facilities. The Commission bases its decisions on technical competence, financing, rates, market demand, gas supply, environmental impact, long-term feasibility, and other issues concerning a project.

1.1 PROJECT PURPOSE AND NEED

Venture Global states that the purpose of the Project would be to transport and liquefy domestic natural gas in order to provide a cost-effective outlet for the domestic natural gas to the global market. This would be accomplished by constructing liquefaction blocks and a new pipeline for feed gas at a new facility along the Mississippi River and loading LNG into vessels berthed at the Venture Global marine facility to transport LNG to global markets. Any exports would be consistent with authorizations from the DOE.

1.2 PURPOSE AND SCOPE OF THIS ENVIRONMENTAL IMPACT STATEMENT

The principal purposes in preparing an EIS include the following:

- identify and assess potential impacts on the human environment that would result from implementation of a proposed action;
- identify and assess reasonable alternatives to a proposed action that would avoid or minimize adverse effects on the human environment;
- facilitate public involvement in identifying significant environmental impacts; and
- identify and recommend specific mitigation measures to avoid or minimize environmental impacts.

This EIS focuses on the facilities that are under FERC's jurisdiction (i.e., the new terminal and liquefaction facility and the new pipelines). The topics addressed in this EIS include geology; soils; water use and quality; wetlands; vegetation; wildlife; fisheries and essential fish habitat (EFH); threatened, endangered, and special status species; land use, recreation, and visual resources; socioeconomic; cultural resources; air quality; noise; reliability and safety; cumulative impacts; and alternatives. This EIS also presents our conclusions and recommended mitigation measures.

The Energy Policy Act of 2005 (EPAct 2005) provides that FERC shall act as the lead agency for coordinating all applicable authorizations related to jurisdictional natural gas facilities and for purposes of complying with NEPA. FERC, as the lead federal agency, is responsible for preparation of this EIS. This effort was undertaken with the participation and assistance of the U.S. Army Corps of Engineers (USACE), U.S. Coast Guard (USCG), DOE, U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA), and the U.S. Environmental Protection Agency (EPA) as cooperating agencies under NEPA. Cooperating agencies have jurisdiction by law or special expertise with respect to environmental impacts involved with a project. The roles of FERC, the USACE, USCG, DOE, DOT/PHMSA, and EPA in the project review process are described below. This EIS provides a basis for coordinated federal decision making in a single document, thereby avoiding duplication among federal agencies in the NEPA environmental review processes. In addition to the lead and cooperating agencies, other federal, state, or local agencies may use this EIS in approving or issuing permits for all or part of the Project. Federal, state, and local permits, approvals, and consultations for the Project are discussed in section 1.5.

During the draft EIS comment period, a commenter suggested the Project cannot proceed without "a regional programmatic EIS for all such economically connected actions for all across New Orleans and Galveston Districts." Because the Commission does not have a program to direct the development of the natural gas industry's infrastructure, either on a broad regional basis or in the design of specific projects, and does not engage in regional planning exercises that would result in the selection of one project over another, we have determined that it would not be appropriate to prepare a programmatic EIS. This EIS analyzes the project-specific impacts of Plaquemines

LNG, and includes a discussion of cumulative impacts associated with other nearby actions affecting the environment in the same geographic scope.

1.2.1 Federal Energy Regulatory Commission

Based on its authority under the NGA, FERC is the lead agency for preparation of this EIS in compliance with the requirements of NEPA, the Council on Environmental Quality's (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and FERC regulations implementing NEPA (18 CFR 380).

As the lead federal agency for the Project, FERC is required to comply with the following: section 7 of the Endangered Species Act of 1973 (ESA), as amended; the Magnuson-Stevens Fishery Conservation and Management Act, commonly referred to as the Magnuson-Stevens Act (MSA); section 106 of the National Historic Preservation Act (NHPA); and section 307 of the Coastal Zone Management Act of 1972 (CZMA). Each of these statutes has been taken into account in the preparation of this EIS. FERC will use this document to consider the environmental impacts that could result if it issues an authorization to Plaquemines LNG under section 3(a) of the NGA and a Certificate to Gator Express Pipeline under section 7(c) of the NGA.

FERC consulted with cooperating agencies throughout the pre-filing and application phases of the Project. The cooperating agencies provided input on the Project during several conference calls. In addition, an interagency scoping meeting was held on December 9, 2015, in order to solicit comments and concerns regarding the Project. Agency representatives also participated in the public scoping meeting held on October 21, 2015. The cooperating agencies had the opportunity to comment on both the draft and final EIS. FERC consulted with those agencies about their comments and concerns and have incorporated them into the final EIS.

1.2.2 U.S. Army Corps of Engineers

The USACE has jurisdictional authority pursuant to the following: section 404 of the Clean Water Act (CWA) (33 United States Code [U.S.C.] 1344), which governs the discharge of dredged material into waters of the United States; section 10 of the Rivers and Harbors Act (RHA) (33 U.S.C. 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody; and section 14 of the RHA (33 U.S.C. 408), which grants permission for the alteration, occupation, or use of a USACE civil works project if the activity will not be injurious to the public interest or affect the USACE project's ability to meet its authorized purpose. Because the USACE would need to evaluate and approve several aspects of the Project and must comply with the requirements of NEPA before issuing permits under the above statutes, it has elected to participate as a cooperating agency in the preparation of this EIS. The Project is within the New Orleans District of the USACE's Mississippi Valley Division. Staff from the New Orleans District participated in the NEPA review and will evaluate USACE authorizations, as applicable.

The primary decisions to be addressed by the USACE include the following:

- issuance of a section 404 permit for the placement or redistribution of dredged and/or fill material within jurisdictional waters, to include wetlands, associated with construction of the terminal and pipeline;

- issuance of a section 10 permit for construction activities within navigable waters of the United States; and
- section 14 (or section 408) permission for the alteration, occupation, or use of the USACE-managed civil works projects, including USACE-maintained navigation channels and federal levees associated with the construction and operation of the terminal and associated facilities.

As an element of its review, the USACE must consider whether a project strives to avoid, minimize, and compensate for impacts on existing aquatic resources, including wetlands, in order to achieve a goal of no overall net loss of values and functions. Additionally, the USACE reviews applicable portions of a project that may impact USACE-managed civil works projects to determine whether or not the project would be injurious to the public interest or would impair the usefulness of the federal civil works projects (e.g., a levee). The USACE must also evaluate whether or not a project has a “water dependency.” The USACE would issue a Record of Decision to formally document its decisions on a proposed action, including section 404(b)(1) analyses and required environmental mitigation commitments.

1.2.3 U.S. Coast Guard

The USCG is the federal agency responsible for determining the suitability of waterways for LNG marine traffic. The USCG exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173, the MSA (50 U.S.C. 191), the Ports and Waterways Safety Act of 1972, as amended, and the Maritime Transportation Security Act of 2002 (MTSA) (46 U.S.C. 701). The USCG is responsible for matters related to navigation safety, vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment in or adjacent to navigable waters up to the last valve immediately before the receiving LNG tanks. As appropriate, the USCG (acting under the authority in 33 U.S.C. 1221 et seq.) also would inform FERC of design- and construction-related issues identified as part of safety and security assessments. If the Project is approved, constructed, and operated, the USCG would continue to exercise regulatory oversight of the safety and security of the LNG terminal facilities in compliance with 33 CFR 127.

As required by its regulations, the USCG is responsible for issuing a Letter of Recommendation (LOR) as to the suitability of the waterway for LNG marine traffic following a Waterway Suitability Assessment. The process of preparing the LOR begins when an applicant submits a Letter of Intent to the local Captain of the Port. In a letter dated January 23, 2017, the USCG issued a LOR for the Project. In the LOR, the USCG stated that, after reviewing the Waterway Suitability Assessment (WSA), they recommend that the Lower Mississippi River be considered suitable for accommodating the type and frequency of LNG marine traffic in accordance with the guidance in the Coast Guard Navigation and Vessel Inspection Circular 01-2011.

1.2.4 U.S. Department of Energy

The DOE must meet its obligation under section 3 of the NGA to authorize the import and export of natural gas, including LNG, unless it finds that the proposed import or export would not

be consistent with the public interest. On March 1, 2016, Plaquemines LNG submitted, in Fossil Energy Docket No. 16-28-LNG, an application to the DOE/Office of Fossil Energy (FE) to export up to a total of 24.0 MTPA of natural gas in the form of LNG to Free Trade Agreement (FTA) and non-FTA nations over 25 years. Venture Global seeks to export LNG from the terminal to any country: (1) with which the United States has, or in the future may have, a free trade agreement requiring national treatment for trade in natural gas; (2) with which the United States does not have a FTA requiring national treatment for trade in natural gas; (3) that has, or in the future develops, the capacity to import LNG via ocean-going carriers; and (4) with which trade is not prohibited by United States law or policy.

Section 3(c) of the NGA, as amended by section 201 of the Energy Policy Act of 1992 (Public Law 102-486), requires that applications to DOE requesting authorization of the import or export of natural gas, including LNG, from or to a nation with which there is in effect an FTA requiring national treatment for trade in natural gas, be deemed consistent with the public interest and granted without modification or delay. On July 21, 2016, DOE/FE approved Venture Global Plaquemines LNG, LLC's application to export LNG to FTA nations in DOE/FE Order No. 3866.

In the case of applications to export LNG to non-FTA countries, section 3(a) of the NGA requires DOE/FE to conduct a public interest review and grant the applications unless DOE/FE finds that the proposed exports will not be consistent with the public interest. Additionally, NEPA requires DOE/FE to consider the environmental impacts of its decisions regarding applications to export natural gas to non-FTA nations. DOE/FE has not yet granted Venture Global export authority to countries without an FTA. In accordance with 40 CFR 1506.3, after an independent review of the EIS, DOE/FE may adopt the document prior to issuing a Record of Decision on the Venture Global application for authority to export LNG to countries without an FTA.

1.2.5 U.S. Department of Transportation

The DOT has prescribed the minimum federal safety standards for LNG facilities in compliance with 49 U.S.C. 60101. Those standards are codified in 49 CFR 193 and apply to the siting, design, construction, operation, maintenance, and security of LNG facilities. The National Fire Protection Association (NFPA) Standard 59A (NFPA 59A), *Standard for the Production, Storage, and Handling of Liquefied Natural Gas*, is incorporated into those requirements by reference, with regulatory preemption in the event of conflict. In February 2004, the USCG, the DOT, and the FERC entered into an Interagency Agreement to ensure greater coordination among these three agencies in addressing the full range of safety and security issues at LNG terminals, including terminal facilities and tanker operations, and maximizing the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. Under the Interagency Agreement, the FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with terminal construction and operation. The DOT and the USCG participate as cooperating agencies, but remain responsible for enforcing their regulations covering LNG facilities. On August 31, 2018, FERC and DOT signed a Memorandum of Understanding (MOU) to coordinate the siting and safety

review of FERC-jurisdictional LNG facilities.² On April 3, 2019, the DOT issued a Letter of Determination (LOD), which provides PHMSA's analysis and conclusions regarding 49 CFR 193, Subpart B regulatory requirements for the Commission's consideration in its decision to authorize, with or without modification or conditions, or deny an application.³

The DOT also houses the Federal Aviation Administration (FAA), which is a federal agency responsible for regulating all aspects of civil aviation including management of airports, air traffic control, and protection of the public, property, and the national security and foreign policy interests of the U.S. during commercial space launch and reentry activities. In its mission to safely manage U.S. airspace and air traffic, the FAA requires that certain elevated structures with the potential to affect navigable airspace are placed on public notice (14 CFR 77). Due to the height of facilities associated with the Project, on January 16, 2017 Venture Global submitted a Notice of Proposed Construction or Alteration of Objects that may affect the Navigable Airspace and ensure that marking and lighting of all elevated structures is in compliance with FAA standards. On January 25, 2017, Venture Global received a DOT FAA Determination of No Hazard to Air Navigation in accordance with 14 CFR Part 77.

1.2.6 U.S. Environmental Protection Agency

The EPA has delegated water quality certification (section 401 of the CWA) to the jurisdiction of individual state agencies; in Louisiana, jurisdictional authority under section 401 of the CWA has been delegated to the Louisiana Department of Environmental Quality (LDEQ). The EPA also oversees the issuance of a National Pollutant Discharge Elimination System (NPDES) permit by the LDEQ for point-source discharge of used water into waterbodies (section 402 of the CWA). The EPA shares responsibility for administering and enforcing section 404 of the CWA with the USACE and has authority to veto USACE permit decisions.

The EPA has jurisdictional authority under the Clean Air Act of 1970 (CAA) (42 U.S.C. 85) to control air pollution by developing and enforcing rules and regulations for all entities that emit pollutants into the air. Under this authority, the EPA has developed regulations for major sources of air pollution and certain source categories and has established general conformity applicability thresholds. The EPA has delegated the following jurisdictional authority under the CAA to the LDEQ, unless the source would be located within Native American lands:

- Title 1, Part A, Section 111 – New Source Performance Standards (NSPS);
- Title 1, Part A, Section 112 – National Emission Standards for Hazardous Air Pollutants (NESHAP);
- Title I, Part C – Prevention of Significant Deterioration (PSD); and

² August 31, 2018 Memorandum of Understanding between the Department of Transportation and the Federal Energy Regulatory Commission Regarding Liquefied Natural Gas Transportation Facilities, <https://www.ferc.gov/legal/mou/2018/FERC-PHMSA-MOU.pdf>.

³ April 3, 2019 letter "Re: Plaquemines LNG Project, Docket No. CP17-66-000, 49 CFR, Part 193, Subpart B, Siting – Letter of Determination." Filed in Docket Number CP17-66-000 on April 4, 2019. FERC eLibrary accession number 20190404-3002.

- Title V – Operating Permits.

Under section 309 of the CAA, the EPA is (1) required to review and publicly comment on the environmental impacts of major federal actions, including actions that are the subject of draft and final EISs, and (2) responsible for implementing certain procedural provisions of NEPA (e.g., publishing the Notices of Availability of the draft and final EISs in the Federal Register) to establish statutory timeframes for the environmental review process.

1.3 PUBLIC REVIEW AND COMMENT

1.3.1 Pre-filing Process and Scoping

On June 18, 2015, Venture Global filed a request with FERC to use our pre-filing review process. This request was approved on July 2, 2015, and pre-filing Docket No. PF15-27-000 was established in order to place information filed by Venture Global and related documents issued by FERC into the public record. The pre-filing review process provides opportunities for interested stakeholders to become involved early in Project planning, facilitates interagency cooperation, and assists in the identification and resolution of issues prior to a formal application being filed with FERC.

Venture Global held an open house in Port Sulphur, Louisiana (Plaquemines Parish) and Lafitte, Louisiana (Jefferson Parish)⁴ on September 15 and 16, 2015, to provide information to the public about the Project. FERC staff participated in the meeting by describing the FERC process and providing those attending with information on how to file comments with FERC.

On October 5, 2015, FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Plaquemines Liquefied Natural Gas Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting* (NOI). This notice was sent to about 370 interested parties, including federal, state, and local officials, agency representatives, conservation organizations, Native American tribes, local libraries and newspapers, and property owners in the vicinity of planned Project facilities. Publication of the NOI for the Project established a 30-day public comment period for the submission of comments, concerns, and issues related to the environmental aspects of the Project.

On October 21, 2015, FERC conducted a public scoping meeting in Belle Chasse, Louisiana (Plaquemines Parish) to provide an opportunity for the public to learn more about the Project and participate in our analysis by providing oral comments on environmental issues to be included in the EIS. Five individuals elected to present oral comments at the scoping meeting in support of the Project. A transcript of these comments is part of the public record for the Project and is available for viewing on the FERC internet website (<http://www.ferc.gov>). We received comments from three federal agencies, one federally recognized tribe (tribe), and two state agencies in response to the NOI for the Project (EPA, National Marine Fisheries Service [NMFS], the National Park Service [NPS], the Choctaw Nation of Oklahoma, Louisiana Department of Wildlife and Fisheries (LDWF), and Louisiana Department of Transportation and Development

⁴ Jefferson Parish was included in the initial open house because the original project scope included two additional feed gas pipelines to be constructed in Jefferson Parish. Venture Global has since removed these pipelines within Jefferson Parish from the project scope.

[DOTD]). The Commission also received written comments from elected officials, public officials, and one citizen.

On December 9, 2015, a joint interagency meeting for the Project was conducted with representatives of the EPA, NMFS, Louisiana Department of Natural Resources (LDNR), and LDWF to discuss coordination of agency review, permit requirements and status, impacts on natural resources, and each agency's interest in participating in our environmental review as a cooperating agency. Following the interagency meeting, FERC staff visited the terminal site and pipeline routes. In addition, interagency conference calls were conducted bi-weekly with the agencies and Venture Global representatives throughout the pre-filing period.

On September 14, 2016, FERC issued a *Supplemental Notice of Intent to Prepare an Environmental Impact Statement for the Planned Plaquemines Liquefied Natural Gas Project*. This NOI was sent to eight new landowners in the vicinity of Project facilities based on the revised pipeline route (see previously referenced footnote 2). Publication of the NOI for the Project established a 30-day public comment period for the submission of comments, concerns, and issues related to the environmental aspects of the Project.

Issues identified after the initial open house and during and after public scoping are summarized in table 1.3-1, along with a listing of the EIS sections that address the comments.

Table 1.3-1 Key Environmental Concerns Identified during the Scoping Process and Draft EIS Review for the Project	
Issue/Specific Comment	EIS Section Addressing Comment
General	
Right-of-way requirements and configurations	2.2.2
Project design	2.1
Improve Project map/include political boundaries	2.1.1
Quantity and location of fill material and excavation of native material	4.4
Relevant permits (air, water, transportation, etc.)	1.5.11
Need for a programmatic EIS for LNG terminals	1.2
Project timeline	2.1.1
Alternatives	
Explore alternative pipeline routes and the use of existing pipeline systems	3.5
Provide a clear discussion of the reasons for the elimination of alternatives that are not evaluated in detail	3.3.1
Describe how each alternative was developed, how it addresses each Project objective, and how it will be implemented	3.0 through 3.6
Describe the rationale used to determine whether impacts of an alternative are significant or not	3.0 through 3.6
Describe the methodology and criteria used for determining Project siting	3.3 and 3.5
Evaluate Project alternatives to demonstrate the Project's compliance with section 404(b)(1) guidelines	3.3, 3.5, and 4.4

Table 1.3-1 Key Environmental Concerns Identified during the Scoping Process and Draft EIS Review for the Project	
Issue/Specific Comment	EIS Section Addressing Comment
Discuss alternatives to avoid or minimize dredged or fill material discharged into waters of the United States	4.4
Soils	
Aquatic erosion/sediment control	4.2.3
Water Quality and Aquatic Resources	
Altered hydrology	4.3.2.1
Dredged material may contain contaminants and should be tested prior to placement	4.3.2.2
Test sediments to be placed in waters of the United States for beneficial use for contamination according to the USACE/EPA Inland Testing Manual to determine their suitability for open water disposal	4.3.2.2
Test sediments for contamination using the USACE Upland Testing Manual in cases where potentially contaminated dredged material is proposed for disposal in a Confined Disposal Facility and there is potential for effluent to enter waters of the United States	4.3.2.2
Impacts on productivity of Barataria Bay estuary	4.6.2.1 through 4.6.4.2
Impacts on coastal restoration projects and sand/silt resources	4.8.4
Impacts on water supply and the adaptability of the Project to these changes	4.3.1.4
Effects of Project discharges on surface water quality	4.3.2.2
Discharges within affected waters	4.3.2.2
Water reliability for the Project	4.3.1.4 and 4.3.2.2
Mitigation measures necessary or beneficial in reducing impacts on water quality and aquatic resources	4.3.1.4 and 4.3.2.2
CWA section 303(d) Impaired Waters, restoration and ongoing protection efforts, and mitigation measures	4.3.2.1
Impacts on groundwater quality and quantity associated with construction and operation activities	4.3.1.4
Mitigation measures to reduce impacts on groundwater resources	4.3.1.4
Work closely with state and local agencies that regulate the protection of groundwater resources	4.3.1.4
Identify areas of the Project located in the 50- or 100-year floodplain	4.3.2.1
A stormwater discharge permit is required for 1 or more acres of land disturbance	4.3.2.2
Wetlands	
Wetland crossing methods	Appendix C and 4.4
Right-of-way width in wetlands	2.4.5.2
Pipeline construction in the coastal zone will damage wetlands	4.4.3 and 4.8.7
Majority of wetlands within pipeline rights-of-way are categorized as EFH	4.6.4.1
Wetland delineation needed	4.4.2
Include a wetland mitigation plan to be reviewed by EPA, USACE, and other agencies, along with alternatives to show that potential impacts on wetlands have been addressed	4.4.2
Use of barge lay method in non-marsh areas	2.5.2.4

Table 1.3-1 Key Environmental Concerns Identified during the Scoping Process and Draft EIS Review for the Project	
Issue/Specific Comment	EIS Section Addressing Comment
Use of spoil that is sidecast during barge channel creation	4.4.2.2
Vegetation	
Critically imperiled Coastal Live Oak-Hackberry Forest ecological community	4.5.1
Introduction of invasive and exotic plant species	4.5.3
Fish and Wildlife Resources	
Habitat fragmentation	4.5.4 and 4.6.2.2
Mitigation plan to offset fish and wildlife resource impacts	4.6.1.2 and 4.6.2.2
Noise pollution	4.6.1.2 and 4.6.2.2
Light pollution	4.6.1.2 and 4.6.2.2
Listed threatened and endangered species with the potential to occur in Project area	4.6.2
Impacts on wildlife	4.6.2
Consistent surveying, monitoring, reporting protocols	Appendix C
Presence of aquatic species managed under the MSA by the Gulf of Mexico Fishery Management Council (GMFMC) and the NMFS within wetlands	4.6.4
Compliance with 50 CFR 600.920(e) regarding EFH	4.6.4
Measures to minimize EFH impacts	4.6.4
Compensation lands and mitigation	4.4.2
Re-suspension of oiled sediments	4.7.1
Land Use	
Impacts on viewshed from nearby residential areas and areas greater than 2 miles	4.8.6.1
Impacts on aesthetics and recreational opportunities	4.8.6
Light pollution	4.8.6
Noise pollution	4.11.2
Impacts on the Jean Lafitte National Historical Park and Preserve	4.8.4
Impacts on the Barataria Preserve	4.8.4
Socioeconomics/Environmental Justice	
Property Values	4.9.6
Traffic impacts in Belle Chasse	4.9.8.1
Impacted communities within the geographic scope of the Project (i.e., minority and low-income populations)—evaluation and outreach	4.9.1
Coordination with tribal governments	4.10
Impacts on charter and sport fishing	4.9.3

Table 1.3-1 Key Environmental Concerns Identified during the Scoping Process and Draft EIS Review for the Project	
Issue/Specific Comment	EIS Section Addressing Comment
Cultural Resources	
Impacts on culturally and historically significant properties	4.10
Section 106 of NHPA compliance	4.10.5
Air Quality	
Evaluation of baseline conditions	4.11.1.2
Air pollution and emission sources	4.11.1.4
Greenhouse gas emissions from Project operation	4.11.1.4
Statement of Purpose and Need	
Clearly identify the underlying purpose and need to which the FERC is responding in proposing the alternatives	3.0
Discuss the Project in the context of the natural gas supply and the need for additional export capabilities	1.1
Transportation	
If the Project requires access to or use of state highway rights-of-way, then a driveway permit or joint use agreement is required	2.1.1.8
Climate Change	
Future climate scenarios; potential changes to the affected environment due to climate change	4.11.1
Climate adaptation measures in response to future climate scenario impacts on the Project	4.11.1
Greenhouse gas emissions associated with production, transport, and combustion of natural gas proposed to be exported by the Project	4.11.1.4
Hazardous Materials	
Hazardous waste from construction and operation	2.4
Methane leakage prevention	2.1.1.8

1.3.2 Public Review of the Draft EIS

The draft EIS was filed with the EPA and a Notice of Availability for the draft EIS was mailed to federal, state, and local government agencies; elected officials; Native American tribes; affected landowners; local libraries and newspapers; intervenors in the FERC's proceeding; and other interested parties (i.e., miscellaneous individuals who provided scoping comments or asked to be on the mailing list). The distribution list for the Notice of Availability was provided in appendix A of the draft EIS.

On November 13, 2018, we issued a *Notice of Availability of the Draft Environmental Impact Statement for the Proposed Plaquemines LNG and Gator Express Pipeline Project*. This notice, which was published in the Federal Register, listed the date and location of a public comment session and established a closing date of January 7, 2019, for receiving comments on the draft EIS. Copies of the draft EIS were mailed to 486 stakeholders. The EPA noticed the draft EIS in the Federal Register on November 23, 2018.

We held one public session in the Project area to solicit and receive comments on the draft EIS. The meeting was held on December 11, 2018, in Belle Chase, Louisiana. The session provided the public an opportunity to present oral comments to a court reporter on the environmental analysis described in the draft EIS. A total of 24 individuals attended this public session, including 11 who provided oral comments. We also received six comment letters from federal and state agencies, companies/organization, and individuals in response to the draft EIS. All comments received are included in our comment responses contained in appendix H. Transcripts from the public session, as well as the written comment letters, were entered into the public record and are available for viewing on the FERC's eLibrary website (www.ferc.gov).

This EIS addresses all substantive comments submitted to FERC or made at the open houses, scoping meetings, interagency meetings, and public comment session on the draft EIS. Table 1.3-1 lists the environmental issues and concerns identified by commenters during the draft EIS review as well as the scoping process and identifies the section of the EIS where the issue is addressed.

The Commission mailed a copy of the *Notice of Availability of the Final Environmental Impact Statement for the Plaquemines LNG and Gator Express Pipeline Project* to agencies, individuals, organizations, and other parties identified in the distribution list provided as appendix A. Additionally, this final EIS was filed with the EPA for issuance of a Notice of Availability in the Federal Register.

In accordance with the Council on Environmental Quality's (CEQ) regulations implementing NEPA, no agency decision on a proposed action may be made until 30 days after the EPA publishes a Notice of Availability of the final EIS in the Federal Register. However, the CEQ regulations provide an exception to this rule when an agency decision is subject to a formal internal appeal process that allows other agencies or the public to make their views known. In such cases, the agency decision may be made at the same time the notice of the final EIS is published, allowing both periods to run concurrently. The Commission's decision for this proposed action is subject to a 30-day rehearing period.

1.4 NON-JURISDICTIONAL FACILITIES

Under section 7 of the NGA, FERC is required to consider, as part of a decision to authorize a project, all facilities that are directly related to the project if there is sufficient federal control and responsibility to warrant environmental analysis as part of the NEPA environmental review for the project. Some projects have associated facilities that do not come under the jurisdiction of the Commission. These "non-jurisdictional" facilities may be integral to the need for the jurisdictional facilities, or they may be merely minor components that would be constructed and operated as a result of authorization of the jurisdictional facilities.

Non-jurisdictional facilities associated with the Project would include new utility service connections to the local electric and water distribution systems within the temporary adjacent workspace. These utility connections would be provided by the local electric and water utility companies and would be authorized and regulated by state and/or local agencies. The utility companies would conduct the necessary environmental reviews and obtain all necessary permits for non-jurisdictional facilities.

The new electric utility connection that would be utilized during terminal construction would be provided by Entergy Louisiana, LLC. The anticipated design calls for a tie-in with Entergy's existing power line that runs along and inside the Project property line on the south side of State Highway 23 (SH 23) at the terminal site. The land disruption at this tie-in location would be minimal and localized, involving the installation of an electrical junction box, meters, and associated equipment. The electric service agreement would determine the scope of each party's responsibilities for the connection facilities. All other land disruptions associated with provision of electric services would be confined to the terminal site and, therefore, within the FERC-permitted workspace.

The Project may require a connection to an existing water line owned and operated by Plaquemines Parish Water Works along SH 23. The design would call for an approximately 1,500-foot-long water line from a tie-in with the existing line (owned by Plaquemines Parish Water Works) to facilities at the terminal site. Although it is anticipated that service would be disconnected after construction, if a permanent connection becomes necessary, any additional environmental impacts would be minimal and confined to the existing utility corridor that runs along and inside the Project property line on the south side of SH 23. Venture Global is also exploring options to provide supporting water utilities via on-site groundwater wells and withdrawal from the Mississippi River. None of these three options would require new workspace, as all options would be available within the terminal site or adjacent to the terminal site (SH 23).

1.5 PERMITS, APPROVALS, AND REGULATORY REVIEWS

Federal agencies are required to comply with various federal environmental regulations and laws. In addition, project applicants must comply with various federal environmental laws and regulations for projects that may or may not impact the environment. These regulations include, but are not limited to, the CZMA, ESA, MSA, Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle (BGEPA), Marine Mammal Protection Act (MMPA), RHA, CWA, CAA, MTSA, and NHPA, the Federal Aviation Act of 1958, and the National Flood Insurance Act of 1968 (NFIA). Each of these statutes, and others, has been taken into account in the preparation of this document. The major permits, approvals, and consultations for the Project are identified in table 1.5-1. Each federal environmental regulation and law directly relevant to this Project is discussed in the following paragraphs.

1.5.1 Endangered Species Act

Under section 7 of the ESA, a project authorized, funded, or conducted by any federal agency should not "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined... to be critical..." (16 U.S.C. 1536(a)(2)(1988)). FERC is required to consult with other federal agencies to determine whether any federally listed endangered, threatened, or proposed species, including their respective designated critical habitats, occur in the vicinity of a project. If FERC determines that these species or habitats have the potential to be impacted by a project, FERC is required to prepare a biological assessment (BA) to identify the extent of adverse impact and recommend measures to avoid or mitigate probable impacts. If FERC determines that no federally listed proposed, endangered, or threatened species or their designated critical habitat

would be impacted by the Project, no further action is necessary under the ESA. Section 4.7 provides information on the status of FERC's compliance with section 7 of the ESA.

1.5.2 Magnuson-Stevens Fishery Conservation Management Act

The MSA, as amended by the Sustainable Fisheries Act of 1966 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. The MSA requires federal agencies to consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (MSA section 305(b)(2)). No criteria have been established for conducting EFH consultations. However, NMFS recommends combining EFH consultations with interagency coordination procedures required by other statutes, such as NEPA, the Fish and Wildlife Coordination Act, or the ESA (50 CFR 600.920(e)), to reduce duplication and improve efficiency. As part of the consultation process, FERC has prepared an EFH assessment. This assessment and the status of EFH consultation are provided in section 4.6.

1.5.3 Migratory Bird Treaty Act

Migratory birds are species that nest in the United States and Canada during the summer and then migrate south to the tropical regions of Mexico, Central and South America, and the Caribbean for the non-breeding season. Migratory birds are protected under the MBTA (16 U.S.C. 703–711). Birds protected under the MBTA include all common songbirds, waterfowl, shorebirds, hawks, owls, eagles, ravens, crows, native doves and pigeons, swifts, martins, swallows, and others, including their body parts (feathers, plumes, etc.), nests, and eggs. The act makes it unlawful to pursue, hunt, take, capture, or kill, attempt to take, capture, or kill, possess, offer to or sell, barter, purchase, deliver, or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product, manufactured or not, without a permit.

Executive Order 13186 (66 Federal Register 3853) directs federal agencies to identify where unintentional take is likely to have a measurable negative effect on migratory bird populations and to avoid or minimize adverse impacts on migratory birds through enhanced collaboration with the U.S. Fish and Wildlife Service (FWS). Executive Order 13186 states that emphasis should be placed on species of concern, priority habitats, and key risk factors, and that particular focus should be given to addressing population-level impacts. On March 30, 2011, the FWS and the Commission entered into a *Memorandum of Understanding Between the Federal Energy Regulatory Commission and the U.S. Department of the Interior United States Fish and Wildlife Service Regarding Implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds,"* that focuses on avoiding or minimizing adverse impacts on migratory birds and strengthening migratory bird conservation through enhanced collaboration between the two agencies. This voluntary MOU does not waive legal requirements under the MBTA or any other statutes and does not authorize the take of migratory birds. See section 4.6.2.1 of this draft EIS for the status of our compliance with the MBTA.

1.5.4 Bald and Golden Eagle Protection Act

The BGEPA prohibits taking without a permit, or taking with wanton disregard for the consequences of an activity, any bald or golden eagle or their body parts, nests, chicks, or eggs,

which includes collection, molestation, disturbance, or killing. The BGEPA protections include provisions not included in the MBTA, such as the protection of unoccupied nests and prohibition on disturbing eagles. The BGEPA includes limited exceptions to its prohibitions through a permitting process, including exceptions to take golden eagle nests that interfere with resource development or recovery operations. This EIS discusses compliance with the BGEPA under the jurisdiction of the USFWS in section 4.6.2.1.

1.5.5 Marine Mammal Protection Act

All marine mammals are protected under the provisions of the MMPA (16 U.S.C 31). While many marine mammal species are listed as threatened or endangered through ESA protections, the MMPA provides additional protections for all marine mammals. The MMPA prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the United States. “Take” is defined as “to hunt, harass, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal.” Harassment is strictly defined as “any pursuit, torment, or annoyance that has the potential to injure marine mammal stock in the wild, or has the potential to disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including migration, breathing, nursing, breeding, feeding or sheltering.” Actions that have the “potential to injure” are Level A harassment, and those actions that have the “potential to disturb” are Level B harassment. NMFS administers the MMPA in protecting whales, dolphins, porpoises, seals, and sea lions; the FWS protects walruses, manatees, dugongs, otters, and polar bears; and the Animal and Plant Health Inspection Service, a part of the U.S. Department of Agriculture (USDA), is responsible for regulations managing marine mammals in captivity (NMFS, n.d.[d]).

1.5.6 Rivers and Harbors Act

The RHA pertains to activities impacting navigable waters, including harbor and river improvements. Section 10 of the RHA prohibits the unauthorized obstruction or alteration of any navigable water. Construction of any structure or the accomplishment of any other work affecting course, location, condition, or physical capacity of waters of the United States must be authorized by the USACE. Section 14 of the RHA, also referred to as section 408, grants permission for the alteration, occupation, or use of a USACE civil works project if the activity will not be injurious to the public interest or affect the USACE project’s ability to meet its authorized purpose. Section 4.3 provides the status of our compliance with the RHA.

1.5.7 Clean Water Act

The CWA, as amended, regulates the discharges of pollutants into waters of the United States and regulates quality standards for surface waters. Both the EPA and the USACE, along with a joint application with LDNR, Office of Coastal Management (OCM), have regulatory authority under section 404 of the CWA. The EPA has implemented pollution control programs, including setting wastewater standards for industry and creating water quality standards for all contaminants in surface waters. Under the CWA, it is unlawful to discharge any pollutant from a point source into waters of the United States without a permit. In accordance with section 402 of the CWA, the EPA operates the NPDES permit program, which regulates discharges by industrial, municipal, and other facilities that directly enter surface waters. Section 404 of the CWA regulates

the discharge of dredged or fill material into waters of the United States and is under the jurisdiction of the USACE. The status of NPDES and section 404 permitting requirements are further addressed in section 4.4 of this EIS.

Section 401 of the CWA requires that an application for a federal permit to conduct an activity that may result in a discharge to waters of the United States must provide the federal regulatory agency with a section 401 certification. Section 401 of the CWA certifications are made by the state in which the discharge originates and declares that the discharge would comply with applicable provisions of the act, including state water quality standards. The LDEQ is the regulatory authority responsible for section 401 water quality certification in Louisiana.

1.5.8 Clean Air Act

The CAA is the basic federal statute governing air pollution and was enacted by the U.S. Congress to protect the health and welfare of the public from the adverse effects of air pollution. Federal and state air quality regulations established as a result of the CAA include, but are not limited to, title V operating permit requirements and PSD review. The EPA is the federal agency responsible for regulating stationary sources of air pollutant emissions; however, in Louisiana, the federal permitting process has been delegated to the LDEQ. A title V and PSD permit application, along with Class I and Class II (including Louisiana Toxic Air Pollutants) air dispersion modeling protocols and an ozone modeling protocol, for the project were initially submitted to the LDEQ on September 15, 2015. The application included the LNG terminal and pipeline system. An addendum to the application and updated modeling protocols were submitted to the LDEQ on June 23, 2017. Class I, Class II, and Louisiana Toxic Air Pollutant dispersion modeling reports were submitted to the LDEQ on September 15, 2017. Section 4.11 evaluates air quality impacts that could occur as a result of construction and operation of the Project.

1.5.9 Federal Aviation Act

The FAA, under the Federal Aviation Act, oversees the safety, development, and regulations of civil aviation. The regulations associated with “the construction, alteration, establishment, or expansion, or the construction, alteration, establishment, or expansion of a structure when notice would promote safety in air commerce and the efficient use and preservation of the navigable airspace and of airport traffic capacity at public-use airports” are outlined in 14 U.S.C. 44718, Structures Interfering with Air Commerce. In accordance with 49 CFR 77, Safe, Efficient Use, and Preservation of the Navigable Airspace, the construction or alteration of structures requires that adequate notice be provided to the FAA. Following notification to the FAA, a public NOI would be issued for an aeronautical study of the obstruction to air navigational facilities and the effect the obstruction would have on the safe and efficient use of navigable airspace. Upon completion of the study, the FAA would issue a determination stating whether the construction or alteration would be a hazard to air navigation. Section 4.12 provides additional information regarding safety associated with the flare stacks.

1.5.10 Maritime Transportation Security Act

The purpose of the MTSA is to protect the nation’s ports and waterways from a terrorist attack. The MTSA requires vessels and port facilities to conduct vulnerability assessments,

develop security plans, and establish Area Maritime Security Committees at all of the nation's ports. These committees coordinate activities of all port stakeholders, including the maritime industry, the boating public, and other federal, state, and local agencies. As a cooperating agency with FERC, the USCG prepared a LOR to analyze the potential risks to navigation safety and maritime security associated with the Project (see section 1.2.3). The USCG also has responsibilities relating to LNG waterfront facilities under 33 CFR 127.

1.5.11 National Historic Preservation Act

Section 106 of the NHPA requires that FERC take into account the impacts of its undertakings on properties listed, or eligible for listing, in the National Register of Historic Places (NRHP), including pre-contact or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance, and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking. In Louisiana, the Louisiana State Historic Preservation Officer (SHPO), within the Department of Culture, Recreation, and Tourism, reviews projects regarding section 106 of the NHPA. Venture Global, as non-federal parties, assisted FERC in meeting its obligations under section 106 by preparing information, analyses, and recommendations under the ACHP regulations in 36 CFR 800. Section 4.10 of this EIS provides information on the status of our compliance with section 106 of the NHPA.

1.5.12 National Flood Insurance Act

The National Flood Insurance Program is managed by the Federal Emergency Management Administration (FEMA). The purpose of the National Flood Insurance Program under the NFIA is to make flood insurance available, improve floodplain management, and develop maps of flood hazard zones. Pursuant to the NFIA, state and local governments must implement floodplain management regulations consistent with measures in 44 CFR 60, Criteria for Land Management and Use. To reduce the risk of flooding, participating local governments in flood-prone areas, as designated by FEMA, agree to adopt and enforce ordinances that meet or exceed FEMA requirements. Section 4.3 provides additional information regarding flood risks and our compliance with the NFIA.

1.5.13 Coastal Zone Management Act

The CZMA calls for the “effective management, beneficial use, protection, and development” of the nation's coastal zone and promotes active state involvement in achieving those goals. As a means to reach those goals, the CZMA requires participating states to develop management programs that demonstrate how those states will meet their obligations and responsibilities in managing their coastal areas. In Louisiana, the LDNR administers the Coastal Zone Management Program (CZMP). Venture Global consulted with and submitted an application to the LDNR for a Coastal Use Permit (CUP) on June 8, 2017, with a revised application submitted in March 2018. The CZMP is discussed further in section 4.8.

1.5.13.1 U.S. Department of Defense

EPAct 2005 and section 3 of the NGA require us to consult with the U.S. Department of Defense (DoD) to determine whether there would be any impacts associated with the Project on

military training or activities on any military installations. FERC initiated informal consultation with a letter to the DoD in January 2016. After conducting an informal review, the DoD responded on February 23, 2016, requesting that Venture Global coordinate with the U.S. Department of the Navy, due to the proximity of the Project to Naval Air Station Joint Reserve Base New Orleans. In January 2017, Naval Air Station Joint Reserve Base New Orleans identified in an email to the FERC that the installation did not have any issues with the Project moving forward and would only contribute a minor impact to operations.

Table 1.5-1 Major Permits, Approvals, and Consultations for the Project			
Agency	Permit/Approval/ Consultation	Status	
		Terminal	Pipelines
Federal			
Federal Energy Regulatory Commission (FERC)	Authorization to Construct and Operate Facilities under sections 3(a) and 7(c) of the Natural Gas Act (NGA)	Application filed February 28, 2017	Application filed February 28, 2017
U.S. Department of Energy, Office of Fossil Energy (DOE/FE)	Authorization to export LNG by LNG carrier to Free Trade Agreement (FTA) and non-FTA nations	FTA approval received on July 21, 2016 (DOE/FE Order No. 3866) Non-FTA application pending	NA
U.S. Department of Homeland Security, U.S. Coast Guard (USCG)	Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas (33 Code of Federal Regulations [CFR] 127), which includes Letter of Intent (LOI) submission (33 CFR 127.007), Waterway Suitability Assessment consultation, and Letter of Recommendation from the USCG (18 CFR 157.21)	Letter of Recommendation received on January 23, 2017	NA
U.S. Environmental Protection Agency (EPA), Region VI, Dallas, Texas	Consultation role to Louisiana Department of Environmental Quality (LDEQ) on air emissions permitting	Planned Review of LDEQ air permit application in November 2018	NA
	Floodplain management and protection of wetlands (44 CFR 9) Review of wetlands impacts for U.S. Army Corps of Engineers (USACE) Clean Water Act (CWA) section 404 permit	Commented on USACE Public Notice on April 12, 2018	Commented on USACE Public Notice on April 12, 2018
USACE, New Orleans District	CWA section 404 permit for impacts on waters of the United States, including wetlands (33 United States Code [U.S.C.] 1344) Rivers and Harbors Act (RHA) section 10 permit for construction and operation of structures in and across	Application for sections 404/10 submitted September 15, 2017	Application for sections 404/10 submitted September 15, 2017

Table 1.5-1 Major Permits, Approvals, and Consultations for the Project			
Agency	Permit/Approval/ Consultation	Status	
		Terminal	Pipelines
	federally navigable waterways (33 U.S.C. 403) Section 408 authorization for work in federal project waters and federally navigable waters (33 U.S.C. 408)	Authorization request for section 408 approval submitted December 2017	Authorization request for section 408 approval submitted December 2017
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS)	Marine Mammal Protection Act Consultation (16 U.S.C. 1382) Endangered Species Act (ESA) section 7 consultation (16 U.S.C. 1856 et seq.) Magnuson-Stevens Fishery Conservation and Management Act (MSA) Consultation, Essential Fish Habitat (EFH) Consultation (50 CFR 600) Fish and Wildlife Coordination Act Consultation (16 U.S.C. 5a, subchapter I)	All Pending	All Pending
U.S. Fish and Wildlife Service (FWS), Southeast Region 4	ESA section 7 consultation (16 U.S.C. 35) Migratory Bird Treaty Act Consultation (16 U.S.C. 7, subchapter II) Fish and Wildlife Coordination Act Consultation (16 U.S.C. Chapter 5a, subchapter I) BGEPA consultation	Concurrence Received February 2017 Revision Pending Pending Pending Pending	Concurrence Received February 2017 Revision Pending Pending Pending Pending
Federal Aviation Administration (FAA)	FAA's regulations at 14 CFR 77	Received FAA clearance determinations January 25, 2017, Extension granted July 19, 2018	NA
U.S. Department of Transportation – Pipeline and Hazardous Materials Safety Administration (PHMSA)	49 CFR 193 Subpart B	Letter of Determination – received April 3, 2019	NA
State – Louisiana			
LDEQ, Water Permits Division	Hydrostatic Test Water Discharge General Permit (LRS 30:2001 et seq.) Section 401 Water Quality Certification (33 U.S.C. 26)	Pending	Pending Received 401 Certification October 1, 2018

Table 1.5-1 Major Permits, Approvals, and Consultations for the Project			
Agency	Permit/Approval/ Consultation	Status	
		Terminal	Pipelines
	Louisiana Pollutant Discharge Elimination System (LPDES) Construction Stormwater Discharge General Permit LAR100000 LPDES Industrial Wastewater Discharge Permit, section 402 (33 U.S.C. 1342)	Received 401 Certification October 1, 2018 Pending Pending	Pending Pending
LDEQ, Office of Environmental Quality	Title V and Prevention of Deterioration of Significant (PSD) Air Permits (40 CFR 70)	Amended application submitted in July 23, 2017	NA
Louisiana Department of Natural Resources (LDNR), Office of Coastal Management (OCM)	Coastal Use Permit (CUP), a Joint Permit Application with USACE (R.S. 49:214.25)	CUP application submitted June 8, 2017	CUP application submitted June 8, 2017
LDNR, Office of Conservation	Title 38, Section 3098 (R.S. 38:3098—Chapter 13-B: Subsurface Water—Well Drillers)	Application to be submitted June 2019	NA
Louisiana Department of Wildlife and Fisheries (LDWF)	Threatened and Endangered Species Consultation (16 U.S.C. 460 et seq.)	Pending	Pending
Louisiana Department of Culture, Recreation and Tourism, Division of Archaeology	National Historic Preservation Act (NHPA) Section 106 Consultation (36 CFR 800) and Review	Concurrence from SHPO: Terminal Site, January 7, 2016; Terminal Site Avoidance Plan, August 22, 2016; Terminal Site Addendum, February 17, 2017; Unanticipated Discovery Plan, February 17, 2017	Concurrence from SHPO: Pipeline System, February 8, 2016; Addendum Report, October 12, 2016 Addendum, January 2017
Louisiana Department of Transportation and Development (DOTD)	Driveway access, trestle crossing, temporary conveyor crossing	Application submitted in January 2019	NA
Louisiana Office of State Lands	Permit and lease for State Water Bottoms (LRS 41:1701-1714)	Application submitted in February 2019	Application submitted in February 2019
Local – Parish			
West Bank Levee	Crossing authorization	See information for section 408 authorization	See information for section 408 authorization
Plaquemines Parish Council	Building permit (if required)	Pending	Pending

2.0 PROPOSED ACTION

2.1 PROPOSED FACILITIES

The Venture Global Project consists of an LNG export terminal facility and a pipeline system in Plaquemines Parish, Louisiana that would supply the necessary gas for export. A description of these facilities is provided below.

- **LNG Terminal:** Construction and operation of various liquefaction, LNG distribution, and appurtenant facilities within the boundaries of the site leased by Venture Global on the Mississippi River, including:
 - six pretreatment facilities (three in each phase);
 - a liquefaction plant with 18 integrated single-mixed refrigerant blocks and support facilities (otherwise referred to as liquefaction blocks or blocks) to be constructed in two phases (nine blocks in each phase);
 - four 200,000-cubic-meter aboveground full-containment LNG storage tanks;
 - three LNG loading docks within a common LNG berthing area; and
 - air-cooled electric power generation facilities.
- **Pipeline System:** Construction and operation of two parallel 42-inch-diameter natural gas pipelines that share one right-of-way corridor for the majority of their respective routes and appurtenant aboveground facilities, including the following:
 - 15.1-mile-long Southwest Lateral Pipeline (Southwest Lateral TGP);
 - 11.7-mile-long Southwest Lateral Pipeline (Southwest Lateral TETCO);
 - TGP metering and regulation station; and
 - TETCO metering and regulation station.

Figure 2.1-1 shows the general location of the terminal site and pipeline routes.



This information is for environmental review purposes only.

- Terminal Site Boundary
- Eastern Workspace
- SW Lateral – TETCO
- SW Lateral – TGP
- Interconnect and Meter Station



Figure 2.1-1
Proposed Project Facilities - Regional Location (Aerial Map)
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana

2.1.1 LNG Terminal

Venture Global proposes the development of an LNG terminal with a nameplate liquefaction capacity of 20.0 MTPA. The LNG liquefaction, storage, and export facilities would be constructed on an approximately 632-acre site on the west bank of the Mississippi River, near river mile marker 55 in Plaquemines Parish, Louisiana (see figure 2.1-2). The terminal site is bordered by the Mississippi River to the north and private property, historically used for agricultural purposes, to the south, east, and west. The terminal site has approximately 7,000 feet of frontage on the Mississippi River. The site is approximately 15 miles northwest of Port Sulfur, Louisiana and is bisected by SH 23. This state highway is a north-south regional highway that serves Plaquemines Parish. In addition, the terminal site extends across a federally maintained Mississippi River levee. The levee is part of the Mississippi River Flood Control Program and is under the regulatory and operational control of the USACE, New Orleans District.

The terminal site is located on “fastlands.” The State of Louisiana defines fastlands as lands surrounded by publicly owned, maintained, or otherwise validly existing levees or natural formations that normally prevent activities, not to include the pumping of water for drainage purposes, within the surrounded area from having a direct and significant impact on coastal waters.

For descriptive purposes, the facilities at and adjacent to the terminal site are divided into two groups: the “terminal facilities” are those facilities located south of the landward toe of the Mississippi River levee and include the pretreatment, liquefaction, storage, and power generation facilities; and the “marine facilities” are those facilities on, over, or north of the Mississippi River levee and include the three LNG loading docks. The marine facilities are divided into land-based and water-based facilities. The material offloading facility (MOF), bulk carrier mooring facility, and barge unloading facility each require temporary access roads across the levee for a total of four crossings (access road for the barge unloading facility is a loop necessitating two crossings).

At the location of the LNG loading docks on the Mississippi River (river mile marker 55), the federal navigation channel is approximately 1,900 feet wide (USACE, 2016a) and does not require regular maintenance since the depth is far greater than the required minimum depth of 45 feet Mean Low Gulf (USACE, 2016b). The existing channel depth would allow construction and operation of the LNG loading docks without the need for any dredging beyond that already performed by the USACE to maintain the navigation channel.

The LNG terminal site would be constructed in two phases (table 2.1-1). Venture Global anticipates initiating construction of Phase II approximately 12 months after initiating Phase I. However, Phase II is predicated on Venture Global’s market outlook and the expected timeframe for securing offtake contracts for Phase II. Initiation of Phase II could be delayed based on market conditions and the status of offtake contracts.

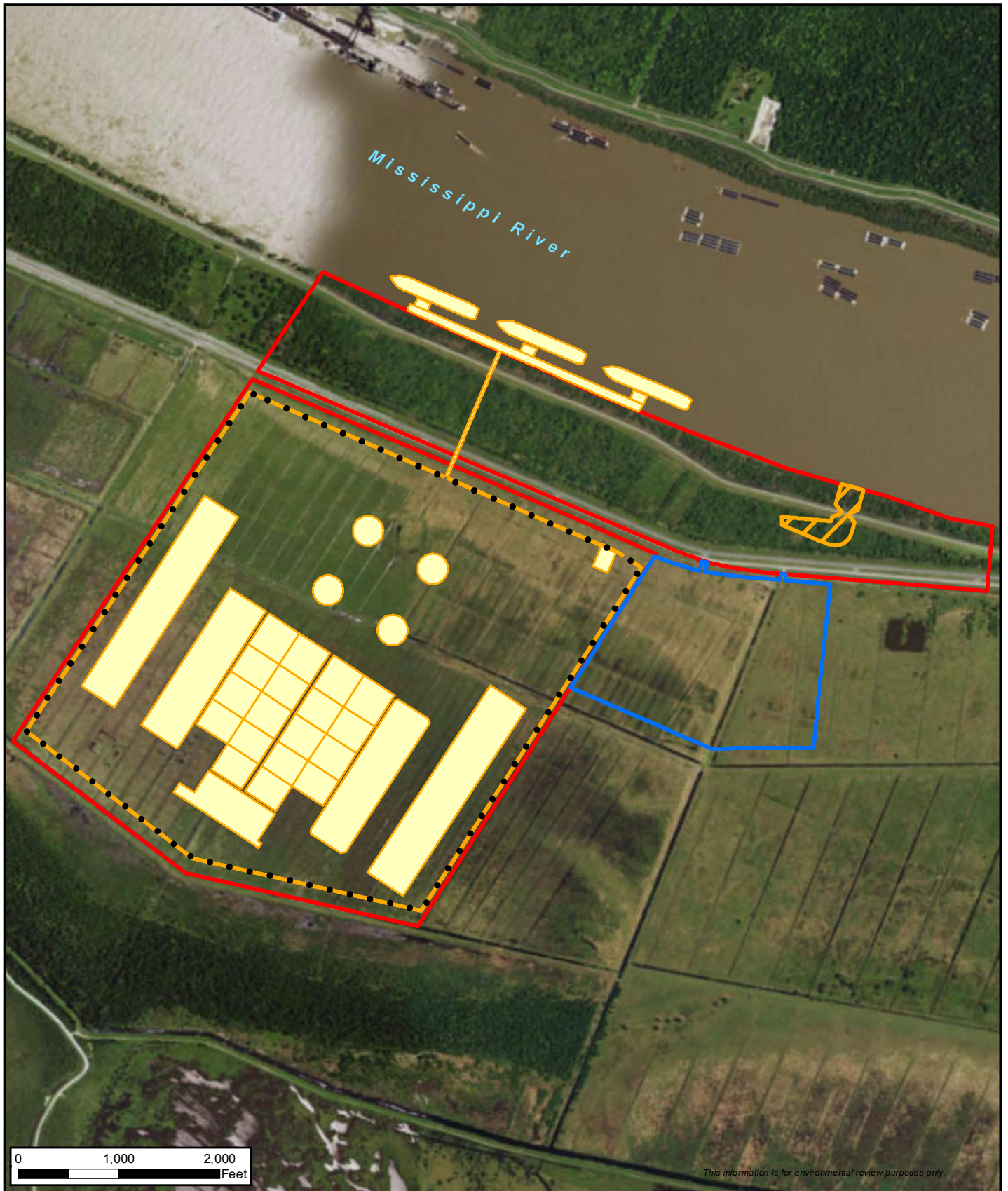
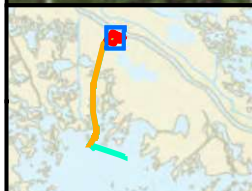


Figure 2.1-2

Proposed Facilities at Terminal Site (Aerial Map)
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana



- Terminal Site Boundary
- Eastern Workspace
- Levee Ramp
- Floodwall



Venture Global plans to initiate construction of Phase I upon receipt of the Project's regulatory approvals required to begin construction. Venture Global anticipates that the full construction of each the two phases would take approximately 35 months each. In both phases, the construction, commissioning, and operational startup of the liquefaction facilities would be achieved in steps, with each of the nine blocks per phase brought on line as it is commissioned. The Project's construction plan and its sequencing would be designed to ensure that LNG can be produced, stored, and loaded onto ships for export upon the commissioning of the first liquefaction block. The phased startup would be implemented pursuant to a simultaneous operations plan to be developed with the Project's engineering, procurement, and construction contractors. For Phase I, Venture Global anticipates commencing production of LNG as the first liquefaction block is completed, approximately 24 months after receiving FERC's authorization to commence construction. LNG production would then steadily increase as more liquefaction blocks are commissioned.

Table 2.1-1 Summary of Major Facility Components Constructed by Phase	
Phase I	Phase II
9 Liquefaction Blocks	9 Liquefaction Blocks
3 Pre-treatment Facilities	3 Pre-treatment Facilities
2 LNG Storage Tanks (full containment type)	2 LNG Storage Tanks (full containment type)
2 LNG Loading Docks	1 LNG Loading Dock
Natural Gas-fired Power Plant (710 megawatt)	Natural Gas-fired Power Plant (710 megawatt)
Southwest Lateral TGP (15.1 miles)	Southwest Lateral TETCO (11.0 miles)
Southwest Lateral TETCO (0.7-mile segment)	
TGP and TETCO Meter Stations	

2.1.1.1 Pretreatment

Upon arrival at the terminal site, the natural gas would enter the gas gate station, which would include isolation and emergency shutdown valves, filters/separators, metering systems, connection to the fuel gas system, and a gas analyzer. At this stage, the gas would be split into two streams, one for process feed to the liquefaction plant and the other for fuel gas supply¹ to the electric power generation facilities. The feed gas pressure would be boosted as necessary by electric motor-driven compressors at the terminal site to achieve approximately 750 pounds per square inch gauge (psig) before pretreatment and before the gas enters the liquefaction system. Air-cooled heat exchangers would cool the gas to near ambient temperature to remove the heat caused by compression.

The pipeline-quality gas delivered to the terminal site would be composed primarily of methane but would also contain ethane, propane, butane, and other heavy end hydrocarbons (between 2 and 3 percent) in addition to small quantities of nitrogen, oxygen, carbon dioxide

¹ Natural gas feed for power generation would be supplemented with boil-off gas and other fuel gas streams generated in the liquefaction plant.

(CO₂), and water. To ensure that the liquefaction plant can function properly, the process feed gas would be treated to remove CO₂, hydrogen sulfide (H₂S), and water. The trace amounts of CO₂ present in natural gas would freeze in the cryogenic liquefaction process and block the cryogenic exchangers if not removed beforehand. H₂S is also removed to lower sulfur dioxide emissions.

Each construction phase consists of a Hydrogen Sulfide Removal Unit, an Acid Gas Removal Unit, and a Dehydration Unit. Each Hydrogen Sulfide Removal Unit includes six (6) Hydrogen Absorber Vessels while each Acid Gas Removal Unit includes three (3) parallel treatment blocks. There would be three (3) Dehydration blocks, where one (1) Dehydration block is dedicated to an Acid Gas Removal treatment block.

H₂S Removal Unit

Feed gas from the gas gate station, containing up to 5 parts per million volume (ppmv) H₂S, would be fed to the non-regenerative H₂S removal beds to remove H₂S and, thereby, lower sulfur dioxide emissions. The solid adsorbent is contained in multiple vessels in each of the six H₂S removal units. As the adsorbent is used up, individual vessels are isolated, and the adsorbent is emptied and recharged while the rest of the units remain on line. The treated gas is sent to the acid gas removal unit for further treatment. Spent adsorbent would be placed in containers and transported via truck to a processing facility.

Acid Gas Removal

The acid gas removal unit is designed to treat feed gas containing up to 2 percent mole CO₂ and any remaining traces of H₂S that remain after the H₂S removal unit process. After treatment in the acid gas removal unit, the feed gas would contain no more than 50 ppmv CO₂ and no more than 1 ppmv H₂S. Activated methyldiethanolamine technology would be used primarily due to its ability to remove CO₂ to very low levels and, with respect to comparative technologies, fewer corrosion issues and lower foaming tendencies. There would be three 50-percent capacity acid gas removal units for each phase. Antifoam injection would be provided, as well as amine and water storage and makeup facilities. The low-pressure, CO₂-rich acid gas stream with some H₂S and residual hydrocarbons content would be sent to the thermal oxidizer for destruction. The amines collected in the solvent drain tank would be filtered and transferred to the solvent storage tank, then sent off-site for reprocessing.

Dehydration Unit

The dehydration unit would be located downstream of the acid gas removal unit and is designed to remove water from the water-saturated feed gas leaving the amine tower. The gas dehydration system would consist of three 50-percent-capacity molecular sieve units for each phase, each with four vessels (three operating, one regenerating). The process flow would be routed through a valve system to one of the operating vessels, while the other operating vessels' sieve material would be regenerated with a small flow of dry, hot gas.

At any given time, three molecular sieve beds would be in water adsorption mode, while the other would be in regeneration mode. The regeneration gas is heated by a hot oil system. The dried treated gas is filtered downstream of the molecular sieve vessel and then sent to the heavy

hydrocarbon removal unit. The water content of the gas is reduced to about 0.5 ppmv. Finally, the natural gas is further purified within the liquefaction trains to remove heavy hydrocarbons.

2.1.1.2 Liquefaction

The liquefaction plant would consist of 18 integrated single-mixed refrigerant blocks and support facilities (otherwise referred to as liquefaction blocks or blocks), which would be situated in the central sector of the terminal site (see figure 2.1-2). Nine of the blocks would be constructed in Phase I and nine would be constructed in Phase II. One block would contain two liquefaction trains, each consisting of a cold box, an electric-driven mixed-refrigerant compressor and a process module. Heavy hydrocarbon removal is integral to the cold box. Each train would also contain conventional air coolers (fin fans) to provide cooling during the liquefaction process.

Each block would have a nameplate capacity of 1.1 MTPA of LNG (for a Project nameplate capacity of 20.0 MTPA in aggregate) for export, which equates to a total liquefaction nameplate capacity of approximately 1,033 standard billion cubic feet per year (bcf/y) of natural gas. The Project's peak liquefaction capability may, depending on a variety of factors, be as much as 24.0 MTPA. Under optimal conditions, this equates to a total peak liquefaction capacity of approximately 1,240 bcf/y of natural gas.

The first step of the liquefaction process is to further purify the natural gas arriving from the pretreatment systems to remove heavy hydrocarbons that would freeze during the liquefaction process if not removed beforehand. The pretreated feed gas enters the cold box where it is chilled to a point at which most of the heavy components condense and are then separated in a distillation process. The small quantities of products removed would be recovered and used by the LNG terminal's hot oil heaters for fuel.

After the heavy hydrocarbons have been removed, the pretreated gas continues through the cold box, is de-superheated, condensed to liquid, and then sub-cooled to near -260 degrees Fahrenheit (°F) in aluminum plate-fin heat exchangers, which are enclosed and insulated with perlite powder in steel cold boxes. Refrigeration for this process is produced by a specifically designed single-loop, mixed-refrigerant system. The refrigerant, a mixture of hydrocarbon gases and nitrogen, is pressurized by a multi-stage electric motor-driven compressor and then partially condensed in air-cooled heat exchangers. The resultant cooled and pressurized vapors and liquids are separated into various streams and continue to be condensed and sub-cooled in the cold-box plate-fin heat exchangers. The cooling source for these mixed-refrigerant streams and the natural gas liquefaction stream is created by flashing cold mixed-refrigerant to lower pressures, then passing those colder mixed refrigerant streams in counter current to the streams to be cooled in the plate-fin heat exchangers. The lower-pressure, mixed-refrigerant is warmed to near ambient temperature and returned to the suction of the compressors to complete the cycle.

Each liquefaction train would contain a refrigerant make-up system with gas analyzers and controls that maintains the refrigerant components in proper proportion. The refrigerant make-up system is also designed to recover refrigerant during equipment shutdown. Distribution piping would connect vessels in the common refrigerant storage area to each liquefaction train. Except for certain safety systems, one distributed control system in the control building would be used for

supervisory process and power control. Each liquefaction train would have its own process controller.

When the LNG exits the cold-box, it is depressurized to 100 psig and delivered sub-cooled to the LNG storage tanks, where it is flashed into the container.

2.1.1.3 LNG Tanks

The LNG storage tanks would be located between the liquefaction blocks and the LNG berthing area (see figure 2.1-2). Each tank would be approximately 300 feet in diameter and 180 feet in height from grade to the top of the dome roof, with a net usable capacity of 200,000 cubic meters. The four LNG tanks constructed during Phase I and Phase II (two during each Phase) would be full containment type.

Each full containment tank would consist of:

- a pile supported at grade tank foundation system with electric heater, designed to support the tank;
- an outer reinforced concrete tank with a carbon steel vapor barrier;
- a 9 percent nickel steel inner tank;
- a concrete ring beam, which supports the shell of the inner tank;
- an aluminum suspended insulation deck supported by hangers from the roof;
- an insulation system with insulation on top of the suspended deck, between the outer concrete tank and the 9 percent nickel steel inner tank, and between the outer tank bottom and the inner tank bottom;
- a tank settlement monitoring system;
- a heating system in the concrete foundation to prevent frost heave of the soil below the tank;
- submerged pumps, pump wells, internal piping, etc.;
- valves for pressure and vacuum protection;
- appurtenant equipment including roof platform, spill protection, stairs, walkways, caged ladders, monorail, handrails, pressure relief and vacuum relief valves, pipe-racks, equipment for various monitoring, fire detection and control system, etc.;
- electrical features including tank lighting, tank grounding and lightning protection; and
- control and instrumentation systems.

The Phase I tanks would be on the north side of the storage area, and the Phase II tanks would be on the south side of the storage area. The storage tanks, like other LNG facilities at the LNG terminal site, must be built to the requirements of NFPA Standard 59A (2001), as incorporated by DOT/PHMSA regulations at 49 CFR 193. Venture Global will design and construct the LNG storage tanks to other applicable regulations, codes, and standards.

Prior to being placed into service, the LNG storage tanks would be hydrostatically tested in accordance with the requirements of American Petroleum Institute (API) Standard 620, Q8.3. The source of hydrostatic test water would be appropriated from the adjacent drainage canal located at the southern edge of the LNG terminal site. In the event that this drainage canal does not have enough available water, alternative plans would be to pull water from the Mississippi River. Following any necessary treatment, the used test water would be discharged back to the canal or river adjacent to the terminal site within the parameters of the LDEQ permit.

Liquefied natural gas from the liquefaction plant would be stored in the LNG tanks prior to being transferred to ocean-going LNG carriers.

2.1.1.4 LNG Loading and Ship Berthing Area

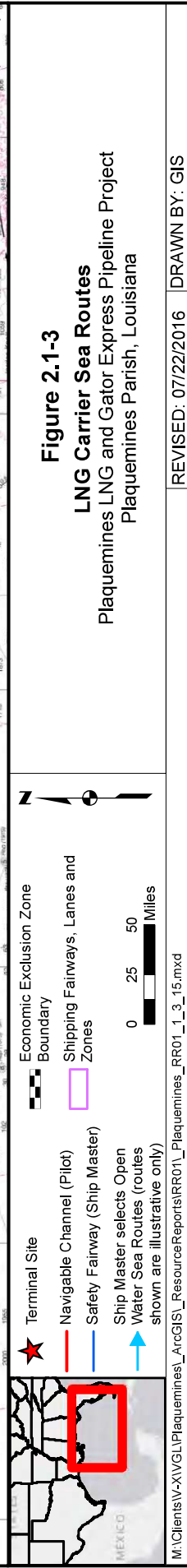
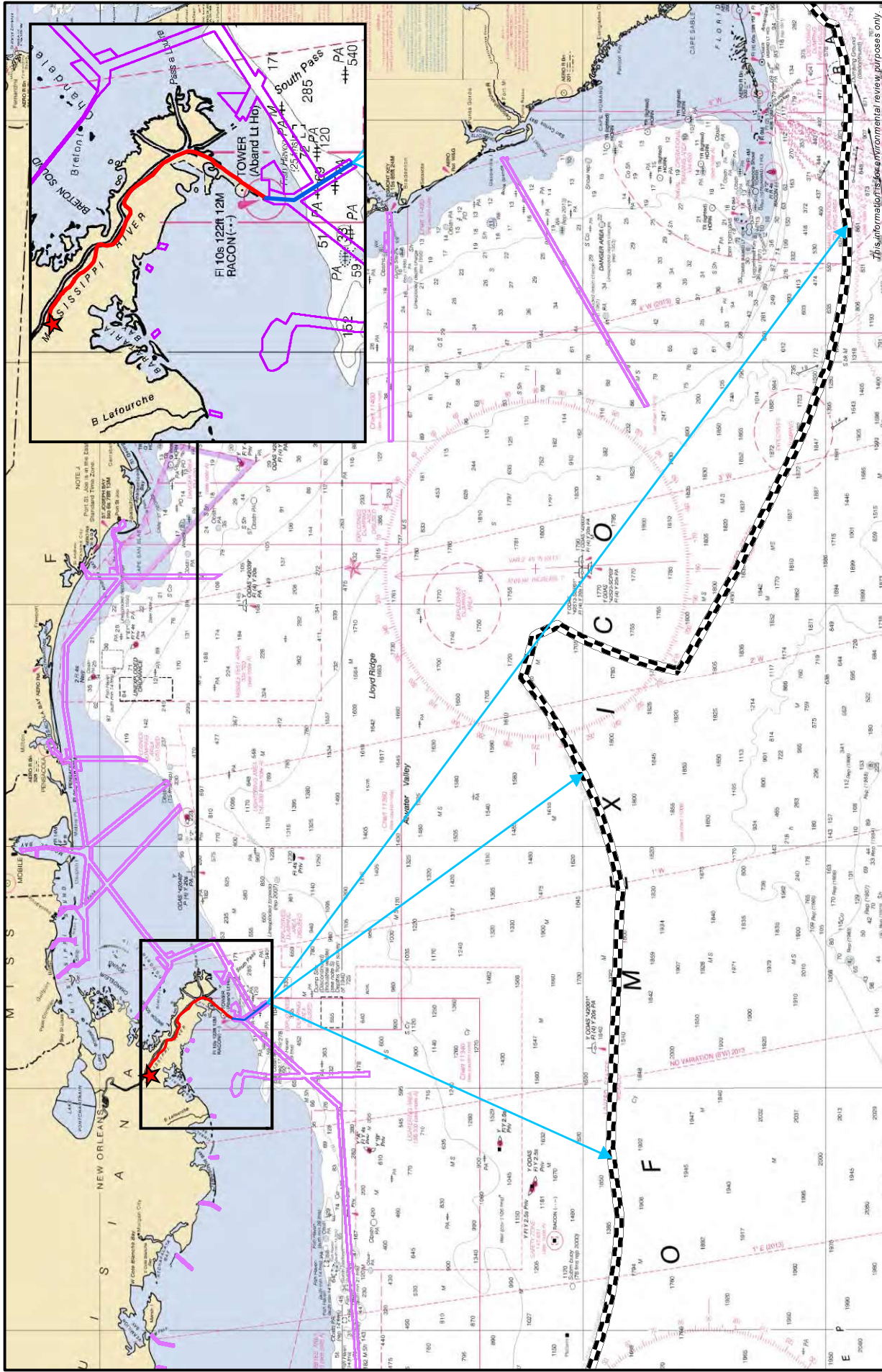
The LNG carriers would access the LNG terminal from the Gulf of Mexico via the Mississippi River. Figure 2.1-3 identifies the U.S. Exclusive Economic Zone; shipping fairways, lanes, and zones; and potential LNG carrier sea routes.

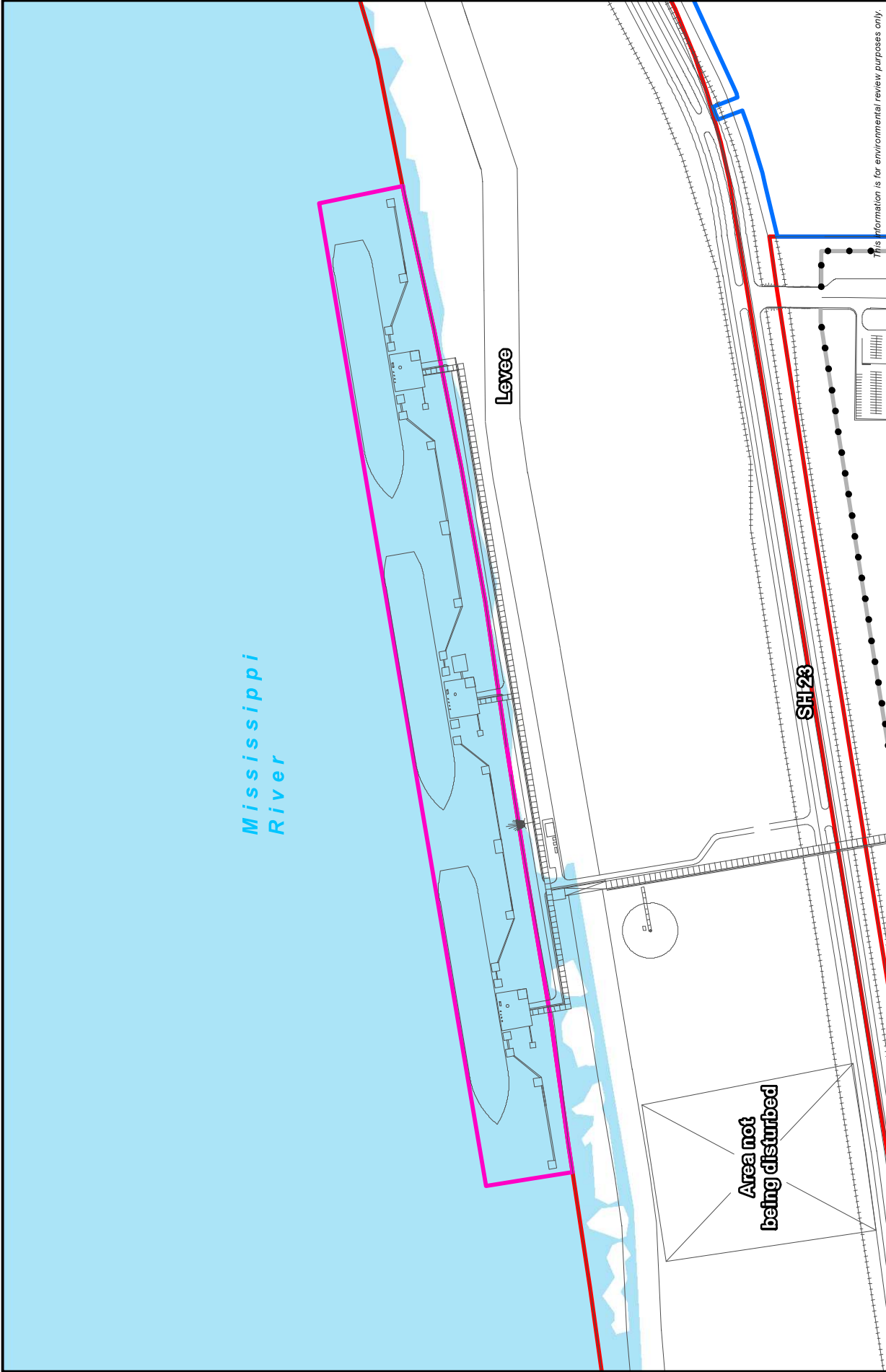
Each LNG loading dock would feature a concrete platform, which would be constructed on steel piles. Each platform would support three marine loading arms and one marine vapor return arm. LNG would be pumped from the LNG tanks through loading arms to ocean-going LNG carriers. The design pumping rate from the LNG storage tanks would be 12,000 cubic meters per hour. The vapor return arm is provided to route displaced/flash gas back to an LNG storage tank. Each loading and vapor return arm would have a powered emergency release coupling. Figure 2.1-4 shows a more detailed view of the marine structures.

2.1.1.5 Flare Stack

A flare stack is a gas combustion device primarily used for burning off flammable gas released by pressure relief valves. The purpose of a pressure relief and flare system is to safely and reliably protect plant systems from overpressure during start-up, shutdown, plant upsets, and emergency conditions. Upset events that require flaring or depressurizing are not planned, and the control system is designed to safely control the gas release and mitigate the air quality impacts of a release. Planned flaring is usually associated with system start-up, planned maintenance and shutdown scenarios, and LNG carrier gas-up/cool-down operations.

Three separate flare structures would be installed at the LNG terminal: a warm/cold flare structure containing two separate flare headers to handle cold relief fluids and wet/warm relief fluids; a low-pressure vent flare structure for low-velocity marine loading; and a marine vapor control structure for LNG carrier gas-up/cool-down operations.





This information is for environmental review purposes only.



- Terminal Site Boundary
- Eastern Workspace
- LNG Loading Docks

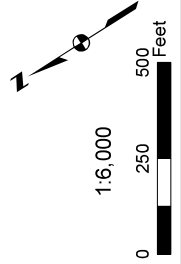


Figure 2.1-4
Proposed Layout of LNG Loading Docks
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana

After initial facility start-up, during which flaring of gas from process cool-down would occur, the LNG terminal is designed to limit flaring events only to LNG carrier gas-up/cool-down, which may occur up to forty times a year. Venture Global does not anticipate any other flaring/venting during normal operating conditions.

2.1.1.6 Power Generation Facilities

During operations, electrical power would be generated on the LNG terminal site by two combined-cycle gas turbine power generation facilities sized to reliably meet the LNG terminal's peak power demand of electricity in total for Phases I and II. A substation and transformer yard would be located near the power generation facilities.

The main power load would be 36 electric motor drivers for compressors in the liquefaction plant consisting of one driver for each of the two liquefaction trains in each of the 18 liquefaction blocks. Other plant loads would include LNG pumps, boil-off gas and boost compressors, and the multiple fan motors that would be used for air cooling during the liquefaction process. The power generation facilities would supply their own auxiliary electric loads, including fans in the air-cooled steam condensers, and would have multiple diesel generators for black start capability. Interconnection to the existing electrical transmission grid would not be necessary for Project operation.

2.1.1.7 Construction Facilities

Temporary Marine Facilities

Venture Global intends to construct three temporary marine delivery facilities for use during Project construction. These temporary marine delivery facilities include the MOF, bulk carrier mooring facility, and barge mooring facility.

The MOF would be located in the Mississippi River, adjacent to the shoreline and east of the LNG loading docks. The MOF would consist of a concrete platform (200 feet x 300 feet) supported by large-diameter steel pilings. The platform elevation would be +15.0 feet North American Vertical Datum of 1988 (NAVD88). The primary use for the facility would be offloading of the LNG modules, power plant components and equipment, and other heavy lift/heavy haul (greater than 50 tons) material and equipment. The MOF would be used during both Phase I and Phase II. Once construction of Phase II is complete, the MOF would be removed, and the impact area would be restored to preconstruction conditions to the extent practicable.

The bulk carrier mooring facility would consist of five mooring piles at the proposed location of the LNG loading dock farthest upstream on the Mississippi River. The primary use of the bulk carrier mooring facility would be docking and unloading of bulk carriers, which would use an onboard conveyor system to offload rock, structural fill, and cement to a receiving hopper located on the channel side of the Mississippi River levee. The material would then be transported across the levee and SH 23 to the LNG terminal construction area by an overhead conveyor system. Mooring of deep-draft bulk carriers would require the use of two moored barges (approximately 250 feet long by 50 feet wide) to serve as spacers between the mooring dolphins and the bulk carriers. The bulk carrier mooring facility would be used during Phase I and then removed before construction of the third LNG loading dock at the same location during Phase II.

The barge mooring facility would consist of six mooring dolphins located on the Mississippi River, approximately 700 feet downstream from the MOF. The primary purpose of the barge mooring facility would be to secure cargo barges (anticipated to be 250 feet long and 52 feet wide) for offloading of piles and other materials by a shore-based crane during construction of the LNG terminal facilities. The materials would be transported by truck from the offloading area to receiving areas on the LNG terminal site. Once construction of Phase II is complete, the barge mooring facility would be removed, and the impact area would be restored to pre-construction conditions to the extent practicable.

Temporary Electric Power

The local electric power provider, Entergy Louisiana, LLC, would provide a utility service connection that would be used to provide electrical power during construction of the LNG terminal. This would be a temporary electric utility connection that would be removed following start-up of the LNG terminal's power plant. The design calls for an approximately 1,500-foot-long interconnect from the existing power line located along SH 23 heading southwest to a temporary construction electrical distribution center within the LNG terminal site. Continued interconnection to the existing electrical transmission grid would not be necessary for Project operation.

2.1.1.8 Support Facilities

Water Supply

Venture Global is evaluating three potential water supply sources for construction and operation, including the following:

- connection to the public water supply;
- treated groundwater from on-site wells; and
- treated surface water from the Mississippi River or other local waterbodies.

Pending discussions with the parish, Venture Global may connect to the Plaquemines Parish Water District's existing water line that is adjacent to SH 23 and install an aboveground pipeline for approximately 1,500 feet to a distribution point at the LNG terminal site. This connection could potentially provide potable water during construction and would possibly be maintained for operational supply. Plaquemines LNG is also evaluating the feasibility of constructing two or more groundwater supply wells that would supply water to the facility through a groundwater treatment system. The water supply system for the LNG terminal, regardless of source, is expected to include some volume of storage capacity in aboveground storage tanks.

During LNG terminal operations, the primary uses of potable water would include water supply for administration buildings, control rooms, and maintenance buildings for potable and sanitary uses and makeup water for the power plant steam system. Potential uses of potable water could include utility hose stations; indoor firewater sprinkler systems; initial fill and makeup for the closed-loop tempered water system, acid gas removal unit, and turbine water wash; and firewater system pressurization.

For firewater system pressurization, Venture Global proposes to use potable water to fill a fresh water storage tank. The firewater jockey pumps would draw from this tank to pressurize the main firewater ring header. Each jockey pump has a rated capacity of 132 gallons per minute. If the firewater jockey pumps cannot maintain firewater header pressure, then the jetty firewater pumps would draw water directly from the Mississippi River. Each jetty firewater pump has a rated capacity of 4,000 gallons per minute.

The sanitary waste system used for LNG terminal operations would include holding tanks on-site, which would be pumped out as necessary to be disposed at licensed facilities.

Safety and Security Communication

The LNG terminal would be designed to minimize the occurrence of events that could result in unsafe conditions and to mitigate potential impacts on the public and facility personnel. Proposed safety systems include the following:

- emergency shutdown (ESD) system – an automated system to prevent escalation of hazards from accidents or equipment failure;
- spill and leak containment and alarm systems for LNG and other hazardous liquids;
- flammable vapor detection systems;
- fire protection systems with:
 - heat detection;
 - ultra-violet radiation detection;
 - smoke detection;
- firewater delivery systems with seawater loop and hydrants; and
- electronic monitoring and emergency messaging systems.

Fire and gas detection systems would provide the means to monitor for and alert operators of hazardous conditions throughout the LNG terminal site resulting from fire, gas leaks, and low temperature LNG spills. The detection of these hazardous conditions would result in local audio and visual (e.g., strobe lights) signals with various alarms and colors, depending on the detected hazard. When appropriate, automatic emergency shutdown of specific equipment and systems would occur and may activate a wider ESD system response. Firewater and fire suppression/extinguishing systems would be provided to protect personnel, the public, and facility equipment in the event of a fire. Lightning arrestors would also be included in facility designs.

The terminal would be surrounded by perimeter fencing, with gated and monitored access, and would have 24-hour surveillance performed using a combination of electronic monitoring and facility personnel, in accordance with all applicable maritime and critical energy infrastructure

safety and security laws. Security features include an intrusion detection system with closed-circuit TV cameras, intrusion monitors, and low-intrusion plant perimeter lighting.

Access Roads

During operation, vehicular access to the LNG terminal site would be via existing local public roadways. Venture Global indicates that access would require improvements such as auxiliary turn lanes along southbound SH 23, new site entrances and exits on SH 23, and required signage and lighting. All improvements would be designed in accordance with the American Association of State Highway and Transportation Officials, “*A Policy on Geometric Design of the Highways and Streets*” per DOTD recommendations.

Buildings

The LNG terminal site would also include the following systems and buildings necessary for the safe and efficient operation of the LNG terminal:

- ship loading control rooms;
- main process and power plant control room;
- administrative offices;
- workshop;
- warehouse; and
- various ancillary equipment buildings and shelters.

Stormwater Drainage and Containment

LNG terminal site preparation activities would be designed to ensure efficient and environmentally protective stormwater drainage. The LNG terminal site would be designed to direct discharges towards perimeter outfalls through a system of ditches and, if necessary, holding basins and filtration devices during construction, allowing sufficient retention time to preclude high sediment loads from reaching receiving waters. Stormwater controls, including placement of gravel or other suitable material to provide a stable, well-drained surface, would be installed. Throughout construction, Venture Global would follow the erosion and sedimentation control procedures described in its Project-specific *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) based, respectively, on FERC’s *Upland Erosion Control, Revegetation, and Maintenance Plan* (FERC, 2013a) and *Wetland and Waterbody Construction and Mitigation Procedures* (FERC, 2013b), and would also follow its construction Stormwater Pollution Prevention Plan (SWPPP).

2.1.1.9 LNG Carriers

The marine facilities would be designed to accommodate LNG carriers with capacities between 120,000 m³ and 185,000 m³. An LNG carrier's transit to the LNG terminal would begin outside the Mississippi River, where a river pilot would board the vessel when it enters the pilot boarding area. The LNG carrier then would travel into the Mississippi River to mile marker 55 arriving at the LNG Terminal. Figure 2.1-3 identifies the U.S. Exclusive Economic Zone; shipping fairways, lanes, and zones; and potential LNG carrier sea routes.

2.1.2 Pipeline System

The pipeline system includes two natural gas pipelines in Plaquemines Parish, Louisiana, the Southwest Lateral TGP and the Southwest Lateral TETCO. These pipelines would connect the LNG terminal to the existing transmission pipeline network and provide feed gas to the liquefaction and power generation facilities. Each pipeline would have a nominal gas supply capability of 1.97 standard bcf/day, which includes a 20 percent contingency over the terminal design case, delivered from TGP's or TETCO's existing pipeline system, assuming a battery limit design pressure of approximately 500 to 900 psig at the gas gate station on the LNG terminal. The major components of the pipeline system are described below.

The Southwest Lateral TGP would consist of approximately 15.1 miles of 42-inch-diameter steel pipeline extending to the LNG terminal from a proposed interconnection with TGP's interstate transmission pipeline system. For the TGP line, approximately 14.4 miles would be concrete coated and 0.7 mile would not be concrete coated.

The Southwest Lateral TETCO would consist of approximately 11.7 miles of 42-inch-diameter steel pipeline extending to the LNG terminal from the proposed interconnection with TETCO's interstate transmission system. For the TETCO line, approximately 11.1 miles would be concrete coated and 0.6 mile would not be concrete coated.

One platform-mounted meter station with a pig launcher and pressure regulating valve would be located in the vicinity of each of the two pipeline interconnections described above for a total of two meter stations for the pipeline system. A gas gate station with pig receivers and pressure regulating valves would be located at the LNG terminal and would interconnect with the two pipelines. It would also include filter/separators, custody transfer meters, emergency shutdown valves, and gas analyzers.

Three mainline valves (MLVs) would be located on the Southwest Lateral TGP, and three MLVs would be located on the Southwest Lateral TETCO. On the Southwest Lateral TGP and the Southwest Lateral TETCO, one MLV would be located at the southwest end of each pipeline's pipe bridge crossing of the non-federal levee southwest of the LNG terminal (figure 2.1-2). A permanent access road that would be approximately 50 feet in length would be constructed to allow access to the MLV from Lake Hermitage Road.

One interconnect valve on the Southwest Lateral TETCO with a pig launcher and pressure regulating valve would be located on the platform-mounted TETCO meter station, which includes an approximately 300-foot-long, 42-inch-diameter pipe section. The valve and pipe section would

connect to the Southwest Lateral TGP, allowing the Southwest Lateral TGP to transport gas from either the existing TGP system or the existing TETCO system at any given time.

One pipe bridge to provide an aerial crossing for the two pipelines would be installed over the non-federal levee southwest of the LNG terminal and northeast of Lake Hermitage Road. All other sections of the pipeline would be installed underground.

During construction, Venture Global would require water access to the construction site for barges and other vessels involved in dredging, pipe laying, equipment and material deliveries, and spoil storage. Regional access to the area would be through the Intracoastal Waterway (ICW), which runs into Barataria Bay about 6 miles northwest of the Southwest Lateral TETCO meter station. From Barataria Bay, northwest access to the pipeline route would be through Wilkinson Canal and Lake Laurier. All barge access to the work area would follow existing waterways, and a majority of the system is sufficiently deep (at least 8 feet) to allow free passage. However, some dredging would be required in four areas, totaling 8.9 miles, to increase the minimum water depth to the required level. Venture Global would undertake this dredging as part of the Project and in accordance with the necessary federal, state, and local permits and approvals.

2.2 LAND REQUIREMENTS

2.2.1 LNG Terminal

The LNG terminal site would occupy an approximately 632-acre property and an adjacent parcel for workspace. The property has been secured by Venture Global pursuant to a lease option agreement that grants Venture Global the exclusive right to lease the LNG terminal site for up to 70 years. The lease agreement was approved by Plaquemines Parish Council on August 13, 2015, and executed by Venture Global and the Port of Plaquemines on August 19, 2015. The LNG terminal site would be utilized for permanent operational facilities. In addition, the majority of infrastructure for the three LNG loading docks and three temporary marine delivery facilities would be constructed and sited in the Mississippi River along the northern edge of the 632-acre property and would constitute an additional 14.6 acres of operational footprint. See figure B-1 in appendix B for workspaces within the terminal site.

For Phase I of the Project, adequate workspace would exist at the LNG terminal site to construct the facilities; however, temporary workspace beyond the LNG terminal site would be needed to support construction during Phase II of the Project. The proposed temporary workspace consists of approximately 80 acres of land along SH 23, east of and adjacent to the LNG terminal site. Venture Global currently has an option to lease this property from the Port of Plaquemines. It shares the same land use characteristics as the LNG terminal site, namely agricultural pasture designated as “fastlands” by the State of Louisiana. Although this temporary workspace is necessary only during construction, it would be permanently impacted by the ground preparation and aggregate overlay needed to allow its use as an equipment storage and laydown area.

Table 2.2-1 provides a summary of the land requirements at the LNG terminal and water-based marine facilities.

Table 2.2-1 Summary of Land Requirements at the Terminal Site^a						
Terminal Component	Land Impacted by Construction (acres)	Land Impacted by Operation (acres)	Water Impacted by Construction (acres)	Water Impacted by Operation (acres)	Total Area Impacted by Construction (acres)	Total Area Impacted by Operation (acres)
Terminal Facilities	534.5	534.5	0.0	0.0	534.5	534.5
Land-Based Marine Facility	7.4	7.4	0.0	0.0	7.4	7.4
Terminal Workspace ^b	13.1	0.0	0.0	0.0	13.1	0.0
Water-Based Marine Facility	3.9	3.9	10.7	10.7	14.6	14.6
Utility Workspace ^c	6.4	0.0	0.0	0.0	6.4	0.0
Eastern Workspace	80.0	80.0	0.0	0.0	80.0	80.0
Marine Workspace	2.8	0.0	69.9	0.0	72.7	0.0
	648.1	625.8	80.6	10.7	728.7	636.5
^a Does not include undisturbed land (77.0 acres) at the LNG terminal site. ^b Terminal workspace includes areas along the federal levee where workspace for the crossing of the levee would be required. ^c Temporary terminal workspace includes areas located along SH 23 currently used for utilities.						

2.2.2 Pipeline System

Venture Global would construct its pipeline system using either a barge lay, push lay, or conventional lay method. In the areas that require installation by barge lay, Venture Global would require a 300-foot-wide construction right-of-way (temporary right-of-way plus permanent easement).

During the draft EIS comment period, the LDWF recommended that the temporary rights-of-way not exceed 75 feet and permanent rights-of-way not exceed 30 feet in wetlands. However, wider rights-of-way are necessary for this Project given the large diameter pipeline (42-inch-diameter pipeline with a 6-inch-thick concrete coating), the unconsolidated soils along the pipeline route, and the need for sufficient space to store spoil during trench excavations used for later restoration. In areas where the push method is used to install the pipeline, including in wetlands, a 130-foot-wide construction right-of-way is necessary due to the need for a relatively wide and deep trench to ensure the required depth of cover and containment of the sidecast spoil. In areas where the barge lay method is used to install the pipeline in open waters, a 300-foot-wide construction right-of-way would be required to accommodate an approximately 100-foot-wide flotation channel for lay barge and supply barge access, and up to about 100 feet on either side of the flotation channel for construction workspace to deposit sidecast trench material. The permanent operational easement width of 80 feet (where the two pipelines are collocated) reflects the necessary access rights for inspection and maintenance during pipeline operation. Following workspace restoration in wetlands, only 60 feet of this 80-foot width would be subject to any

further disturbance through potential periodic vegetation maintenance (i.e., a 30-foot-wide corridor centered over each pipeline). Of this, only a 10-foot-wide corridor centered on each pipeline would be subject to the level of clearing necessary to ensure a continued herbaceous state to facilitate aerial surveys of the pipeline corridor for safety purposes. The land requirements for the pipeline system and its aboveground facilities are shown in table 2.2-2.

The use of temporary workspaces is required to safely cross atypical features, such as wetlands, waterbodies, existing utilities, and road crossings. Temporary workspaces are used on either side of these crossings, typically not in wetlands or waterbodies, and are used to stage equipment and supplies and segregate topsoil or muck because workspaces are often a reduced width within an actual road, utility, or sensitive environmental resource crossing.

Table 2.2-2 Summary of Land Requirements for the Pipeline System and its Aboveground Facilities		
Facility	Area Impacted by Construction (acres)	Area Impacted by Operation (acres)
Southwest Lateral TGP (Phase I)^{c,d}		
Pipeline Facilities	447.7 ^a	128.0 ^b
Aboveground Facilities (meter stations and MLVs)	71.8	9.3
Additional Temporary Workspace ^c	46.4	0.0
Access Roads	0.7	<0.1
Barge Access Channels ^d	322.6	0.0
Southwest Lateral TGP Total	889.2^d	137.3^d
Southwest Lateral TETCO (Phase II)^{e,f}		
Pipeline Facilities	64.7 ^a	0.0 ^c
Aboveground Facilities (meter stations and MLVs)	0.0	0.0
Additional Temporary Workspace	0.0	0.0
Access Roads	0.0	0.0
Barge Access Channels ^e	0.0	0.0
Southwest Lateral TETCO Total	64.7	0.0
Overall Pipeline System Total	953.9	137.3
a No construction workspace is required at horizontal directional drill (HDD) segments except for HDD entry and exit points and HDD pull-back areas (both addressed as additional temporary workspace [ATWS]). No construction workspace is required for pipeline facilities at pipeline trestle crossings except for trestle construction and trestle supports (both addressed as ATWS and aboveground facilities, respectively). b Calculated on the basis of a 50-foot-wide (Southwest Lateral TGP) and 80-foot-wide (Southwest Lateral TGP collocated with Southwest Lateral TETCO) permanent easement. c Excludes 62.5 acres of temporary workspace associated with meter stations which is included within stated aboveground facilities impacts. d Acreage totals include temporary dredging and dredge spoil placement impacts for channels providing worksite access for construction barges and support vessels. e To the extent that the temporary rights-of-way and workspace for the Southwest Lateral TETCO and Southwest Lateral TGP are shared, the overlapping acreage is included in the Southwest Lateral TGP and Southwest Lateral TETCO (Phase I) total and excluded from the Southwest Lateral TETCO (Phase II) total. f To the extent that the permanent easements for the Southwest Lateral TETCO and Southwest Lateral TGP are shared, the overlapping acreage is included in the Southwest Lateral TGP and Southwest Lateral TETCO (Phase I) total and excluded from the Southwest Lateral TETCO (Phase II) total.		

Venture Global is not planning to use pipe yards. Instead, Venture Global would receive pipe joints at the workspaces that have been transported from the pipe-coating yard by truck for upland and HDD construction, and transported by lay barge for open water and wetland pull sections.

Venture Global would require one temporary and one permanent access road for the pipeline system. Additionally, Venture Global would require barge access to the pipeline system. Venture Global would utilize existing channels for barge access; however, three areas would require deepening to accommodate construction vessels. See table 2.2-2 for land requirements for these Project components.

2.3 CONSTRUCTION SCHEDULE

Construction of the Phase I facilities is anticipated to last for approximately 35 months. Construction of the Phase II facilities is anticipated to commence approximately 12 months after construction of the Phase I facilities is initiated and is scheduled to also last for 35 months, in which case the Project would be fully complete and operational by 2023. The Southwest Lateral TGP and would be constructed concurrently with the LNG terminal's Phase I facilities; the Southwest Lateral TETCO would be constructed concurrently with the LNG terminal's Phase II facilities.

Each phase of the LNG terminal's construction would require an average 1,400 workers and up to 2,200 workers during a 6-month peak. The number of workers on-site would typically be higher during the 23 months of terminal construction phase overlap. During this 23-month period, the total number of workers at the terminal site could range from 1,500 to 3,600, and would average approximately 3,000 workers during the overlapping period.

The average workforce for each phase of construction is estimated to be 1,400 workers, which would overlap for a period of approximately 12 months, during which the average combined on-site workforce would be approximately 2,800 workers.

Construction of the pipeline system would require fewer workers than the LNG terminal and for a shorter duration. As discussed in section 1.5.2.3, the Southwest Lateral TGP and a 0.7-mile-long segment of the Southwest Lateral TETCO would be constructed during Phase I; the remaining 11.0 miles of the Southwest Lateral TETCO would be constructed during Phase II. For both Phases I and II, estimates for pipeline construction include approximately 150 workers at the beginning of construction to stake and prepare the work areas. Following the initial period, construction activity would gradually increase to a peak of about 500 workers for a one-month period and then gradually decrease as installation of the pipelines near completion. See Section 4.9, Socioeconomics, for further details regarding construction workforces.

2.4 ENVIRONMENTAL COMPLIANCE

FERC may impose conditions on any Certificate or authorization it grants for the Project. These conditions generally include additional requirements and mitigation measures recommended in this EIS to minimize the environmental impact that would result from construction and operation of the facilities (see sections 4 and 5). We will recommend that these additional requirements and mitigation measures (bold type in the text of the EIS) be included as

specific conditions to any approving Certificate or authorization issued for the Project. We will also recommend to the Commission that Venture Global be required to implement the mitigation measures proposed as part of the Project unless specifically modified by other Certificate or authorization conditions.

2.4.1 Environmental Inspection

Venture Global would be represented during construction by an environmental compliance manager, hired by and reporting to Venture Global, who would have overall authority for quality assurance and compliance with mitigation measures, other applicable regulatory requirements, and company specifications. The environmental compliance manager would be assisted by lead Environmental Inspectors (EIs), who would report directly to the manager. Venture Global would employ two to four EIs per construction spread based on the environmental and/or cultural resources present on each spread. The EIs would be on-site during active construction and would have peer status with all other activity inspectors.

The EI, as well as all Project contractors and company personnel, would have authority to stop construction activities that violate the measures set forth in the documents and permit authorizations for the Project. The environmental inspection program weekly reports would be sent to FERC for review and placed into the public record.

The EIs' duties are described in detail in Venture Global's Plan (see appendix B). At a minimum, the EI would be responsible for the following:

- identifying, documenting, and overseeing corrective actions as necessary to bring an activity back into compliance;
- verifying that the limits of authorized construction work areas and locations of access roads are properly marked before clearing and maintained throughout construction;
- verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;
- identifying erosion/sediment control and stabilization needs in all areas;
- locating dewatering structures and slope breakers to ensure they would not direct water into sensitive areas such as known cultural resource sites, wetlands, waterbodies, and sensitive species habitats;
- verifying that trench dewatering activities do not result in the deposition of sand, silt, and/or sediment near the point of discharge in a wetland or waterbody. If such deposition is occurring, the EI would stop the dewatering activity and take corrective action to prevent a reoccurrence;

- advising the environmental compliance manager and/or Chief Construction Inspector when conditions (such as wet weather) make it advisable to restrict construction activities to avoid excessive rutting, topsoil/subsoil mixing, or excessive compaction;
- approving imported soils and verifying that the soil is certified free of noxious weeds and soil pests, unless otherwise specified by the landowner;
- ensuring that erosion controls are properly installed, as necessary, to prevent sediment flow into wetlands, waterbodies, sensitive areas, and onto roads;
- inspecting and ensuring the maintenance of temporary erosion control measures at least daily in areas of active construction or equipment operation, on a weekly basis in areas with no construction or equipment operation, and within 24 hours of each 0.5 inch or greater of rainfall;
- ensuring restoration of contours and topsoil;
- ensuring the repair of all ineffective temporary erosion control measures as soon as possible but not longer than 24 hours after identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts;
- keeping records of compliance with conditions of all environmental permits and approvals during active construction and restoration; and
- identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase.

Additional inspection requirements would be included pending Venture Global's compliance with other permits, certifications, and approvals as shown in table 1.5-1 in section 1.5.

2.4.2 Compliance Monitoring

Venture Global would review Project-specific environmental conditions with prospective contractors during pre-bid meetings and would incorporate such conditions into construction bid documents. Contractors would be obligated to comply with all environmental conditions in the Project's permits. Venture Global would require that all contractors develop and train their construction workers in spill prevention and cleanup, waste management, and incident managing and reporting to support environmental compliance during construction.

For purposes of quality assurance and to support regulatory compliance, Venture Global would be represented by one chief inspector for the LNG terminal site and one chief inspector for the pipeline system. One or more craft inspectors and one or more EIs would assist each chief inspector. In addition, craft inspectors would be used for inspection services at manufacturing and fabrication facilities handling process modules, equipment, and piping prior to delivery to the LNG terminal site. All inspectors would have access to the compliance specifications and other relevant material contained in the construction contracts.

FERC would also conduct field inspections during construction. Other federal and state agencies may also conduct oversight or inspection to the extent determined necessary by the individual agency. After construction, FERC would continue to conduct oversight inspection and monitoring during operation of the Project to ensure successful restoration. Additionally, FERC staff would conduct operations inspections of the LNG facility throughout its entire life.

2.4.3 Environmental Training

Venture Global would implement a training program designed to meet regulatory requirements and to ensure all individuals receive training tailored to their particular role before beginning on-site work. The program would also ensure that adequate training records are maintained and refresher training is provided as needed.

2.5 CONSTRUCTION PROCEDURES

This section describes the general procedures proposed by Venture Global for construction activities at the LNG terminal and pipeline system. Refer to section 4 for more detailed discussions of proposed construction and restoration procedures, as well as additional measures that we are recommending to avoid or reduce environmental impacts.

The Project must be constructed in accordance with DOT/PHMSA Federal Safety Standards for LNG Facilities (49 CFR 193) and the incorporated NFPA 59A (2001), “Standard for the Production, Storage and Handling of LNG” and would be in compliance with National Electrical Code (NFPA 70) and applicable sections of the USCG’s regulations for Waterfront Facilities Handling LNG (33 CFR 127 and Executive Order 10173). Specifically for the pipeline system, safety requirements are embodied in, but are not limited to, the DOT/PHMSA regulations in 49 CFR Part 192 and the LDNR Office of Conservation pipeline safety regulations found in Louisiana Administrative Code (LAC) 43:XIII.

Venture Global developed a Project-specific Plan and Procedures based, respectively, on FERC’s Plan (FERC, 2013a) and Procedures (FERC, 2013b), which are available on the FERC website at <http://www.ferc.gov/industries/gas/enviro/guidelines.asp>. Implementation of the Project-specific Plan and Procedures during construction and post-construction monitoring would help ensure that ground disturbance and restoration activities are implemented in an environmentally appropriate manner. See appendix C for the Project-specific Plan and Procedures and Venture Global’s proposed modifications to the FERC Plan and FERC Procedures.

During construction, some potential exists for spills of hazardous materials, such as hydraulic fluid and diesel fuel for equipment and vehicles. In addition, stormwater runoff from the construction workspace could carry unconfined debris and materials. To address these and related concerns for the LNG terminal site, Venture Global has developed and would adhere to a construction-specific Spill Prevention, Controls, and Countermeasures (SPCC) Plan and a SWPPP; likewise, the pipeline system has developed a comparable construction-specific SPCC Plan and SWPPP.

The LNG terminal and pipeline system would be required to implement all conditions in the Certificate or authorization issued by the Commission for the Project. Venture Global would

implement the Project-specific Plan and Procedures developed to avoid or minimize environmental impacts during construction, which are discussed throughout this EIS.

2.5.1 LNG Terminal

Construction activities at the Project site would involve clearing and grading, placement of fill, installation of foundations for the planned Project facilities, other equipment settings, ancillary equipment, piping, and structures. Construction operating hours would be from 7:00 a.m. to 7:00 p.m., Monday through Saturday. Land-based and marine-side pile driving construction activity, is expected to also occur 6 days per week starting at 7:00 a.m., as well, but would end at 5:00 p.m. It is anticipated that the Project would require nighttime construction at the terminal site during the initial 6 to 12 months.

2.5.1.1 Site Preparation

The LNG terminal site would require significant area-wide improvements, including clearing, grubbing, grading, soil stabilization, and filling to increase ground elevation, some of which must be performed prior to foundation development and plant construction. Existing ground elevations at the LNG terminal site range from -2 and -4 feet (NAVD88) and would be leveled to an elevation of -2 feet (NAVD88) by grading and import of fill materials. It is anticipated that the existing soil at the LNG terminal site may require improvement and stabilization to provide a load-bearing surface during construction. Venture Global would employ commonly used stabilizers such as crushed stone, sand, portland cement, and/or hydrated lime while aggregate materials (e.g., gravel, oyster shell, and/or crushed stone) and geotextile layers would be used to level and finish temporary workspace and operational areas, as necessary. Initially, aggregate materials would be delivered to the LNG terminal site by truck to construct access roads and the crane pad for the barge mooring facility. Following installation of three temporary marine delivery facilities, aggregate materials would arrive by barge, bulk carrier, and truck.

Venture Global would install a floodwall around the portion of the LNG terminal site south of SH 23 to protect it from storm surge during construction and operations. At the outset of construction, Venture Global would install a temporary facility area interior to the floodwall at the LNG terminal site, which would include mobile offices, sanitary facilities, and a parking area. This would support preliminary construction activities, which include access road construction, preliminary site preparation, initial construction of the floodwall, a pile test program, and development of the three temporary marine transfer facilities. Once these temporary facilities are established, the overall workspace would be expanded to include additional laydown areas for construction.

2.5.1.2 Terminal Site

Following site grading, soil stabilization, and road installation, LNG tank foundation construction and floodwall installation would commence with the installation of piles. After the pile locations have been determined, precast or steel piles would be installed by vibratory or hammer methods; cast-in-place piles would be installed in pre-drilled holes. After the piles have been installed to design depths, caps would be constructed. Precast or steel piles would be

delivered to the site by barge and/or truck. Concrete for cast-in-place concrete piles would be supplied by one or more on-site concrete batch plants.

The liquefaction trains would be connected with the gas gate station and LNG storage tanks by aboveground piping interconnects on steel-framed support racks. Pipe spool fabrication would be undertaken mainly off-site. Spools fabricated off-site would be delivered by truck and barge. Where possible, pipe racks would be modularized to minimize site work. Pipe sections would be painted, coated, and insulated, as necessary, after welds have been tested according to applicable codes.

Process modules such as pretreatment systems, liquefaction cold-boxes, and refrigerant compressors would be delivered by barge or truck. All equipment units necessary for the Project would be constructed at existing commercial facilities, while larger modular units would be barged to the LNG terminal MOF to be placed on their respective foundations.

Once foundations have been completed, work on the liquefaction blocks, piping interconnects, and associated utility systems can occur within the same general timeframe, but would be coordinated such that various inter-dependent systems (e.g., electrical and instrumentation) can be installed and tested according to an appropriately sequenced schedule. After the equipment and piping have been set in place, cable systems would be installed. Ultimately, road finish, final site grading, seeding, and cleanup would be completed. Temporary construction facilities would be disassembled and removed on a progressive basis when they are no longer needed. Pipe sections would be either hydrostatically or pneumatically tested, depending on the type and intended function of the pipe.

2.5.1.3 Marine Facilities

Venture Global does not anticipate that dredging would be required for installation of the three LNG loading docks or for LNG carriers to operate in the berthing area. Three LNG loading docks would be constructed in a collective berthing area and be supported by steel piles. The loading docks would be constructed of concrete decking with a hydraulic gangway, lighting, control buildings, and cathodic protection. The LNG liquid loading arms, which would be located on the concrete decks, would be fully balanced in the empty condition by a counterweight system and maneuvered by hydraulic cylinder drives.

The construction plan for the LNG loading docks and associated structures (cryogenic piping, utility lines, and piping/utility line trestle) to cross the federal levee and SH 23 would be developed in consultation with the USACE, DOT/PHMSA and DOTD.

2.5.1.4 Piping and Equipment Installation and Testing

All pipe would be fabricated according to American Society of Mechanical Engineers (ASME) standards by ASME section IX qualified welders. Once process equipment is set in place on the foundations, roughly aligned, and secured to the foundations, pipe installation would begin. Venture Global would coat all piping and equipment with a material that resists corrosion. When all process equipment is installed and electrical, mechanical, and other instrumentation work completed, the key pre-commissioning activities would commence.

After all pre-commissioning activities are complete, Venture Global would clean and hydrostatically or pneumatically test piping in compliance with the applicable codes that govern pipe design, and purge the piping. In general, Venture Global would pneumatically test cryogenic piping using dry air or nitrogen and hydrostatically test non-cryogenic piping using clean water. All testing would be performed in accordance with ASME B31.3.

2.5.2 Pipeline System

The applicant would construct the pipeline system and associated facilities as described in this section and in accordance with 49 CFR 192 and LDNR safety regulations (LAC 43:XIII). The pipelines and associated appurtenances would be coated below grade with fusion-bonded epoxy, field-applied sleeves, or an equivalent protective coating and painted above grade; in some areas, the pipeline may be coated with a layer of abrasive resistant coating over the fusion-bonded epoxy. Additional cathodic protection systems must be installed in accordance with applicable DOT and LDNR safety regulations. The pipeline sections in water-saturated or inundated areas would be coated with a 6-inch-thick layer of concrete over the fusion-bonded epoxy, providing negative buoyancy to counteract the tendency of the pipeline to float. All pipe welds would be coated and applied in the field. Venture Global would not conduct concrete coating in the field.

2.5.2.1 Surveying and Easement Acquisition

Prior to initiating construction-related activities, Venture Global would survey the route and secure right-of-way easements from the appropriate landowners. The limits of construction would be clearly marked in the field with various color-coded flagging to represent temporary easement, centerlines, workspaces, environmentally sensitive features, etc. Venture Global would notify landowners in advance of construction activities that could affect their property or business. All landowners have granted Venture Global permission to conduct environmental and engineering surveys.

2.5.2.2 General Construction Procedures

Venture Global would construct the Southwest Lateral TGP during Phase I of the Project. Additionally, to minimize construction disturbance in the area between Southwest Lateral TGP milepost (MP) 14.3 and MP 15.1, the corresponding collocated segment of Southwest Lateral TETCO (MP 11.0 to MP 11.7), would be installed concurrently in Phase I. The remainder of Southwest Lateral TETCO would be constructed in Phase II. Southwest Lateral TETCO would be installed adjacent to Southwest Lateral TGP with 50 feet of separation between the two pipelines. An 80-foot-wide permanent easement would be retained where the two pipelines are collocated.

Five installation methods would be used during construction of the two lateral pipelines: conventional lay, barge lay, push lay, horizontal directional drill (HDD) lay, and bore lay. In addition, Venture Global would construct a pipe bridge to cross the non-federal levee located north of Lake Hermitage Road.

2.5.2.3 Conventional Lay Construction

Pipeline construction using conventional techniques typically involves the following sequential activities: clearing; trenching; stringing, welding, and installation; backfilling and grade restoration; hydrostatic testing and tie-ins; and cleanup and restoration. Venture Global proposes to use conventional lay techniques in upland, non-saturated soil locations. The construction work area would be cleared to remove trees, rocks, brush, and roots, and then leveled to allow operation of construction equipment. Trenching involves excavating a pipeline ditch and would be accomplished with backhoes and/or similar excavation machinery. The trench would be excavated to a sufficient depth to allow a minimum of 3 feet of cover over the pipeline. The 42-inch pipe would require a minimum trench depth of 10 feet in order to allow 3 feet of cover. The bottom width of the trench would be cut to accommodate the pipe to be installed. Stringing trucks would lay, or string, the individual pipe sections on temporary supports (skids) along the working side of the trench in preparation for subsequent welding, joint coating, lowering-in, backfilling, and associated inspection activities. After the pipe is lowered into the trench, the trench would be backfilled with previously excavated material. After the completion of backfilling all disturbed areas would be graded, erosion controls installed, and restoration completed.

2.5.2.4 Barge Lay Construction

The barge lay method would be required for pipeline sections located in deeper water or channels as it eliminates the need for land-based equipment and fill. In open waters, the pipeline would be installed using shallow-draft spud barges. The use of spud barges² in open waters would require the excavation of a flotation channel within a 300-foot-wide construction right-of-way. Using barges with anchor spuds eliminates the need for an anchor spread and anchor-handling boats, minimizing the area affected by construction operations.

The right-of-way centerline and boundaries would be staked with poles or floating buoys ahead of excavation. The pipeline trench would be excavated using a barge-mounted clam-bucket (or equal) dredge. Within the construction right-of-way, it is anticipated that the dredge barge would first excavate the flotation channel (where necessary) and then excavate the pipe trench along the bottom of the flotation channel. The dredge barge would cast the flotation channel and sidecast spoil to either side of the right-of-way centerline, keeping the spoil below the water surface, where feasible, to minimize wave generated turbidity. The spoil piles would be placed parallel to the trench in 500-foot in lengths, with 50-foot-wide openings to allow the passage of local watercraft.

The pipeline would be fabricated aboard a string of shallow-draft spud barges, connected together in a line to form the lay barge. The pipe would first be offloaded from tugboat-towed supply barges and then each pipe joint would then be aligned end-to-end with the previous joint. The pipe joints would be assembled into one continuous pipeline by passing through multiple welding, inspection, repair, and coating stations. To ensure that the assembled pipe meets or exceeds the design strength requirements, the welds would be visually inspected and examined using radiography (X-ray), ultrasound, or other approved methods, in accordance with ASME

² A spud barge is a form of barge that can be moored through the use of through-deck pilings, known as spuds. Spuds may be fabricated or made of commercially available pipe sections or logs.

standards. Once each weld has passed inspection and received its final coating, the pipe would be lowered off the back end of the lay barge into the pipe trench by lifting the anchor spuds of the lay barge and moving the lay barge forward the length of one pipe joint. The next pipe joint would be rolled into position for welding and the process would be repeated.

From MP 8.1 to 8.5 (Southwest Lateral TGP) and MP 5.6 to 6.0 (Southwest Lateral TETCO), which represents a relatively short crossing of marshland between two large bodies of open water (Upper Wilkinson Bay and Raquette Bay), Venture Global proposes to use the barge lay method as this marsh area is too saturated to support equipment required to install the pipe via push lay. To minimize disturbance in this area of open water, Venture Global would stockpile the estimated 89,500 cubic yards of spoil generated by trench excavation on several barges within the southern body of open water (Upper Wilkinson Bay). Instead of side-casting on the construction right-of-way, Venture Global intends to load the material barges and temporarily moor the barges in the barge staging area. The barge staging area was selected as it is the closest location in which the open water was deep enough to accommodate the barges without requiring more excavation. Venture Global would utilize the barge staging area for approximately 30 days during each phase of construction.

2.5.2.5 Push Lay

For the push method, a 130-foot-wide construction right-of-way with a 30-foot-wide trench width would be required. Push lay techniques are typically used in saturated areas where soil stability is efficient to support a trench and construction equipment. Trench spoil bank heights are anticipated to be relatively low because the excavated material lacks adequate unconfined compressive strength. To accommodate the trench spoil placement storage, the need for two spoil banks parallel to the push ditch is anticipated. A 50-foot-wide area would be required on both sides of the push ditch for spoil banks, equipment travel, and reasonable buffer gaps. Thus, the push construction technique would require a 130-foot-wide construction right-of-way due to the combination of the 30-foot-wide push ditch and the two 50-foot-wide areas for spoil banks, equipment travel, and reasonable buffer gaps between the edges of the right-of-way, spoil banks, and ditch.

Push sites in open-water areas would consist of several shallow-draft spud barges connected together to provide a working platform. At the push site, various pipeline operations would take place, including pipe make-up, welding, non-destructive testing, joint coating and coating repairs, and installation of flotation apparatus. Where there is standing water, only enough clearing and trenching would be done to accommodate installation of the pipe. Each excavator used would have a lateral reach sufficient to place spoil within the 130-foot-wide construction right-of-way. Pipe stringing and lowering in the push lay method would be similar to that described in the conventional lay method.

2.5.2.6 HDD Lay

The HDD method is a trenchless method for installing underground pipe and is used to avoid direct impacts on sensitive resources (e.g., waterbodies, wetlands) or infrastructure (e.g., major roads, railroads). This method entails drilling relatively deep beneath the surface features

on a curved path. This method requires specialized equipment and personnel and has four general steps:

1. placement of guide wires over the anticipated path of the drill;
2. drilling a pilot hole on an arc-shaped path that typically extends between 30 and 50 feet beneath the waterbody or other sensitive feature;
3. enlarging the pilot hole with a series of reamers to accommodate the pipeline; and
4. pulling a pre-fabricated section of pipe through the hole.

The HDD method involves an entry and exit pad on each side of the crossing. The initial step of placing HDD guide wires over the path of the drill may require minor hand clearing. A pilot hole is drilled under the feature. The head of the pilot drill string contains a pivoting head that can be controlled by an operator as the drill progresses. Typically, the pilot hole would be directed downward at an angle until the proper depth is achieved, then turned and directed horizontally for the required distance, and finally angled upward back to the surface. Throughout the process of drilling and enlarging the hole, mud slurry, consisting of bentonite and water, would be pressurized and pumped through the drill stem to lubricate the drill bit, maintain the hole, and remove drill cuttings. Bentonite is the commercial name for a nontoxic mixture of naturally-occurring clays and rock particles. This slurry, referred to as drilling mud or drilling fluid, has the potential to be inadvertently released to the surface if fractures or fissures are encountered in the substrate during drilling.

The potential for an inadvertent release is generally greatest during drilling of the pilot hole when the pressurized drilling mud is seeking the path of least resistance and near the drill entry or exit pits where the drills are at their shallowest depths. The path of least resistance is typically back along the path of the drilled pilot hole. However, if the drill path becomes temporarily blocked or encounters areas such as large fractures or fissures that lead to the ground, then an inadvertent release could occur. Venture Global developed a site-specific HDD plan for each drill site and an HDD Contingency Plan to monitor for, contain, and clean up any inadvertent releases of drilling fluid during HDD operations. The HDD Contingency Plan is included in appendix D and would be utilized to:

- provide procedures that will minimize the potential for release of drilling mud into sensitive resource areas, such as wetlands and waterbodies, or onto adjacent upland surfaces;
- provide for timely detection of inadvertent returns;
- ensure the implementation of an organized, timely, and “minimum impact” response in the event an inadvertent return of drilling fluid occurs;
- ensure that all appropriate notifications are made in a timely manner;
- provide for an alternative plan in case of drill failure; and

- establish the criteria by which Venture Global will determine when a proposed HDD crossing is unsuccessful and must be abandoned.

Venture Global would install one 0.4-mile-long segment of pipe using the HDD method for each of the two pipelines. Both drill segments would be at the same route location, extending into the LNG terminal from just north of the pipe bridge crossing of the non-federal levee north of Lake Hermitage Road (MP 14.6 to MP 15.0 for the Southwest Lateral TGP, and MP 11.2 to 11.6 for the Southwest Lateral TETCO). Both HDDs would be undertaken during Phase I construction. Additional information on the related geotechnical investigations is presented in section 4.1.1.

2.5.2.7 Bore Lay

The bore method is a process that allows for trenchless installation by drilling a horizontal tunnel beneath a surface feature, such as road or utility, and installing a prefabricated segment of pipeline through the hole. Similar to the HDD method, throughout the boring process, a fluid mixture consisting of water and bentonite clay (a naturally occurring mineral) is pumped into the drill hole to lubricate the bit, transport cuttings to the surface, and maintain the integrity of the hole during installation of the prefabricated segment.

If a bore installation is successful, there is little to no impact on the surface feature being crossed. However, if a natural fracture or weak area in the ground is encountered during drilling, an inadvertent return of drilling fluid to the environment could occur. Venture Global's HDD Contingency Plan (appendix D) would also be applicable to bore construction methods and would outline the procedures that would be followed to minimize the potential for an inadvertent release of drilling mud and to undertake effective cleanup should a release occur.

2.5.2.8 Aboveground Facility Construction Procedures

Two meter stations are required for the pipeline system. Each meter station would be located in an open-water area; therefore, traditional site preparation, including clearing, grading, and compacting, would not occur. Construction would include the placement of a platform on installation piles. The meter stations would be constructed atop these platforms.

All components in high-pressure natural gas service would be pressure tested prior to arrival or on site, and all controls and safety equipment and systems, emergency shutdown, relief valves, and gas measurement and control equipment would be commissioned prior to being placed in service.

2.5.3 Access Roads

During construction, vehicular access to the LNG terminal site would be via existing local public roadways. Venture Global does not anticipate that such access would require any improvements to these roadways, with the exception of new auxiliary turn lanes along southbound SH 23, new site entrances/exits on SH 23, and signage and lighting as required by DOTD.

Venture Global would construct one permanent access road to the two MLVs just west of Lake Hermitage Road and one temporary access road to the pipe bridge area just east of Lake

Hermitage Road. Both access roads would be used during construction, and the permanent access road would also be used during operation.

2.5.4 Pipe Storage and Contractor Yard

Venture Global is not planning to use pipe yards. Instead, Venture Global would receive pipe joints from the pipe-coating yard transported to the workspaces by truck for upland and HDD construction, and transported by lay barge for open water and wetland pull sections. The LNG terminal site would not require any additional pipe storage yards beyond the site's own limits of construction.

2.5.5 Special Construction Procedures

2.5.5.1 Levee Crossing Construction Procedures

On the pipeline system, Venture Global plans to use a pipe bridge to cross the non-federal levee and adjacent canal south of the LNG terminal site. For the pipe bridge crossing, the construction process includes piling, pile cap installation, crane erection, setting vertical and horizontal bridge assemblies, and piping installation. Installation of the piles would be completed at the base of each bridge vertical assembly. Precast, steel, cast in-place, or concrete-driven piles would be installed by either a ground-supported rig, a marsh buggy-supported rig, or a barge-supported rig. The piles would be driven or constructed to meet the design capacity and would be tested to verify vertical and horizontal capacity of the piles in each group of piles. The concrete foundation would be poured as a pile cap around the top of the trimmed piles to create a fixed connection between the cap and the piles.

The bridge components would be trucked to the site in 20-foot to 130-foot-long preassembled section lengths. The bridge vertical components would be set on the pile caps and would support the horizontal components on top of the vertical components. All field connections are planned to be bolted connections to reduce the amount of field labor, amount of equipment that is required on site, and impact on the temporary workspace. The pipeline would be supported on the bridge by temporary rollers during installation. The final pipe supports would be installed as adjustable supports with clamping straps to allow axial thermal growth while resisting movement due to wind and seismic loading. The piping would be transitioned from the top of the bridge through piggable induction bends and connected to below-grade piping near the ends of the bridge work area.

2.5.5.2 Wetland and Waterbody Construction Procedures

Crossings of waterbodies and wetlands would be undertaken in accordance with the Project-specific Procedures. Because the Project involves use of the push method or barge lay method for installation of large-diameter pipelines, Venture Global proposes to use construction right-of-way widths greater than 75 feet, as described below.

In general, FERC requires wetland crossings to be accomplished using a maximum right-of-way width of 75 feet. Venture Global states in its application that this is not possible on this Project. The route for the Southwest laterals is located in a region where consolidated soils comprise less than 3 percent of the routes. Therefore, Venture Global's implementation of the

push method is designed to minimize impacts on the vegetated wetland areas but does require workspaces greater than 75 feet wide.

Given the poor cohesion and expected high water content/saturation of the wetland soils along the route, Venture Global anticipates that the top-of-trench width would be a minimum of 30 feet and up to 50 feet to accommodate sloughing and resultant shallow side slopes. Further, because the material excavated from the trench would lack cohesion, the spoil banks are anticipated to be relatively low in height (approximately 3 feet) and wide (approximately 45 feet).

2.5.5.3 HDD Construction

The HDD method is a trenchless crossing method used to avoid direct impacts on sensitive resources (e.g., waterbodies, wetlands) or infrastructure (e.g., major roads, railroads) by conducting a deep bore beneath them. This method, described above in section 2.5.2.6, requires specialized equipment and personnel.

Venture Global would install one 0.4-mile-long segment of pipe using the HDD method for each of the two pipelines. Both drill segments would be at the same route location, extending into the LNG terminal from just north of the pipe bridge crossing of the non-federal levee north of Lake Hermitage Road (MP 14.6 to MP 15.0 for the Southwest Lateral TGP, and MP 11.2 to 11.6 for the Southwest Lateral TETCO). Both HDDs would be undertaken during Phase I construction. Additional information on waterbody crossings, including the use of the HDD method, is presented in section 4.3.2.2.

2.5.5.4 Proposed Modifications to the Federal Energy Regulatory Commission's Plan

Venture Global's Project-specific Plan includes proposed modifications to FERC's Plan (appendix C). FERC allows project sponsors to request modifications to its Plan. The FERC Plan directs applicants to specify in their application any individual measures that they consider unnecessary, technically infeasible, or unsuitable due to local conditions, and to describe the alternative measures they propose to use. They must also explain how their proposed alternative measures would achieve a comparable level of mitigation as the FERC measures.

The Project-specific Plan includes numerous minor wording changes to specify the Project sponsor and provide clarifications that do not require our specific approval. Those proposed modifications that are substantive and for which we have determined that Venture Global provided adequate justification are listed in appendix C, table 1. The table includes the original text from FERC's Plan, the modified text in the Project-specific Plan, and our determination regarding the proposed modification.

2.5.5.5 Proposed Modifications to the Federal Energy Regulatory Commission's Procedures

Venture Global's Project-specific Procedures regarding wetland and waterbody crossings include certain proposed modifications to FERC's Procedures (appendix C). Just as with our Plan, FERC's Procedures directs applicants to specify in their application any individual measures that they consider unnecessary, technically infeasible, or unsuitable due to local conditions, and to

describe the alternative measures they propose to use. They must also explain how their proposed alternative measures would achieve a level of mitigation comparable to the FERC measures.

The Project-specific Procedures include numerous minor wording changes to specify the Project sponsor and provide clarifications that do not require our specific approval. Those proposed modifications that are substantive and for which we have determined Venture Global provided adequate justification are listed in appendix C, table 2. The table includes the original text from FERC's Procedures, the modified text in the Project-specific Procedures, and our determination regarding the proposed modification. One modification that was proposed by Venture Global regarding the time-of-year for crossing waterbodies is already allowed by the FERC Procedures and is not included in the following table; however, this is discussed further in section 4.3.2.3.

2.6 OPERATION, MAINTENANCE, AND SAFETY PROCEDURES

All facilities would be operated and maintained in accordance with government safety standards and regulations that are intended to ensure adequate protection of the public and to prevent facility accidents and failures.

2.6.1 LNG Terminal

Operating procedures would be prepared for the Project after final design is completed. These procedures would address safe startup, shutdown, cool down, purging, etc., as well as routine operation and monitoring. Comprehensive training would be provided to ensure that all facility personnel are familiar with and adhere to properly documented and recognized safety procedures. The potential hazards of cryogenic LNG operation and proper equipment operation would be two areas of focus. Operators would meet the applicable training requirements of the USCG, DOTD, and other regulatory entities. Maintenance and safety procedures would be developed to cover the proper disposal for all hazardous fluids generated by LNG terminal operations. The procedures would include training of staff in the storage and handling of hazardous material. Additionally, the terminal SPCC Plan discusses spill response procedures, materials, and training; mitigation measures/response; and hazardous liquids quantities, storage, and disposal.

Maintenance of the LNG terminal and pipeline system must be conducted in accordance with the provisions of 49 CFR 193, subpart G, and would be in compliance with all applicable laws and regulations, and through procedures and programs developed by Venture Global. Full-time staff would conduct routine maintenance and minor repairs, whereas major overhauls and non-routine maintenance would be handled by specialty contractors. Both scheduled and unscheduled maintenance would be entered into a computerized maintenance management system and disseminated to the appropriate personnel for follow-up. All operators and maintenance personnel would be trained in the use of the computerized maintenance management system. Scheduled preventive and predictive routine maintenance would include equipment rotation and inspection of safety equipment, environmental equipment, and instrumentation. All maintenance activities would be implemented by trained maintenance technicians reporting to a Maintenance Supervisor.

Prior to operations, Venture Global would develop a complete solid and hazardous waste management plan that would describe procedures to ensure compliance with applicable state regulations and federal requirements per 40 CFR 260, Hazardous Waste Management. Solid waste typically generated during operations includes predominantly nonhazardous office waste and routine maintenance wastes such as paper, cardboard, scrap metal, wood, plastic, and small equipment parts. Examples of hazardous waste materials typically generated during operations include used oils, transmission and hydraulic fluids, antifreeze, absorbents, amines, greases, paints, and cleaning agents.

Under Venture Global's solid and hazardous waste management plan, recyclable materials would be separated and recycled. Non-recyclable wastes would be stored in covered trash bins according to state and local requirements. Hazardous wastes would be stored in labeled 55-gallon drums or other containers appropriate for the particular waste, equipped with secondary containment if required. Hazardous and non-hazardous waste must be transported in accordance with applicable DOT regulations for recycling, treatment, or disposal and in compliance with federal, state, and local regulations.

2.6.2 Pipeline System

Operation activities for the pipelines would be limited to right-of-way maintenance and pipeline inspection and repair, as needed. Company personnel would perform periodic aerial and ground inspections for exposed pipe, unauthorized encroachment on the right-of-way, activities in the vicinity of the right-of-way, and other conditions that could present a safety hazard or require preventative maintenance or repairs. The pipeline cathodic protection system would also be monitored and inspected periodically to ensure proper and adequate corrosion protection. Appropriate corrective actions for conditions observed during inspection would be taken as necessary.

The pipeline facilities would be clearly marked at line-of-sight intervals and at crossings of foreign pipelines, marine channels, roads, and other key points. The markers would indicate the presence of the pipelines and provide a telephone number and address where a company representative can be reached in the event of an emergency or prior to any excavation in the pipeline vicinity by a third party.

3.0 ALTERNATIVES

To adhere to CEQ regulations for complying with NEPA (40 CFR 1502.14), an EIS must evaluate reasonable alternatives. This EIS does so by comparing the environmental impacts of the proposed action against a range of alternatives. Each of the cooperating agencies with obligations under NEPA can use this alternatives analysis as part of their decision-making process. Individual agencies would ensure consistency with their own administrative procedures prior to accepting the recommendations in this EIS.

In accordance with NEPA and Commission policy, we evaluated alternatives to the Project to determine whether any would be reasonable and have significant environmental advantages compared to the proposed action. The alternatives analyzed consisted of the No Action Alternative, system alternatives for the LNG terminal and the pipeline system, alternative LNG terminal site locations, alternative LNG terminal configurations, an alternative pipeline route, and alternative locations for aboveground facilities. In some cases, the analysis concluded that consideration of alternatives was not feasible or required, and this is indicated, where applicable.

As part of the No Action Alternative, this EIS considers the effects and actions that could conceivably result if the proposed Venture Global Project were not constructed. The analysis of system alternatives evaluates the ability of other existing, planned, or proposed (new or expanded) LNG export terminals and pipeline systems to meet the Venture Global Project's purpose and objectives. The evaluation of alternative sites for the LNG terminal focuses on several locations. The primary consideration of pipeline route alternatives is related to the proposed Southeast and Southwest laterals.

We applied the following evaluation criteria when considering and weighing potentially reasonable and environmentally preferred alternatives to the Venture Global Project:

- The alternative must be technically and economically feasible and practical.
- The alternative must offer significant environmental advantages over the proposed Project or segment of the Project.
- The alternative must meet Venture Global's stated purpose of its proposed Project, specifically:
 - to provide a cost-effective outlet for domestic natural gas to the global market by constructing liquefaction blocks and a new pipeline to transport LNG to global markets; and
 - provide a peak liquefaction capability of 24.0 MTPA for export, consistent with Venture Global's DOE/FE authorization.

Venture Global participated in our pre-filing process during the preliminary design stage of the Project (see section 1.3). This process emphasized identification of stakeholder issues as well as identification and evaluation of alternatives that could reduce environmental impacts. We analyzed each alternative based on public comments and guidance received from federal, state, and local regulatory agencies. Additional sources of information included Venture Global's field

surveys, aerial photography, USGS topographic maps, the FWS's National Wetland Inventory (NWI) maps, pipeline system maps, agency consultations, and publicly accessible databases. To ensure equitable results, consistent data sources were used when comparing a feature across alternatives (e.g., NWI data were used for wetlands comparisons, rather than a combination of NWI and field survey data). The following sections include a discussion of the scope, methodology, and results of our alternatives analysis.

The USACE assisted us in preparing this EIS and may use the document in its permit decision-making process. When making a decision on whether to issue its permit, the USACE must consider whether a proposed project represents the least environmentally damaging, practicable alternative pursuant to CWA section 404(b)(1) guidelines. The term "practicable" means that the alternative is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall purpose of the project. The USACE may not permit the discharge of dredged or fill materials into waters of the United States if there is a practicable alternative to the discharge that would result in less adverse impact on the aquatic ecosystem, unless the alternative would result in other significant adverse environmental consequences.

It is important to note that not all alternatives warrant the same degree of evaluation. Through environmental comparison and exercise of our professional judgement, each alternative was evaluated until it became clear that the alternative would: (1) be unable to meet the stated purpose of the proposed Project; (2) be technically and/or economically infeasible or impracticable; or (3) not offer a significant environmental advantage. The alternatives that appeared to be reasonable with the potential for significantly less environmental impact are reviewed in greater detail below. A detailed discussion of the environmental consequences of the Project (both adverse and beneficial) is included in section 4.0.

3.1 NO ACTION ALTERNATIVE

If FERC denies the Venture Global application (the No Action Alternative), the resource impacts (including short- and long-term and permanent impacts) identified in this EIS would not occur. However, the No Action Alternative would prevent Venture Global from achieving its stated purpose of transporting LNG to global markets. The No Action Alternative would also preclude the economic benefits of employment and tax revenues, as discussed in sections 4.9.1 and 4.9.2. Selecting the No Action Alternative could require potential end users to make different arrangements to obtain LNG from other sources. This could result in the use or expansion of other existing or proposed LNG facilities and associated interstate natural gas pipeline systems, or in the construction of new infrastructure in the Project area or elsewhere in the United States, resulting in both adverse and beneficial environmental impacts. LNG terminal developments and pipeline system expansions of similar scope and magnitude to the proposed Project would likely result in environmental impacts of comparable significance, especially those projects in a similar regional setting. In section 3.2, we examine reasonable LNG system alternatives.

Commenters have suggested that LNG export projects could be replaced by renewable energy resources alternatives such as wind power, solar power, tidal power, and hydropower. All of these alternatives represent alternative means of producing electrical power. Because the

Project's primary purpose is to prepare natural gas for export to foreign markets, development or use of renewable energy technology would not be a reasonable alternative to the proposed action.

3.2 SYSTEM ALTERNATIVES

System alternatives would make use of other existing, modified, or proposed LNG facilities and/or pipeline systems to meet the stated objectives of the Project. A system alternative would make it unnecessary to construct all or part of the Project; however, some modifications or additions to another existing system may be necessary. Such modifications or additions would result in environmental impacts that could be less than, similar to, or greater than those associated with construction of the Project. The purpose of identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with construction and operation of proposed facilities could be avoided or reduced while still meeting the purpose and basic objectives of the Project. The analysis of the system alternatives for the LNG terminal is presented in section 3.2.1, and the pipeline system alternatives are evaluated in section 3.2.2.

3.2.1 LNG Project System Alternatives

For a system alternative to be viable and recommended, it must meet the purpose and need of the project, be technically and economically feasible, and offer a significant environmental advantage over the project as proposed. In the case of this Project, it must also be compatible with Venture Global's proposed export capacity, consistent with authorizations from the DOE/FE. Venture Global is proposing to export LNG to FTA and non-FTA countries. The volume of gas (commodity) for FTA countries has already been approved by the DOE and, therefore, is determined to be in the public interest by the DOE. The DOE determination for non-FTA countries is pending. There are other approved, proposed, or planned LNG export facilities along the Gulf Coast that have also either obtained or applied for DOE approval for the export of LNG associated with the production capacity in the respective project plans/proposals. Each of the approved, proposed, or planned projects considered as a potential system alternative (either to expand an existing facility or new construction at a proposed terminal site to accommodate the Venture Global's Project objective) is listed in table 3.2-1. In order for Venture Global's customers to obtain LNG from any of these other facilities, these facilities would need to construct additional liquefaction facilities to meet the export capacity proposed by Venture Global and as approved by the DOE authorizations. We recognize that liquefaction capacity may not be fully subscribed at all of these other facilities based on contracts executed as of the writing of this EIS. However, because the DOE's export approval is a determination that the export is in the public interest, we will not speculate that any portion of other LNG terminals' liquefaction capacity is in "excess" or available as an alternative for use by Venture Global to meet its Project objectives.

TABLE 3.2-1 System Alternatives – Summary of Approved, Proposed, and Planned LNG Export Projects				
Project Name (FERC Docket No.) ^a	Owner Location	Total Capacity (MTPA)	Project Status	Status of FTA/Non- FTA Approvals
Approved LNG Export Terminals				
Cheniere/Sabine Pass LNG Terminal (CP11-72 and CP14-12)	Sabine Pass Liquefaction, LLC / Sabine Pass Liquefaction Expansion, LLC / Sabine Pass LNG, L.P.	20.0	Trains 1-4: Operating	FTA: Authorized Non-FTA: Authorized
Sabine Pass Expansion (CP13-552 and CP13-553)	Sabine, Louisiana	9.0	Train 5: Under construction Train 6: Under construction	
Cameron LNG Terminal (CP13-25)	Cameron LNG, LLC	15.0	Under construction	FTA: Authorized Non-FTA: Authorized
Cameron LNG Expansion (CP15-560)	Hackberry, Louisiana	10.0	Approved	FTA: Authorized Non-FTA: Authorized
Freeport LNG Dev/Freeport LNG Expansion/ FLNG Liquefaction Terminal (CP12-29, CP12-509, and CP15-518)	Freeport Development, L.P./ FLNG Liquefaction, LLC/ FLNG Liquefaction 2, LLC/ FLNG Liquefaction 3, LLC/FLNG Liquefaction 4, LLC	15.3	Under construction	FTA: Authorized Non-FTA: Authorized
Freeport LNG Expansion (CP17-470)	Freeport, Texas	5.1	Application filed 06/29/2017	FTA: Authorized Non-FTA: Pending
Corpus Christi Liquefaction Project (CP12-507 and CP12-508)	Corpus Christi Liquefaction, LLC Corpus Christi, Texas	15.0	Train 1: Operating Trains 2-3: Under construction	FTA: Authorized Non-FTA: Authorized
Stage 3 Project (CP18-512 and CP18-513)	Corpus Christi Liquefaction Stage III, LLC Corpus Christi, Texas	11.45	Application filed 06/28/2018	FTA: Authorized Non-FTA: Pending
Lake Charles LNG Terminal (CP14-120)	Lake Charles LNG Company, LLC / Lake Charles LNG Export Company, LLC / Trunkline Gas Company, LLC Lake Charles, Louisiana	16.45	Under construction	FTA: Authorized Non-FTA: Authorized
Magnolia LNG Terminal (CP14-347)	Magnolia Pipeline Company, LLC / Magnolia LNG, LLC Lake Charles, Louisiana	8.0	Approved	FTA: Authorized Non-FTA: Authorized
Golden Pass LNG Terminal (CP14-517 and CP14-518)	Golden Pass Products, LLC / Golden Pass Pipeline, LLC Sabine Pass, Texas	15.6	Approved	FTA: Authorized Non-FTA: Authorized
Calcasieu Pass LNG Export Terminal (CP15-550 and CP15-551)	Venture Global Calcasieu Pass, LLC Cameron Parish, Louisiana	12.0	Under Construction	FTA: Authorized Non-FTA: Authorized
Proposed LNG Export Terminals				
Gulf LNG Terminal (CP15-521)	Gulf LNG Liquefaction Company, LLC / Gulf LNG Energy, LLC Pascagoula, Mississippi	10.0	Application filed on 06/19/2015	FTA: Authorized Non-FTA: Pending

TABLE 3.2-1 System Alternatives – Summary of Approved, Proposed, and Planned LNG Export Projects				
Project Name (FERC Docket No.) ^a	Owner Location	Total Capacity (MTPA)	Project Status	Status of FTA/Non- FTA Approvals
Driftwood LNG Project (CP17-118 and CP17-119)	Driftwood LNG, LLC and Driftwood Pipeline, LLC Lake Charles, Louisiana	26.0	Approved	FTA: Authorized Non-FTA: Pending
Rio Grande LNG Project (CP16-454 and CP16-455)	Rio Grande LNG, LLC / Rio Bravo Pipeline Company, LLC Brownsville, Texas	27.0	Application filed on 05/05/2016	FTA: Authorized Non-FTA: Pending
Annova LNG Project (CP16-480)	Annova LNG Common Infrastructure, LLC / Annova LNG Brownsville A, LLC/ Annova LNG Brownsville B, LLC / Annova LNG Brownsville C, LLC Brownsville, Texas	7.0	Application filed on 07/13/2018	FTA: Authorized Non-FTA: Not requested
Port Arthur LNG Project (CP17-20 and CP17-21)	Port Arthur LNG, LLC / Port Arthur Pipeline, LLC	13.5	Approved	FTA: Authorized Non-FTA: Pending
Venture Global Plaquemines LNG (CP17-66)	Venture Global Plaquemines LNG, LLC Plaquemines Parish, Louisiana	20.0	Application filed on 02/28/2017	FTA: Authorized Non-FTA: Pending
<i>Planned LNG Export Terminals</i>				
Commonwealth LNG Project (PF17-8)	Commonwealth LNG, LLC / Commonwealth Projects, LLC Cameron Parish, Louisiana	9.0	Pre-filing approved on 08/15/2017	FTA: Authorized Non-FTA: Pending
Fourchon LNG Export Facility (PF17-9)	Fourchon LNG, LLC Lafourche Parish, Louisiana	5.0	Pre-filing approved on 08/21/2017	FTA: Authorized Non-FTA: Pending
Galveston Bay LNG Project (PF18-7)	Galveston Bay LNG, LLC Galveston, Texas	16.5	Pre-filing approved on 12/7/2018	FTA: Authorized Non-FTA: Pending
Pointe LNG Project (PF18-8)	Pointe LNG, LLC Plaquemines Parish, Louisiana	6	Pre-filing approved on 10/16/2018	Not submitted
Delta LNG (PF19-4)	Venture Global Delta LNG, LLC Plaquemines Parish, Louisiana	24.0	Pre-filing request submitted 04/17/2019	FTA and Non-FTA: Pending
^a To access the public record for this proceeding, go to FERC's website (http://www.ferc.gov), click on "Documents and Filings" and select the eLibrary feature. Click on "General Search" from the eLibrary menu and enter the docket number.				

An expansion of existing facilities to meet the export capacity proposed by Venture Global would need to be of a similar scope of pre-treatment and liquefaction facilities and possibly additional storage and marine transfer facilities, while any new facility would need a similar scope of pre-treatment, liquefaction, storage, and marine transfer facilities to accommodate the objectives of the proposed Project. Any expansion of an existing facility would result in environmental impacts that would likely be equal to or greater than the environmental impacts of the proposed action (depending on the environmental resource affected) and may not provide a

significant environmental advantage over the proposed Project. Our analysis of system alternatives listed in table 3.2-1 assumes and/or considers whether the Project has an equal chance of being constructed, has the onsite space required for an expansion to accommodate facilities similar to those proposed for the Project, could be served by a pipeline system(s) for the export of 24.0 MTPA of LNG, and has a compatible in-service timeframe to meet the Project's objective. Meeting these criteria would qualify the system as a potential alternative. However, future Commission review and market forces will ultimately decide which and how many of these facilities are built.

As identified in table 3.2-1, we reviewed the liquefaction terminals that have been authorized, proposed, or planned as an alternative to the Project. Our review of Venture Global's proposed LNG terminal site we find no significant impacts in section 4.0 when mitigation is included, during the construction and operation of the LNG terminal or pipeline system. Additionally, we did not receive any specific comments relating to the use of a specific liquefaction terminal as a system alternative to the proposed LNG terminal. We note again that the Commission does not design projects. If the Commission ultimately determines that another project would be more appropriate, it could deny a proposal, but it could not force another entity to build a project that it has not proposed. Also, if the market support is not demonstrated for a project, and export volumes proposed by one liquefaction terminal are met by another liquefaction terminal, a project may not get built. However, we cannot speculate as to the future state of export markets or any project that may ultimately meet the same market demands as Venture Global.

As mentioned, Venture Global's export of LNG to FTA countries has already been found in the public interest by the DOE. For our analysis, we are assuming that all projects have contracted volumes and, as a result, these are not available as a direct "replacement" for the export volumes proposed by Venture Global. Any of the potential system alternative terminals would require additional volumes above and beyond what they have proposed or have been authorized in order to replace the liquefaction facilities of Venture Global.

If another entity proposes replacement facilities for Venture Global's facilities, they would need to submit an application identifying exactly what the replacement facilities would entail, including their environmental impact, and conduct the corresponding safety and engineering analysis. While this information is not available to Venture Global, it is likely that similar facilities at other locations would have very similar impacts to Venture Global's proposal, as they are also in coastal areas. Each of these sites would include the permanent fill of wetlands and involve impacts on waterways and fisheries. But, a simple one-to-one "placement" of the Venture Global facilities at another location may not be an accurate representation of what would be required, especially if the additional LNG vessel traffic would require additional berths. Such an analysis would be based on speculation and hypotheticals and would not provide the information necessary to inform the decision makers of the associated environmental impact.

It should also be noted that unlike a pipeline under section 7 of the NGA, an authorization granted under section 3 of the NGA does not grant the applicant eminent domain. As a result, we cannot speculate that a recommended alternative site would be available unless the landowner would make it available for purchase or lease.

Because none of the potential system alternatives would be able to design, engineer, permit, and construct a project within the timeframe proposed by Venture Global, and similar facilities at other coastal locations would have very similar impacts to Venture Global's proposal, we find that none of the system alternatives are a viable replacement that meets Venture Global's objectives. In conclusion, no system alternative meets the criteria of being technically and economically feasible, provides a significant environmental advantage, and meets the objectives of Venture Global to permit and construct a project; therefore, we do not recommend any system alternative to replace the proposed LNG terminal.

3.2.2 Pipeline System Alternatives

To serve as a viable pipeline system alternative to the proposed Venture Global pipeline system, the system would need to: (1) transport all or a part of the volume of natural gas required for liquefaction at the LNG terminal; and (2) cause significantly less impact on the environment than the proposed Venture Global pipeline system. Gas provided by a system alternative must connect to the Venture Global pipeline or directly to the LNG terminal.

We conducted a review of all existing natural gas pipeline systems in the Project area. Following identification and evaluation of geographically proximate natural gas pipeline systems, the delivery capacity of each system was considered. The proposed pipeline is designed to connect the LNG terminal to TGP and TETCO, the two existing natural gas pipeline systems nearest to the terminal site with sufficient delivery capacity to serve Project needs. Because there is no existing or proposed pipeline that connects these systems to the LNG terminal, there is no reasonable system alternative to the Venture Global pipeline. Route alternatives for the Venture Global pipeline are discussed in section 3.5.

3.3 ALTERNATIVE TERMINAL FACILITY SITES

3.3.1 LNG Terminal Site Alternatives

Based in part on the information provided by Venture Global, we evaluated site alternatives identified by Venture Global in the general area of the proposed LNG terminal site.

Venture Global chose Louisiana as their preferred location based on the following three attributes:

- ready access to the Gulf of Mexico and maritime transportation routes to both the eastern and western hemispheres;
- availability of potential sites on major navigable waterways (Calcasieu River and Mississippi River) that can accommodate LNG carriers and have a history of industrial and commercial use; and
- state and local government support for industrial commerce and development.

Venture Global defined selection criteria to analyze site alternatives in southeast and southwest Louisiana. Venture Global identified sites based on whether they:

- provide direct access to a deep-draft shipping channel (40 feet or more below sea level) with sufficient water frontage for multiple LNG carriers;
- have compatible surrounding land use and are of sufficient size to construct and operate the proposed LNG facility;
- are available for purchase or long-term lease arrangements;
- have a sufficient buffer between the site and residential neighborhoods;
- have suitable road access and proximity to one or more highways;
- are proximate to natural gas pipeline infrastructure;
- are proximate to utilities (water and electrical); and
- avoid/minimize wetland/waterbody impacts and have viable mitigation options.

Using the eight selection criteria described above, the six potential sites were evaluated by Venture Global to determine the preferred location for the proposed LNG terminal. The general locations of the six site alternatives are shown on figure B-2 in appendix B. A comparison of each alternative site is presented in table 3.3-1 and discussed below.

3.3.1.1 Mississippi River Mile 55–West Bank (Proposed Site)

This parcel was the only site that meets all of the screening criteria established by Venture Global; therefore, Venture Global selected this site as the proposed LNG terminal site. The parcel has sufficient shoreline frontage (approximately 7,000 feet) on the Mississippi River to accommodate three LNG loading docks in a location that would allow safe and efficient navigation for both LNG carriers and existing marine traffic. The parcel is also of a suitable size, geometric shape, and topographic profile to optimize the layout design for plant infrastructure and buffer zones with respect to engineering feasibility, constructability, and safety. This site is available for lease and is located near existing utilities that would be required for operation. Louisiana Highway 23 bisects the proposed site, providing easy access.

Table 3.3-1 Alternative Sites Selection Criteria Summary						
Selection Criteria	Mississippi River Mile 55 West Bank (proposed)	Mississippi River Mile 56	Mississippi River Mile 55 East Bank	Cutrone Property	South Carlyss Site I	South Carlyss Site II
Deepwater access/waterfront footage	Yes	No	No	No	No	No
Sufficient land area and compatibility with surrounding land use	Yes	No	No	Yes	No	No
Land available for lease or purchase	Yes	No	No	No	Yes	Yes
Sufficiency of buffer ^a	Yes	No	No	Yes	No	No
Road and highway access	Yes	Yes	Yes	Yes	Yes	Yes
Proximity to natural gas pipelines	Yes	Yes	Yes	Yes	Yes	Yes
Proximity to utilities	Yes	Yes	Yes	Yes	Yes	Yes
Wetland/waterbody avoidance/minimization and viable mitigation alternatives	Yes	Yes	Yes	Yes	No	No
Notes: ^a The distance necessary in order to not create an LNG thermal dispersion hazard to surrounding residential areas, businesses or public areas.						

Natural gas pipelines to supply feed gas are in proximity to this site. In addition to meeting the Venture Global selection criteria, the site is located within fastlands, so it is protected by levees and pump systems to minimize flood risks. NWI wetland data indicated that riparian wetlands are located in the batture area within the Mississippi River levee, only small pockets of wetlands exist within the site landward of the Mississippi River levee, and there is appropriate mitigation available in the form of mitigation bank credits and potential restoration parcels in the vicinity of the site. For these reasons, Venture Global selected the Mississippi River Mile 55–West Bank as its preferred site and proposed LNG terminal location.

3.3.1.2 Mississippi River Mile 56

The Mississippi River Mile 56 site is an approximately 297-acre land parcel on the east bank of the Mississippi River at river mile 56. Currently, the property is used for agriculture. A coal-handling facility (United Bulk Terminal) is located directly to the east, and a barge terminal (Associated Terminal) lies to the west. Louisiana State Highway 39 fringes the parcel's northern boundary, and the Mississippi River marks the southern boundary. A small residential community is located adjacent and directly to the north. A highway, natural gas pipelines, and utilities are located in proximity to the site. NWI wetland data indicated that riparian wetlands are located in the batture area within the Mississippi River levee and only small pockets of wetlands exist within the site landward of the Mississippi River levee. Appropriate mitigation is available in the form of mitigation bank credits and potential restoration parcels in the vicinity of the site.

The approximately 5,100 feet of water frontage along the Mississippi River Mile 56 site is insufficient to support the three LNG loading docks for the proposed facility. Land use in the vicinity of the site, including the industrial facilities and residential community, is not compatible with an LNG terminal. The parcel is corporately owned, which could lead to lengthy and uncertain property negotiations; therefore, the availability of the property is uncertain. Sufficient buffers from incompatible land uses would not be available due to the residential community. For these reasons, the Mississippi River Mile 56 site was not considered preferable to the proposed site.

3.3.1.3 Mississippi River Mile 55–East Bank

The Mississippi River Mile 55–East Bank site is an approximately 475-acre parcel on the east bank of the Mississippi River at river mile 55. A coal-handling facility (United Bulk Terminal) is located directly to the west. A highway, natural gas pipelines, and utilities are located near the site. NWI wetland data indicated that riparian wetlands are in the batture area within the Mississippi River levee and only small pockets of wetlands exist within the site landward of the Mississippi River levee. Appropriate mitigation is available in the form of mitigation bank credits and potential restoration parcels in the vicinity of the site.

Like the Mississippi River Mile 56 site, the Mississippi River Mile 55–East Bank site water frontage of approximately 5,600 feet is insufficient for the three LNG loading docks planned for the LNG terminal, and its corporate ownership presents difficulties in securing the property. There is also one residence located on the parcel and several residences adjacent to the parcel to the east. Therefore, the land use in the vicinity of the site, including the industrial facility and the residences, is not compatible with an LNG terminal and the buffer is insufficient. For these reasons, the Mississippi River Mile 55–East Bank site is not considered preferable to the proposed site.

3.3.1.4 Cutrone Property

The Cutrone Property site is located on the east bank of the Mississippi River at river mile 46. The parcel covers approximately 160 acres of agricultural land and has been cleared of trees. A highway, natural gas pipelines, and utilities are located in proximity to the site. NWI wetland data indicated that riparian wetlands are in the batture area within the Mississippi River levee and only small pockets of wetlands exist within the site landward of the Mississippi River levee. Appropriate mitigation is available in the form of mitigation bank credits and potential restoration parcels in the vicinity of the site.

The Cutrone Property site has approximately 3,300 feet of water frontage on a straight stretch of the Mississippi River, where deep water and sufficient natural scour would preclude the need for dredging. However, this 3,300 feet is insufficient for the marine terminal's requirements. Additionally, Venture Global was unable to secure a long-term lease for the site. For these reasons, the Cutrone Property site is not considered preferable to the proposed site.

3.3.1.5 South Carlyss Site I

South Carlyss Site I is an approximately 174-acre parcel of privately owned land bordered to the south and west by Global Drive in Calcasieu Parish. Since the property is privately owned, the property may be available for purchase or long-term lease. The area is zoned for heavy industrial use. An access road and utilities are located near the site. There are natural gas pipelines

in the region; however, the length of a pipeline necessary to provide feed gas would be much longer than what is required at the proposed site and is a primary factor in not choosing this site.

South Carlyss Site I has approximately 2,900 feet of water frontage access on the east side of the site, which is insufficient for three LNG loading docks, which is also a primary reason this site was not selected. There is approximately 1,900 feet of water frontage on the west side of the site along the Intracoastal Waterway, which is also insufficient for three LNG loading docks. Additionally, the Intracoastal Waterway is relatively narrow and is an area of high ship traffic, which would present safety concerns for LNG ship maneuverability. While the land is zoned for heavy industrial use, the size of the site is insufficient and the configuration of the property is impractical for constructing an LNG terminal. Although residential areas located approximately 0.5 mile to the southwest of the site, this is not among the primary reasons this site was not selected. NWI wetland data indicate that the western portion of the site is wetland and could be offset by wetland banking credits. As the size of the property is insufficient the South Carlyss Site I is not considered preferable to the proposed site.

3.3.1.6 South Carlyss Site II

South Carlyss Site II is an approximately 550-acre parcel of privately owned land bordered to the north by Burton Shipyard Road in Calcasieu Parish. The area is zoned for heavy industrial use and has an accessible waterfront. An access road and utilities are located in proximity to the site. There are natural gas pipelines in the region; however, the length of a pipeline necessary to provide feed gas would be much longer than what is required at the proposed site and is a primary factor in not choosing this site. The site is available for purchase or long-term lease.

The site has approximately 3,300 feet of water frontage, which is insufficient for three LNG loading docks, which is also a primary reason this site was not selected. Although residential areas located approximately 0.5 mile to the southwest of the site, this is not among the primary reasons this site was not selected. NWI wetland data indicate that a majority of the site is wetland and avoidance and minimization of wetland impacts would not be feasible but could be offset by wetland banking credits. As the proximity to residences and the required length of feed gas pipeline are limiting factors, we do not consider South Carlyss Site II site preferable to the proposed site.

Conclusion

Of the alternative terminal locations, we conclude that the proposed site (Mississippi River Mile 55-West Bank) represents an acceptable site for the LNG terminal. The proposed site is currently identified as port complex and industrial in the parish's master plan and is sufficiently sized to allow optimal facility layout design, and has the necessary water frontage available. The proposed site is also well separated from area residences and population centers. The proposed site is the only alternative that satisfies all of the tier two selection criteria. From a visual impact perspective, the LNG terminal would be consistent with existing industrial development along this portion of the Mississippi River.

3.4 ALTERNATIVE TERMINAL CONFIGURATIONS

In considering the arrangement of plant infrastructure, Venture Global determined that a critical element involves placing the liquefaction facilities and LNG storage tanks at the proposed locations within the LNG terminal site to ensure compliance with federal siting and safety requirements. Aligning the major infrastructure components in sequence according to process flow (pretreatment, liquefaction, storage, and export) minimizes the amount of cryogenic piping required and optimizes the site layout for process efficiency. With these considerations in mind, layout arrangements need to allow simultaneous operations involving the construction of Phase II infrastructure contemporaneously with the operation of Phase I infrastructure.

The proposed site layout provides the adequate minimum practical distance between the LNG loading docks and the LNG storage tanks; the administrative offices, maintenance facilities, and the central control room are well separated from the main plant. The proposed location of each of the components of the Terminal is in accordance with the applicable federal safety requirements. We did not identify any alternative configurations that would meet the regulations, codes, and guidelines while avoiding or reducing impacts when compared to those of the proposed terminal configuration. Therefore, we conclude that the proposed general configuration of the Terminal site is the preferred alternative.

3.5 ALTERNATIVE PIPELINE ROUTES

The proposed action for the Venture Global pipeline includes two parallel 42-inch-diameter natural gas pipelines sharing one right-of-way corridor for the majority of their routes. We evaluated pipeline route alternatives that could minimize or avoid impacts on environmentally sensitive resources (e.g., population centers, special use areas, waterbodies, wetlands, existing or planned residences, specific landowner concerns).

Typically, pipeline route alternatives are one of three types: major, minor, or variation. Major route alternatives include those that deviate from the proposed route for a significant distance and that provide a substantially different pathway from the source area to the delivery area. Minor route alternatives are typically shorter in length than major route alternatives and are often identified to avoid large environmental resources, engineering constraints, and/or developed areas. Minor route alternatives typically remain within the same general area as the proposed route. Route deviations are typically site-specific and may allow for avoidance of certain localized features such as a residence, wetland, or cultural resource site.

For the purposes of this Project, we reviewed only the proposed route and two major route alternatives. Due to the majority of the pipeline system being located in open water/wetlands (relatively homogenous environments), minor route alternatives and variations that generally are utilized to avoid sensitive resources or address constructability issues were not evaluated. The major route alternatives were sited in open water, where feasible, to avoid wetland impacts and only cross wetlands when necessary. The proposed route and the minor route alternatives are shown in figure B-3 in appendix B.

3.5.1 Background

Initially, at the start of the pre-filing process, the planned Venture Global pipeline system consisted of three pipelines on three routes that would supply feed gas to the Venture Global terminal facility: the 21.2-mile-long Northwest lateral, 12.1-mile-long Southeast lateral, and 11.1-mile-long Southwest lateral pipelines. During the pre-filing process, Venture Global continued to evaluate and develop its Project design. When Venture Global filed with FERC its application for the proposed pipeline system, it had removed the Northwest lateral and Southeast lateral from the Project. It also modified and renamed the Southwest lateral pipeline route so that it now includes two collocated pipelines identified as Southwest Lateral TETCO and Southwest Lateral TGP. The applicants propose to construct and operate these two pipelines in one route—the Southwest laterals pipeline route.

During the draft EIS comment period, a commenter questioned why the Applicant could not use an existing servitude for a future pipeline that would run within the non-federal levee and not impact the marshes to the southwest along the Southwest laterals. After researching the future pipeline and coordinating with the USACE we determined the commenter was referring to the Applicant's Southeast lateral alternative. The Southeast lateral route was outside of the non-federal levee and impacted marshes and open water similar to that of the preferred route and it was approximately 1 mile longer and thus was not preferred.

3.5.1.1 Northwest Lateral Pipeline Route

The 22.8-mile-long Northwest lateral pipeline route was to provide an interconnect point with the existing Bridgeline Holdings, L.P. pipeline near the intersection of Bayou Road and Intracoastal Road, approximately 5 miles southwest of Belle Chasse in Plaquemines Parish. The route crossed the Intracoastal Waterway and proceeded south-southeast toward the proposed LNG terminal site. This pipeline was collocated with an existing pipeline right-of-way from MP 13.0 to MP 20.6. The route was designed to avoid crossing the Jean Lafitte National Park and Preserve, as well as an EPA-designated section 404(c) wetland area.

After further evaluation, Venture Global decided to remove the Northwest lateral pipeline from the proposed action. The Northwest lateral pipeline route would have required a technically difficult crossing of a levee and adjacent waterbody. This route is approximately 6 miles longer than the proposed Southwest Lateral TGP and 11 miles longer than the Southwest Lateral TETCO. Because the Northwest lateral pipeline would have to be coupled with another pipeline to deliver the volume of necessary gas, this longer route would have more potential environmental impacts than the current proposed routes. The Northwest lateral would have crossed 34 National Hydrography Dataset waterbodies, of which 14 of the crossings would be greater than 100 feet. Additionally, the Northwest lateral pipeline route would have crossed approximately 17.8 miles of wetlands. As a result, once Venture Global determined that sufficient feed gas supply could be obtained using just the TGP and TETCO tie-ins, they removed the Northwest lateral pipeline from the proposed Project.

3.5.1.2 Southeast Lateral Pipeline Route

Venture Global also considered the 12.0-mile-long Southeast lateral pipeline that begin at a tie-in with TGP near Port Sulphur in Plaquemines Parish. The route proceeded northwest and then interconnected with a High Point Gas Transmission pipeline before proceeding to the proposed LNG terminal site. The route was collocated with an existing 20-inch-diameter Shell pipeline for 2.4 miles. Based on NWI mapping, the route would cross 3.1 miles of estuarine and freshwater emergent wetland and 3.0 miles of open water. Approximately 1,000 feet of oyster lease areas would also be crossed.

After further analysis, as with the Northwest lateral pipeline, Venture Global decided to remove the Southeast lateral pipeline from the proposed action once they determined that sufficient feed gas supply could be obtained by using only two existing systems (TGP and TETCO). Also, the tie-ins to the TGP and TETCO lines could be located in proximity, which would allow for the two pipelines to be collocated for a majority of their routes.

Because constructing the Southeast lateral and at least one of the other alternative pipelines would result in more overall impacts when compared to the proposed pipeline systems' collocated alignment, Venture Global removed the Southeast lateral pipeline from the proposed Project.

3.5.1.3 Southwest Laterals Pipeline Route

The Southwest laterals pipeline route is the proposed route for the two proposed lateral pipelines. Initially, at the beginning of the pre-filing process, the Southwest lateral was a single pipeline connecting TETCO to the LNG terminal site. After further design, Venture Global decided to also connect to the existing TGP system with a 15-mile lateral pipeline. Due to the proximity of the TGP and TETCO interconnects, the applicants propose to collocate these two laterals for the majority of the route. In its FERC application, Venture Global presented the collocated the Southwest Lateral TGP and Southwest Lateral TETCO pipelines as one proposed route—the Southwest laterals pipeline route.

3.5.2 Southwest Laterals Route (Proposed)

As discussed above, the Southwest laterals route consists of the 11.7-mile Southwest Lateral TETCO pipeline and the 15.0-mile Southwest Lateral TGP pipeline. Two major alternatives for the Southwest Lateral TETCO pipeline route were analyzed. As illustrated on figure B-3 in appendix B, the route for the Southwest Lateral TGP pipeline is collocated for the entire length of the Southwest Lateral TETCO pipeline and (for the additional 3.3 miles) traverses homogenous, open water habitat between the TETCO and TGP interconnects. As a result, we did not identify the need to evaluate any route alternatives for the Southwest Lateral TGP pipeline route and consider it the preferred route for that segment of the pipeline system. The alternatives are discussed in the following sections. A comparison of the three Southwest Lateral TETCO pipeline route alternatives is presented in table 3.5-1.

Table 3.5-1 Summary of Selection Criteria for the Southwest Lateral TETCO Pipeline Routes			
	Proposed	Alternative 1	Alternative 2
Length (miles)	11.7	11.0	11.1
Wetlands (miles)	3.5	6.6	3.6
Upland (miles)	0.6	0.4	0.2
Open Water (miles)	7.6	4.0	7.3
Oyster Leases Crossed (miles)	4.4	1.1	4.4
Collocation (miles)	0.0	0.0	0.0

3.5.2.1 Southwest Lateral TETCO Pipeline – Preferred Route

This preferred alternative is the proposed route for the Southwest Lateral TETCO pipeline. It is 11.7 miles long and located in the coastal marshes of the Mississippi River delta. The route begins at an interconnect point with a TETCO pipeline near Bayou St. Denis in Plaquemines Parish. It proceeds northeast across the wetlands and open water to the proposed LNG terminal site. No utility corridors or other linear rights-of-way running in the same general direction are available for collocation.

Based on NWI information shown in table 3.5-1, the proposed Southwest Lateral TETCO pipeline route crosses approximately 3.5 miles of estuarine emergent and freshwater forested/shrub wetland and 7.6 miles of open water. Approximately 4.4 miles of the 11.7-mile-long route cross oyster leases. Although it is slightly longer than Alternatives 1 and 2, it was selected as the proposed route based on its preferential location in open water, where practicable, to minimize disturbance of marsh vegetation.

3.5.2.2 Southwest Lateral TETCO Pipeline – Alternative 1

Alternative 1 is 11.0 miles long and is the shortest of the three variations for the Southwest Lateral TETCO pipeline route. Alternative 1 crosses 6.6 miles of estuarine emergent and freshwater forested/shrub wetlands and 4.0 miles of open water. Approximately 1.1 miles of the 11.0-mile-long route cross oyster leases. This alternative was not selected because the wetland crossing length is nearly double that of the other alternatives and the tie-in location presented construction challenges due to the local terrain. This alternative did not offer any advantages over the preferred route.

3.5.2.3 Southwest Lateral TETCO Pipeline – Alternative 2

Alternative 2 is 11.1 miles long. This alternative crosses 3.6 miles of estuarine emergent and freshwater forested/shrub wetland and 7.3 miles of open water. Similar to the preferred route, approximately 4.4 miles of Alternative 2 cross oyster leases. Unlike Alternative 1, there is an acceptable location for a tie-in point. This alternative is nearly identical to the proposed route, deviating from the preferred route only at the extreme southern end of the route. The southern 2.5 miles of this alternative route would cross two marsh islands, resulting in an additional 0.1 mile of marsh impacts and habitat/marsh fragmentation. To avoid these marsh islands, the preferred route is approximately 0.6 mile longer, with more open water impacts. However, the preferred

route was chosen over Alternative 2 since it would result in fewer wetland impacts and less habitat fragmentation.

3.6 ALTERNATIVE ABOVEGROUND FACILITIES SITES

Proposed aboveground facilities for the pipeline system would include six MLVs, three pig launchers, two pig receivers, and two metering and regulation (M&R) stations. All of these facilities would occur within or adjacent to the Southwest lateral pipeline route right-of-way. These facilities are small, would only impact environmentally sensitive areas to a minimal extent, are not located near residences, and their locations are tied to the locations of the required interconnect pipeline facilities. We did not identify any environmental concerns that require the need to identify and evaluate alternative sites for these minor aboveground facilities, nor were any alternatives suggested during the public scoping period or draft EIS public comment period. Therefore, we conclude that the proposed aboveground facility sites are the preferred alternative.

4 ENVIRONMENTAL IMPACT ANALYSIS

The environmental consequences of constructing and operating the LNG terminal and pipeline system would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts generally occur during construction with the resource returning to pre-construction condition almost immediately afterward. Short-term impacts could continue for up to 3 years following construction. Impacts were 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 modified a resource to the extent that it would not return to pre-construction conditions during the life of the Project, such as the construction of an aboveground facility. 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. Venture Global, as part of its application, agreed to implement certain measures to reduce impacts. We evaluated the proposed mitigation measures to determine whether additional measures are necessary to reduce impacts. These additional measures appear as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific conditions to any authorization that the Commission may issue. Conclusions in this EIS are based on our analysis of the environmental impacts and the following assumptions:

- Venture Global would comply with all federal laws and regulations;
- the proposed facilities would be constructed as described in section 2.0 of this document; and
- Venture Global would implement the mitigation measures as stated in its application and supplemental filings to FERC.

4.1 GEOLOGY

4.1.1 Geologic Setting

The Project would be located in the Mississippi Alluvial Plain section of the Coastal Plain physiographic province. The Coastal Plain lies along the U.S. Gulf Coast, stretching 100 to 200 miles inland and 100 to 200 miles offshore to the edge of the Continental Shelf. It comprises an elevated sea bottom with low topographic relief and extensive marsh lands, dipping gently seaward from its highest elevations of about 500 feet. The Mississippi River Delta portion of Mississippi Alluvial Plain consists of Quaternary-period unconsolidated sands and clays, with scattered salt diapirs overlain by anhydrite and sulfur deposits (Hunt, 1967). Surficial deposits underlying the LNG terminal and the first 2 miles of the pipeline system are comprised of Holocene-epoch deposits of the natural levee complex of the Plaquemines delta lobe, Mississippi River, which are predominantly of silt, silty clay, and clay. Surficial deposits underlying the remainder of the pipeline system are Holocene-epoch deposits composed of cyclically interbedded interdistributary peat and clay, natural levee silt and clay, distributary sand, and delta-front and prodelta mud and clay (LGS, 2011). The Holocene-epoch deposits are underlain by Pleistocene-

epoch Mississippi River alluvial deposits of mudstones with interbedded sand beds between 500 feet and 2,000 feet below mean sea level (MSL) in the Project area (Ayrer, 2013).

Venture Global performed geotechnical studies to evaluate subsurface soil and groundwater conditions within the proposed terminal site and marine facilities:

- 86 geotechnical borings, ranging in depth from 60 to 200 feet;
- 10 cone penetration tests, ranging in depth from 142 to 148 feet; and
- two seismic cone penetration tests, each to a depth of 143 feet.

The investigations at the proposed terminal indicated that the materials within approximately 300 feet of the surface consist of three distinct strata:

- stratum 1: Cohesive soils consisting of clay, silt, and silty clay generally extend from the surface to a depth of about 150 feet below existing grade.
- stratum 2: Natural granular soils consisting of silty sand and clayey sand occur below Stratum 1 to a depth of about 175 feet below existing grade.
- stratum 3: Cohesive soils consisting of clays and sandy clays occur below Stratum 2 to a depth of about 300 feet below existing grade, the maximum depth explored in this area.

Groundwater was at or very near the surface in the geotechnical borings. The potential for corrosion of buried steel ranged from high to very high, based on resistivity and chloride ion concentrations. The potential for degradation of concrete, based on sulfate ion concentrations, was generally mild to moderate across the site (Fugro, 2016a).

A 2016 topographic survey undertaken by Venture Global indicated elevations at the LNG terminal site range from -2 feet to -5 feet NAVD88 south of SH 23, and from -2 feet to 2 feet NAVD88 between SH 23 and the toe of the federal flood protection levee. The crest of the flood protection levee had a crest of 14 feet NAVD88 adjacent to the proposed terminal site. The non-federal flood protection levee has an elevation of 9.5 feet NAVD88 at the pipeline system crossing.

The geotechnical investigation for the horizontal directional drill (HDD) between the LNG terminal site and non-federal levee will be completed by Venture Global in 2019. The results of this geotechnical investigation would identify the likelihood of success, quantify the potential for hydraulic fracture, and include measures to minimize risk of HDD complications.

4.1.2 Mineral Resources

No non-fuel mineral resources occur within 0.25 mile of the Project. The nearest non-fuel mineral resources are two active surface river silt borrow pits, both operated by Woodland Borrow Pits, LLC, and which are located approximately 3.0 miles southeast and 5.5 miles northwest of the proposed terminal. No borrow pits were identified along the pipeline system. The Lake Hermitage Dome sulphur mine is located 3.2 miles south of the LNG terminal, but this mine is not currently

in production (USGS, 2017). The outer edge of the Lake Hermitage salt dome is located about 0.9 mile east of the pipeline system (at MP 7.5 of the Southwest Lateral TETCO and MP 10.8 of the Southwest Lateral TGP). An unnamed geothermal prospect is located 3,800 feet south of the proposed Southwest Lateral TETCO temporary meter station at MP 0.0 (USGS, 2017).

Oil and gas production is prevalent throughout Louisiana and the surrounding region. The proposed terminal would be proximate to various oil and gas fields, and the Lake Hermitage, Manilla Village Southeast, Saturday Island, and Bay Batiste oil and gas fields underlie the pipeline system (LDNR, 2017a) (figure B-4, appendix B). Active and producing wells drilled in these fields have depths ranging from 11,900 to 19,000 feet. Based on a review of the LDNR's Strategic Online Natural Resources Information System (SONRIS), there are two plugged and abandoned dry hole wells within the proposed terminal site and three plugged and abandoned former oil and gas wells within the pipeline system construction workspace (LDNR, 2017a). In addition to the aforementioned wells, there are 18 additional plugged and abandoned wells, one permitted well, and two producing wells (currently shut-in for future utility) within 0.25 mile of the Project workspace (LDNR, 2017a) (figure B-5, appendix B). To afford the owner(s) the opportunity to have a representative on-site during construction activities, **we recommend that:**

- **Gator Express Pipeline should provide 72 hours' notice to the owner(s) of producing oil and gas wells located within 0.25 mile from the pipeline workspace in order to allow the owner's representative to be on-site during construction activities.**

The pipeline system crosses state mineral lease SL 707 from MP 10.0 to 11.8 on the Southwest Lateral TGP and lease SL 21423 in the workspaces and meter site immediately surrounding the Southwest Lateral TETCO meter station platform. Venture Global has indicated they would negotiate permanent easement rights and any necessary access restrictions with the lease owners.

4.1.3 Geologic Hazards

Geologic hazards are physical conditions, naturally occurring or induced, that can result in damage to land and structures or injury to people. Such hazards typically include seismicity (e.g., earthquakes, surface faults, soil liquefaction, and tsunamis), subsidence, shoreline erosion, and landslides. Conditions necessary for the development of other geologic hazards, including avalanches, volcanism, and karst terrain, are not present near the LNG terminal or pipeline facilities. In general, the potential for these geologic hazards to markedly affect construction or operation of the proposed terminal and pipeline facilities is low. Geologic hazards present at the terminal facility will be discussed in detail in section 4.12. As such, the following geologic hazards, sections 4.1.3.1 through 4.1.3.4, discuss only the pipeline facilities.

4.1.3.1 Seismicity

The majority of significant seismic events are interplate earthquakes associated with movement between two tectonic plates, either laterally along a transform fault where plates are sliding past each other (such as in California) and rift separation zones, or vertically as one plate is subducted below another (such as in Alaska) where tectonic plates are converging (such as the

New Madrid fault across the Missouri/Tennessee border). Relative to these highly active tectonic regions, Louisiana and the surrounding areas are seismically quiet. Seismic events may also be associated with volcanic activity, which is not present in the southeastern area of the continent, and induced events, such as significant injection of fluids (potentially associated with recent Oklahoma earthquakes) and initial filling of major reservoirs (such as Toledo Bend). Historically, induced seismicity resulted in low-magnitude events.

The 2014 U.S. Geological Survey (USGS) Hazard Mapping Program probabilistic seismic hazard analyses for peak ground acceleration (PGA) expected at the Project, expressed as a factor of gravity (g), indicates a 10 percent probability of exceedance is 0.0184g within a 50-year period and a 2-percent probability of exceedance is 0.0434g within a 50-year period due to seismic events (USGS, 2014). While the probabilistic PGA values are for rock, and the clay, silt, and sand underlying the proposed terminal site would amplify short-period PGAs by a factor of 2, PGAs of less than 0.039g would result in only light perceived shaking and no potential damage, and PGAs of up to 0.092 would result in only moderate perceived shaking and very light potential damage (USGS, 2006). The pipelines would be designed for earthquake ground motions, and it is unlikely they would be affected by the design earthquake(s).

4.1.3.2 Shoreline Erosion and Landslides

The flat topography associated with the pipeline system routes, which remains consistent between the open water and terrestrial transitions, would not be subject to landslide hazards. During construction and operation of the pipeline system, Venture Global would implement measures outlined in its Project-specific Plan and Procedures to minimize shoreline erosion and offsite transport of soil.

4.1.3.3 Land Subsidence and Sea Level Rise

Common causes of ground subsidence include the presence of karst terrain, underground mining, and substantial groundwater or fluid withdrawal. Underground mining poses risks to engineered structures due to the potential for the overlying strata to collapse into the voids formed by the extraction of minerals. While Louisiana and parts of adjoining states are underlain by evaporite rocks at various depths up to 7,000 feet, there are no karst or pseudokarst features proximal to the pipeline facilities (Weary and Doctor, 2014). The closest mining activities occurred at the Lake Hermitage Dome sulphur mine, located east of the pipeline system (USGS, 2017). Therefore, subsidence associated with these activities are not anticipated. Subsidence could occur near the pipeline facilities due to oil and gas extraction. As discussed above, these facilities would be within active oil and gas fields. However, if subsidence does occur, the impacts on the pipeline system are expected to be minor.

4.1.3.4 Flooding/Storm Damage/Tsunamis

FEMA produces flood insurance rate maps for municipalities across the nation. The maps are divided into zones with assigned probabilities of experiencing a flood event during any 1-year period. The 100-year flood represents a river channel water level that, based on an analysis of the historic record, is likely to be equaled or exceeded every 100 years, meaning that there is a 1 percent chance that the water level would be equaled or exceeded in any individual year during

a flood event. The lowest mapped probability of flooding is 0.2 percent, which would have an average flooding recurrence interval of 500 years. Venture Global would raise the elevation of its metering stations to the 500-year flood level to avoid minor flooding.

Venture Global conducted a tsunami hazard evaluation to assess the potential for a tsunami or a seiche (standing wave) to impact the LNG terminal. Due to the low probability of strong seismic events in the Gulf of Mexico, the tsunami hazard associated with seismic activity is low. The primary tsunami hazard for the pipeline system area is associated with submarine landslides. However, occurrences are rare (over 1,000 years between significant events) and estimated wave height from modeled events (less than 13 feet for a 500-year return period) are less than predicted storm surges (Fugro, 2016b). The tsunami hazard is inherently considered because the pipeline system and its ancillary facilities are designed for storm surge and the maximum estimated run-up values from potential tsunamis are substantially less than those from storm surge.

4.1.4 Blasting

Blasting is not expected to be necessary during construction. The Project areas at the LNG terminal site and pipeline system are underlain by unconsolidated sediments to depths greater than the excavation depth needed to construct the proposed facilities. In the event that Venture Global becomes aware of the need for blasting, Venture Global would prepare a Project-specific blasting plan in accordance with state and local regulations for the review and written approval of the Director of the Office of Energy Projects prior to conducting any blasting activities.

4.1.5 Paleontology

The geologic materials in the Project area are generally young (Holocene to late-Pleistocene) and do not have a high potential to contain significant paleontological resources. The LNG terminal and pipeline system facilities would not impact any older underlying geologic formations or the fossils, if any, lay within them. The nearest fossiliferous strata, the Sicily Island Loess and the Peoria Loess, which contain land and freshwater gastropods, freshwater pelecypods, and vertebrate bones, outcrops over 100 miles northwest of the Project area (LGS, 2008). Therefore, construction and operation of the LNG terminal would not likely affect paleontological resources.

4.1.6 Design and Construction of the LNG Terminal and Pipeline System

Discussion on issues such as site grading, foundations, and facility structure and design, including wind design and seismic design, are addressed in section 4.12.

4.1.7 General Impacts and Mitigation

The LNG terminal and associated marine facilities would impact 728.7 acres for construction and 636.5 acres during operation. Existing ground elevations at the terminal site vary between -2 and -5 feet NAVD88. The terminal site would be leveled to an elevation of -2 feet NAVD88 by grading and with the import of fill materials to provide a level platform with sufficient space to safely execute the work. As a result, the LNG terminal would permanently alter the existing geologic conditions at the site. Final grade surfacing and landscape would consist of gravel, asphalt, concrete, topsoil, and grass surface areas. Venture Global would drive precast

concrete piles, steel piles, and/or cast-in-place concrete to support key onshore LNG terminal components and structures. The actual types of piles employed, number, and location of piles would be determined during final design stages following a pile test program. We would anticipate installation of over 2,000 steel and concrete piles to a depth of between elevations -80 and -220 feet NAVD88 but no greater than -240 feet NAVD88. For the marine components of the LNG terminal, Venture Global would install a combination of 72-inch-diameter, 66-inch-diameter, 48-inch-diameter, 36-inch-diameter, and 24-inch-diameter steel piles for the LNG loading docks, MOF, and temporary berthing structures (table 4.6-3). The impact on the existing geologic conditions would be permanent and minor, dependent on the final number and location of piles.

Although there are oil and gas fields under the LNG terminal, active and producing wells drilled in these fields have depths ranging from 11,900 to 19,000 feet. As stated in section 4.1.2, the area has abandoned wells, plugged wells, and producing wells within 0.25 miles of the pipeline system and LNG terminal workspaces. Despite the historic presence of oil and gas wells in the area, we do not anticipate that there would be impacts on mineral resources in the Project area.

Based on the above discussion, and in consideration of Venture Global's proposed mitigation and design criteria, and our recommendation, the pipeline system would not significantly affect or be affected by geological conditions in the area.

4.2 SOILS

4.2.1 Existing Soil Resources

The soils affected by the Project were identified and assessed using various data sources, including digital soils data (e.g., the Soil Survey Geographic [SSURGO] database), published soil surveys for Plaquemines Parish (USDA NRCS, 2000), and additional information about soils and associated land uses from the Official Soil Series Descriptions (Soil Survey Staff, 2016a). The SSURGO database is a digital version of the original county soil surveys developed by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for use with geographic information systems (GIS). It provides the most detailed level of soils information for natural resource planning and management. The attribute data within the SSURGO database provides the proportionate extent of the component soils and their properties for each soil map unit.

4.2.1.1 Soil Types and Limitations

The soils at the terminal site include Cancienne silt loams, Cancienne silty clay loams, Carville, Cancienne, and Schriever soils, Harahan clays, and Westwego clays. These soils have slopes ranging from 0 to 1 percent and do not contain bedrock or other root restrictive layers within 80 inches of the surface. Cancienne silt loams and Cancienne silty clay loams consist of somewhat poorly drained mineral rich soils that formed in silty alluvium on alluvial plains or natural levees. Carville, Cancienne, and Schriever soils consist of somewhat poorly drained mineral rich soil. The Carville component occurs in loamy alluvium on delta plains or natural levees. The Cancienne component occurs in silty alluvium on delta plains or natural levees. The Schriever component occurs on clayey alluvium on backswamps or delta plains. Harahan clays and Westwego clays consist of poorly drained mineral rich soils that formed in nonfluid over fluid clayey alluvium on

backswamps or delta plains. In addition to the five soil map units, the SSURGO database shows portions of the terminal site as “water.” Soil characteristics are not applicable for the water areas, but the acreages are included in impact totals. The terminal site has been extensively ditched and drained, thereby likely altering the natural soil characteristics.

Soils types mapped within the pipeline system footprint consist of Bellpass muck, Clovelly muck, Cancienne silty clay loam, Gentilly muck, Harahan clay, Lafitte muck, Schriever clay, and Westwego clay. Three of the five soil types (Cancienne silty clay loam, Harahan clay, and Westwego clay) found at the terminal site are also found within the construction workspace of the pipeline system. Bellpass muck is a very poorly drained organic soil found in decomposed organic material overlying fluid clayey backswamp deposits on delta plains and marshes. Clovelly muck is a very poorly drained organic and slightly saline soil found in herbaceous organic material over very fluid clayey alluvium on coastal plains and marshes. Gentilly muck is a very poorly drained mineral soil found in thin herbaceous organic material over semifluid clayey over consolidated clayey alluvium on marshes. Lafitte muck is an organic, very poorly drained, and slightly saline soil found in herbaceous organic material on delta plains and marshes. Schriever clay consists of poorly drained mineral soils protected from most flooding by earthen levees, found in clayey alluvium on backswamps and delta plains. In addition to the eight soil map units, the SSURGO database shows portions of the pipeline system as “water.” Soil characteristics are not applicable for these areas, but the acreages are included in impact totals.

The soils within the proposed terminal site and pipeline system were evaluated to identify prime farmland and major soil characteristics that could affect construction or increase the potential for adverse construction-related soil impacts. The soil characteristics evaluated include erosion potential, the potential for compaction, and revegetation concerns. Table 4.2-1 summarizes the amount of prime farmland and soil characteristics within each component of the Project.

4.2.1.2 Prime Farmland Soils

The USDA defines prime farmland as “land that has the best combination of physical and chemical characteristics for producing food, feed fiber, and oilseed crops” (Soil Science Division Staff, 2017). The USDA advised that, since the Project would not receive federal funding, the Project is exempt from the rules and regulations of the Farmland Protection Policy Act – subtitle I of title XV, section 1539-1549. 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, built-up land, and open water cannot be designated as 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., by draining or irrigating). Impacts on prime farmland are of general concern because of the potential for decreases in long-term agricultural productivity.

Table 4.2-1 Characteristics of Soils Associated with the Terminal Site and Pipeline System			
Facility	Prime Farmland ^a	Hydric ^a	Compaction Prone ^b
Terminal Site^c			
Terminal Site, Water & Land-based Marine Facilities, and Adjacent Workspace (does not include 77.0 acres of undisturbed area within the terminal site) ^d	146.4	457.6	625.8
Terminal Site Subtotal^e	146.4	457.6	625.8
Pipeline System			
Southwest Lateral TETCO and Southwest Lateral TGP (Phase I)	6.4	80.4	7.8
Southwest Lateral TETCO (Phase II) ^f	0.1	17.6	0.1
Pipeline System Subtotal	6.5	98.0	7.9
PROJECT TOTAL	152.9	555.6	633.7
Sources: Soil Survey Staff, 2016a, 2016b; USDA NRCS, 2000			
^a As designated by the NRCS.			
^b Includes soils in somewhat poor to very poor drainage classes with surface textures of sandy clay loam and finer.			
^c Terminal workspace includes areas along the federal levee where workspace for the crossing of the levee would be required.			
^d Temporary terminal workspace includes areas located along SH 23 currently used for utilities.			
^e Does not include undisturbed land (77.0 acres) at the terminal site.			
^f Overlapping workspaces are included in the Southwest Lateral TETCO totals.			

Two of the soils at the terminal site are designated as prime farmland: Cancienne silt loam, 0 to 1 percent slopes; and Cancienne silty clay loam, 0 to 1 percent slopes. These soils make up approximately 146.4 acres (20.1 percent) of the soils affected at the terminal site. The portion of the terminal site south of SH 23 was historically used for sugar cane production and has been extensively ditched and drained. Most of the terminal site is currently fallow agricultural land and used for cattle pasture.

Two of the eight soils along the pipeline system are designated as prime farmland: Cancienne silty clay loam, 0 to 1 percent slopes; and Schriever clay, 0 to 1 percent slopes. These soils make up approximately 6.5 acres (0.7 percent) of the soils that would be affected by pipeline system construction and are considered prime farmland under all conditions. None of the soils represent unique farmland or farmland of statewide importance.

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” (Soil Survey Staff, 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. Generally, hydric soils are those soils that are classified as somewhat poorly drained, poorly drained, or very poorly drained.

Due to extended periods of saturation, hydric soils can be prone to compaction and rutting, particularly during the operation of heavy equipment. Compaction can also occur in poorly drained, fine-textured, non-hydric soils when the surface layers are wet. In addition, high groundwater levels associated with hydric soils can create a buoyancy hazard for buried pipelines.

Three of the five soil map units at the terminal site are classified as hydric soils: Carville, Cancienne, and Schriever soils; Harahan clay; and Westwego clay. These soils make up approximately 62.8 percent of the soils affected at the terminal site.

Seven of the eight soils at the pipeline system are classified as hydric soil. The only non-hydric soil is Cancienne silty clay loam, 0 to 1 percent slopes. This soil makes up approximately 98.0 acres (10.4 percent) of the soils that would be affected by construction of the pipeline system.

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 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 are the most susceptible to compaction and rutting.

All five soils at the terminal site are prone to compaction. These soils make up approximately 625.8 acres (98.3 percent) of the soils affected at the terminal site. The remaining 1.7 percent is associated with the marine facility within the Mississippi River.

Four of the eight soils along the pipeline system are prone to compaction: Cancienne silty clay loam, 0 to 1 percent slopes; Harahan clay; Schriever clay, 0 to 1 percent slopes; and Westwego clay. These soils make up approximately 7.9 acres (0.8 percent) of the soils that would be affected by construction of the pipeline system.

4.2.1.5 Erosion

Highly erodible soils at the terminal site and within the construction workspace for the pipeline system were identified based on SSURGO database parameters that are directly related to the susceptibility of a soil to erosion by water or wind. The USDA has developed separate groupings for water and wind erosion because management and construction mitigation techniques used to minimize erosion hazards are different in each case.

For water erosion, attribute data were used that describe the land capability and slope class of each map unit. All map units with a land capability subclass designation of 4e through 8e, and map units with an average slope class greater than or equal to 9 percent, were identified as susceptible to water erosion. Wind erodibility was assessed based on wind erodibility group (WEG) designations. A WEG is a grouping of soils that have similar surface layer properties that affect their resistance to soil blowing. These properties include texture, organic matter content, and aggregate stability. Soils in WEG 1 and WEG 2 include sandy-textured soils with poor aggregation, which are particularly susceptible to wind erosion.

No soils at the terminal site or pipeline system are susceptible to high-water or wind erosion.

4.2.1.6 Revegetation Potential

Successful restoration and revegetation are important for maintaining soil productivity and protecting the underlying soil from potential damage, such as erosion. Droughty soils, which characteristically have a coarse surface texture and are excessively drained or somewhat excessively drained, may prove difficult to revegetate. The drier soils have less water to aid in the germination and establishment of new vegetation. The coarser textured soils also have a lower water holding capacity following precipitation, which could result in moisture deficiencies in the root zone, thereby creating unfavorable conditions for many plants. In addition, steep slopes can make the establishment of vegetation difficult. SSURGO data indicates that no soils at the terminal site or the pipeline system have issues with revegetation.

4.2.1.7 Stony/Rocky Soils

Soils with significant quantities of stones in the surface layer were identified by querying the SSURGO database. Stones may occur within each component soil series that have either: (1) a cobbly, stony, bouldery, shaly, very gravelly, or extremely gravelly modifier to the textural class of the surface layer; or (2) a surface layer for which more than 5 percent of total weight is made up of stones larger than 3 inches.

No soils at the terminal site or the pipeline system overlay stony/rocky soils.

4.2.1.8 Shallow Bedrock

Soils potentially underlain by shallow bedrock were identified by querying the SSURGO database for component soil series that have a bedrock contact listed at 60 inches or less in depth. The Project is not underlain by any such soils exhibiting shallow bedrock.

4.2.2 Soil Contamination

During construction, some potential exists for spills of hazardous materials, such as hydraulic fluid and diesel fuel for vehicles and equipment. In addition, stormwater runoff from the construction workspace could carry unconfined debris or other materials. To address these concerns, Venture Global would adhere to the Project-specific SPCC Plan and SWPPP for construction activities, in accordance with applicable regulations and permit requirements.

4.2.3 General Impacts and Mitigation

4.2.3.1 LNG Terminal

The soil characteristics listed in table 4.2-1 would be of most concern in circumstances where temporary land disturbance occurs and restoration to pre-construction conditions is required. At the terminal site, initial site preparation would require significant soil modifications to soil properties and topography. These modifications would include soil stabilization through the addition of material such as cement or lime, deposition of fill to achieve a ground elevation increase across the majority of the terminal site, and/or the installation of a surface layer to aggregate material to provide a safe and level work surface.

Given the modifications described above, drainage issues associated with hydric soils and erosion issues would not occur. With respect to soil compaction, readily compactible soils are favored around facility foundations and piles.

During construction disturbance, when surface topography is altered and subsurface soil may be left exposed, heightened erosion and sedimentation concerns are associated with potential stormwater runoff. The Project would address these concerns by adherence to the Project-specific Plan and Procedures, Louisiana Pollutant Discharge Elimination System (LPDES) Stormwater Construction General Permit requirements, and an SWPPP for construction activities at the terminal site.

To reduce impacts of construction on soils, Venture Global would implement measures outlined in its Project-specific Plan and Procedures, which include measures to control erosion and sedimentation during construction and to ensure proper restoration of disturbed areas following construction. Relevant mitigation measures specified in the Project-specific Plan and Procedures include:

- sediment barriers would be installed before ground-disturbing activities are initiated to prevent sediment flow from construction areas into waterbodies, wetlands, and roads;
- temporary erosion control measures (e.g., temporary slope breakers and mulch) would be installed during construction;

- permanent erosion control measures would be maintained following construction;
- erosion control fabric would be placed at dike and drainage swale outlets and adjacent to roads and waterbodies, as necessary;
- dust suppression, via water application, would be used, as necessary, to control and minimize wind erosion;
- during periods of heavy rainfall or unusual soil saturation, rutting, and compaction would be avoided, to the extent practicable, by utilizing low-ground weight construction equipment and/or timber mats; and
- an EI would monitor field conditions daily to ensure that the erosion and sedimentation control measures are functional and adequate until the construction workspace is fully stabilized.

The majority of soil disturbed within the terminal site and associated facilities and workspaces would be permanently impacted from the construction of paved or gravel plant roads, or occupied by aboveground facilities and workspaces. The permanent footprint totals 625.8 acres of land and 10.7 acres within the Mississippi River. The remaining 92.2 acres within the terminal site and associated facilities and workspaces consist of temporary workspaces.

To prevent contamination of soils within nearby wetlands, waterbodies, and other sensitive resources during construction, Venture Global has stated that it would implement its Spill Prevention Plan during construction and its SPCC Plan during operation of the LNG terminal. These plans would outline potential sources of releases at the site, measures to prevent a release to the environment, and initial responses in the event of a spill.

Given the impact minimization and mitigation measures described above, impacts on soils due to construction and operation of the terminal site would be permanent, but minor.

4.2.3.2 Pipeline System

As shown in table 4.2-1, construction and operation of the pipeline system would affect prime farmland, hydric, and compaction prone soils.

Pipeline construction activities that have the potential to affect soil structure and revegetation potential include clearing (brush hogging or mowing), topsoil removal, grading, trenching, backfilling, and restoration. Potential soil impacts include: loss to soil due to water or wind erosion, especially on steep slopes (greater than 9 percent) or fine sandy soils; reduction of soil quality by mixing topsoil with subsoil; soil compaction due to traffic by heavy construction equipment; and disruption of surface and subsurface drainage systems. Most construction disturbance within pipeline rights-of-way is considered temporary in nature, and the general approach is to restore pre-construction conditions, to the extent practicable. However, the presence of certain soil conditions (e.g., droughty soils) can compromise vegetation.

Three of the soil types mapped within the pipeline system construction workspace are also represented at the terminal site. Thus, the same soil characteristics (hydric soils, compaction, and

water erosion) that were discussed in section 4.2.1 also bear consideration for construction of the pipeline system. However, given the temporary nature of disturbance and the intent to restore to pre-construction conditions, to the extent practicable, these soil characteristics have greater relevance for the selection of construction techniques and mitigation measures for the pipeline system than for the LNG terminal.

As described in section 2.5.5.4 and appendix C, Venture Global has developed a Project-specific Plan that includes some modifications to our Plan. Those proposed modifications that are substantive and for which we have determined Venture Global provided adequate justification are listed in appendix C, table 1. One of those proposed modifications is to Section IV.F.3.c of our Plan that requires the installation of sediment barriers along the edge of work areas where wetlands or waterbodies are adjacent to and downslope to prevent sediment flow into the wetland or waterbody. Venture Global states that although the soils in the Project area are of a type that tend to slough when stacked, the terrain has limited elevation changes and yields few downslopes. Venture Global contends that the workspace width (130 feet) is sufficient to limit sediment migration laterally off the construction right-of-way. As a result, Venture Global proposes to only sediment barriers, as practicable, at upland and wetland/waterbody interfaces within the construction right-of-way.

FERC accepts that this proposed alternative measure will achieve a comparable level of mitigation to the FERC Plan that requires the installation of these sediment barriers as necessary to prevent sediment flow into a wetland or waterbody. In the Project-specific Plan, Venture Global has committed that its EIs will ensure erosion control devices are installed to prevent sediment flow into sensitive environmental areas, such as wetlands.

Soil impacts would be minimized through the implementation of the measures outlined in the Project-specific Plan and Procedures. Further, Venture Global would implement its SPCC Plan to reduce potential impacts on soils from spills of hazardous materials used during construction and operation. We have reviewed the SPCC Plan and the Plan and Procedures and found them to be acceptable. Given the impact minimization measures described in these plans, impacts on soils due to construction and operation of the pipeline system would be permanent, but minor.

4.3 WATER RESOURCES

The Project would be located in the Mississippi Alluvial Plain Deltaic Coastal Marshes and Barrier Islands Ecoregion (Daigle, 2006). In general, this ecoregion is a flat deltaic and coastal plain with fresh water and saline marshes, rivers, lakes, bayous, tidal channels, canals, and barrier islands. The geology of this area generally consists of alluvial, deltaic, interdeltaic, coastal, and shallow marine sediments of sand, silt, and clay of comparatively high organic content, including peat deposits in places. The sand and clay layers are stratified, with the sand layers bearing water and the clay acting as confining layers.

4.3.1 Groundwater Resources

Groundwater within Plaquemines Parish primarily consists of salt water with various concentrations of dissolved salts (Ayrer, 2013; USGS, 2013a). Limited freshwater (water with a

chloride concentration of 250 milligrams per liter or less) may be available in the shallow aquifer system that contains point bar deposits and natural levees adjacent to the Mississippi River and that are recharged by the Mississippi River (USGS, 2013a). The deep aquifer system is an extension of the New Orleans aquifer system, which extends from Iberville Parish east to the eastern portion of Orleans Parish and south to the Gulf of Mexico (Ayrer, 2013; USGS, 1989).

Point bar deposits in the shallow aquifer system, which may contain limited amounts of fresh water, consist of sand deposits that are hydraulically connected to the Mississippi River and subject to infiltration of water from the river. There are no known wells screened in these deposits within Plaquemines Parish from the state well registration records; however, wells drilled to 50 to 100 feet deep in point bar deposits in neighboring Orleans Parish have yielded small to moderate quantities of water (USGS, 2013a). In Orleans Parish, water from the point bar deposits is of poor quality due to high iron concentration and very high hardness (USGS, 2013a), both of which can contribute to problems with water collection and distribution systems.

As stated above, the deep aquifers beneath Plaquemines Parish are an extension of the New Orleans aquifer system. The New Orleans aquifer system includes four major aquifers: Gramercy aquifer; Norco aquifer; Gonzales-New Orleans aquifer; and the “1,200-foot” aquifer. These aquifers were formed by deposition of alternating beds of sands and clays that both thicken and dip southward (Ayrer, 2013). The alternating beds of sand function as aquifers, and the beds of clay are confining units between aquifers. The confining layers between the surficial deposits and the underlying aquifers gradually thicken southward, and the underlying aquifers become more deeply buried (USGS, 1989).

According to USGS Water Resources Technical Report No. 46, the Gramercy and Norco aquifers pinch out to the west of the terminal site. In the Project vicinity, the Gramercy aquifer is located approximately 200 to 300 feet below the surface (USGS, 2013a).

Water within the Gramercy and Norco aquifers underlying Plaquemines Parish is moderately saline, and withdrawal from the Gramercy aquifer accounts for less than 1 percent of the total withdrawals in the parish (USGS, 2013a). Limited transmissivity data suggest that the Gramercy aquifer, Norco aquifer, Gonzales-New Orleans aquifer, and the “1,200-foot” aquifer will each have a transmissivity values greater than 10,000 square feet per day at the terminal site. Aquifers with similar transmissivity values can typically yield greater than 300 gallons per minute from properly constructed supply wells.

4.3.1.1 Sole Source Aquifers

Sole source aquifers are designated by the EPA as aquifers that supply 50 percent or more of the drinking water for an area, and for which there are no other reasonably available alternative sources should the aquifer become contaminated (EPA, 2017a). There are no designated sole source aquifers in Plaquemines Parish. The closest sole source aquifers are the Southern Hills Regional aquifer and the Chicot aquifer. The Southern Hills Regional aquifer system is located in eastern Louisiana and south Mississippi, with the southern edge of the aquifer system located more than 50 miles from the Project. The Chicot aquifer is located in southwest Louisiana with the eastern edge more than 100 miles west of the Project area (EPA, 2017a).

4.3.1.2 Water Supply Wells

Louisiana's Wellhead Protection Program is a component of the LDEQ's Drinking Water Protection Program and is designed to protect the quality of public drinking water supplies obtained from community water wells. The LDEQ delineates a drinking water protection area around each well, ranging from a 1,000-foot radius to a 1-mile radius, depending on well screen depth, construction date, or aquifer sources. The Project does not traverse any drinking water protection areas for groundwater wells.

A review of the publicly available well location data available in SONRIS (LDNR, 2017b) indicated that there are no active public water supply wells within 1 mile of the Project. There is one private well documented within 1 mile of the Project. The well is located approximately 1 mile east of the terminal site on the east bank of the Mississippi River. According to the data available in SONRIS (LDNR, 2017b), the well was drilled to a depth of 30 feet and is listed as an active domestic well. Due to the distance from the terminal site, and the fact that the shallow well (approximately 30 feet) is on the opposite bank of the Mississippi River, no short-term or long-term impacts are anticipated on groundwater in the vicinity of the well.

No wells are documented within 1 mile of the pipeline system. There are three wells approximately 1.5 miles east of the pipeline system near the south end of Lake Hermitage Road. These wells, two domestic supply wells and one commercial public supply well, are reported to be between 410 feet and 450 feet deep (LDNR, 2017b). Two of these wells are reported to be in the Gramercy aquifer.

In addition to the publicly available well data, Venture Global identified an artesian well within the eastern workspace for the terminal. This well would be capped and abandoned during construction.

4.3.1.3 Contaminated Groundwater

The LDEQ runs an Aquifer Sampling and Assessment Program to monitor the quality of groundwater produced in Louisiana's major freshwater aquifers. The program samples about 200 wells across 14 aquifers every 3 years and presents the results in a triennial report. The aquifers in Plaquemines Parish are not included in the program, likely because the aquifers in Plaquemines Parish are primarily saline.

Under the Federal Safe Drinking Water Act, the EPA has established the Primary Maximum Contaminant Level (MCL) for pollutants that may pose a health risk in public drinking water. Secondary MCLs have also been set by the EPA, but are defined as non-enforceable guidelines for taste, odor, or appearance. As stated above, groundwater is not a significant source of drinking water in Plaquemines Parish, and the aquifers in Plaquemines Parish are not part of the LDEQ Aquifer Sampling and Assessment Program. Therefore, data regarding aquifer contamination is limited.

Prior land use activities at the terminal site is understood to be agricultural in nature. Venture Global conducted a Phase I Environmental Site Assessment at the terminal site that included a review of federal, state, and local databases. No potential sources of groundwater contamination were identified at or near the terminal site, and no known groundwater

contamination was identified at or near the terminal site. Additionally, Venture Global conducted 86 geotechnical borings at the terminal site. Although samples for contaminant analysis were not collected, Venture Global did not observe any physical evidence (e.g., odor, sheen) of contamination while conducting the geotechnical study.

4.3.1.4 Groundwater Impacts and Mitigation

Excavation

The majority of the construction activities associated with the LNG terminal and pipeline system would involve shallow, temporary, and localized excavation, with the exception of concrete and/or steel piles at the LNG terminal. Shallow aquifers could sustain minor, indirect impacts from changes in overland water flow and recharge caused by clearing and grading of the work areas. In addition, near-surface soil compaction caused by heavy construction vehicles could reduce the soil's ability to absorb water. During construction of the Project, local water table elevation could be affected by excavation and backfill. In areas where groundwater is near the surface, excavation may intersect the water table in low-lying areas.

Venture Global anticipates that surface water would be appropriated from the adjacent drainage canal to be utilized for hydrostatic testing of the LNG storage tanks, piping, and non LNG tanks. A new well or wells may be drilled at the LNG terminal site to supply water for use during operation of the LNG terminal. If groundwater wells are to be installed, Venture Global anticipates that the Gramercy aquifer, Norco aquifer, Gonzales-New Orleans aquifer, and/or the "1,200-foot" aquifer could yield sufficient quantities of water to satisfy the LNG terminal's needs without adverse impact. Supply wells would penetrate the targeted aquifer, and one or more wells would produce up to a total of 600 gallons per minute for treatment and use. These aquifers would not be adversely affected by the withdrawal of this quantity of water, this information would not be adversely affected by the withdrawal of this quantity of water.

Venture Global would install thousands of steel or concrete piles to support the LNG terminal and marine facilities, which would be driven to depths from -80 feet to -220 feet NAVD88. The proposed piles would be driven to a depth above the confined aquifer underlying the Project area. In addition, the proposed pile driving would not penetrate any aquifers supporting area wells.

Approximately 615 12-inch piles would be required to support the meter stations associated with the pipeline; however, due to the relatively small size of these facilities, these piles would be significantly shallower than the piles required for the LNG terminal. Therefore, we expect that the pile driving associated with the meter stations would not have a significant impact on groundwater.

Contamination

Shallow groundwater areas could be vulnerable to contamination caused by inadvertent surface spills of hazardous materials used during construction and operation of the LNG terminal and pipeline system. Accidental spills and leaks of hazardous materials associated with equipment trailers, the refueling or maintenance of vehicles, and the storage of fuel, oil, and other fluids pose the greatest risk to groundwater resources. If not cleaned up, contaminated soil could continue to leach and add pollutants to groundwater long after a spill has occurred.

Venture Global prepared a Project-specific SPCC Plan for both the terminal and the pipeline. We have reviewed the plan and found it acceptable. Implementation of the Project-specific Plan and Procedures and SPCC Plan would minimize the potential for groundwater impacts associated with an inadvertent spill of hazardous materials during construction and operation. These plans identify preventive measures to reduce the likelihood of a spill and also specify measures to contain and clean up a spill should one occur. In addition, these plans address the storage and transfer of hazardous materials and petroleum products.

Groundwater Withdrawals

The Project would require fresh water during the construction at the terminal site. Venture Global proposes to appropriate surface water from a drainage canal located along the southern edge of the terminal property for hydrostatic testing of the LNG tanks (26,200,000 gallons), plant piping, and non-LNG storage tanks. Table 4.3-1 presents the anticipated water usage during LNG terminal construction.

Table 4.3-1 Estimated Water Usage During LNG Terminal Construction		
Water Source	Use	Quantity (gallons)
Plaquemines Parish Water District or groundwater well	Personal and sanitary consumption	6,000,000
	Concrete production, dust suppression, miscellaneous construction uses	11,200,000
Surface water	Hydrostatic testing of LNG tanks	26,200,000
	Hydrostatic testing of piping and non-LNG storage tanks	50,000

As stated above, limited transmissivity data suggest that the Gramercy aquifer, Norco aquifer, Gonzales-New Orleans aquifer, and the “1,200-foot” aquifer will each have a transmissivity values greater than 10,000 square feet per day at the terminal site. Aquifers with similar transmissivity values can typically yield greater than 300 gallons per minute for properly constructed supply well. If new supply wells were to be installed at the terminal site, one or more wells would be installed in the targeted aquifer to produce 600 gallons per minute for treatment and use. Since groundwater is not a significant source of industrial or potable water in Plaquemines Parish, the groundwater withdrawals associated with terminal construction would not have a significant effect on groundwater in the region.

Water necessary for construction of the pipeline system would primarily consist of water for drilling mud (HDD make-up water) and water needed for hydrostatic testing of the pipeline system. Venture Global plans to utilize surface water as the source for hydrostatic testing pipeline construction needs (see section 4.3.2.2).

No wells in the immediate Project area are used for public or private use. No known contaminated sites exist near the Project. Excavations and pile driving are not expected to penetrate to the depth of the deeper aquifers in the Project area. The majority of the water required

would be obtained from surface waters. Venture Global would implement its SPCC Plan during construction, which contains measures to minimize the potential for spills to occur and clean-up procedures in the event of a release of fuels or hazardous materials. Therefore, we conclude that the Project would not have a significant impact on groundwater resources in the Project area.

4.3.2 Surface Water

Water quality standards are developed by states to enhance or maintain water quality, protect the public health and welfare, and provide for the designated uses of the waters of the state. In Louisiana, the surface water quality standards are codified in LAC 33:IX.11.

The LDEQ reports on water quality in the state by basin subsegment, which is a discrete hydrologic unit or watershed (LDEQ, 2014). Subsegments describe the primary waterbody within the watershed; however, the water quality standards and criteria apply to all tributaries and connected waterbodies within the boundaries of a subsegment. There are seven designated uses established for surface waters in Louisiana, including:

1. **Primary Contact Recreation:** Any recreational or other water contact use involving prolonged or regular full-body contact with the water and in which the probability of ingesting appreciable amounts of water is considerable;
2. **Secondary Contact Recreation:** Any recreational or other water contact activity in which prolonged or regular full-body contact with the water is either incidental or accidental and the probability of ingesting appreciable amounts of water is minimal;
3. **Fish and Wildlife Propagation:** The use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment;
4. **Drinking Water Supply:** The use of water for human consumption and general household use;
5. **Oyster Propagation:** The use of water to maintain the biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected;
6. **Agricultural:** The use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption; and
7. **Outstanding Natural Resource Waters:** Waterbodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes.

Table 4.3-2 presents the basins where the LNG terminal and pipeline system are located, as well as the LDEQ-designated uses for each basin.

4.3.2.1 Existing Surface Water Resources

The USGS uses a national standard hierarchical system to categorize surface water resources of the United States into hydrologic unit codes (HUCs). Based on this tiered system, the United States is divided and sub-divided into successively smaller hydrologic units that are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged or nested within each other, from the largest geographic area (regions) to the smallest geographic are (cataloging units). The Project would be located in HUC Region 08 – Lower Mississippi and HUC Sub-region 0809 – The Mississippi River below the Bonnet Carre Floodway. With the only exception being the LNG terminal berths, the Project would be within HUC Accounting Unit 080903 – Central Louisiana Coastal and would be divided between HUC Cataloging Units 08090301 – East Central Louisiana Coastal and 08090302 – West Central Louisiana Coastal. The LNG terminal berths would be located within HUC Accounting Unit 080901 – Mississippi Delta Louisiana and HUC Cataloging Unit 08090100 – New Orleans. These watersheds encompass the Mississippi River, agricultural lands, interconnected wetlands, drainage ditches, man-made channels, fresh and brackish marshes, and open water.

The Mississippi River serves as the primary source of drinking water for the parish (USGS, 2013a), and there are five public drinking water intakes on the River. Two of the intakes are upstream of the LNG terminal: Dalcour intake (25 miles upstream) and Belle Chasse (20 miles upstream). The other three intakes are downstream from the terminal site: Pointe à la Hache and Port Sulphur (both 4 miles downstream) and Boothville intake (35 miles downstream). The Pointe à la Hache intake is on the east bank of the Mississippi River, and the Port Sulphur and Boothville intakes are on the west bank of the Mississippi River. Water from the Mississippi River is high in mineral content (hardness) but, generally, does not exceed the EPA Secondary Maximum Contaminant Levels for drinking water (USGS, 2013a). The portion of the terminal site located within the Mississippi River batture is within the Source Water Protection Area for the Pointe à la Hache water system and the Port Sulphur Water District.

In periods of low flow, the Mississippi River, both at and upstream of the terminal site, is subject to saline water intrusion, where dense, salty water (exceeding the secondary drinking water standard of 500 milligrams per liter (mg/L) total dissolved solids and 250 mg/L chlorides) moves upriver toward New Orleans. Because salt water has a greater density than fresh water, it moves upstream in the form of a wedge in the lower portion of the water column. A highly stratified wedge is common within deep rivers with high freshwater flows, such as the Mississippi River. The leading edge, or “toe,” of the saltwater wedge is well defined. When freshwater flows increase or decrease, the saltwater wedge retreats downstream or advances upstream, respectively.

LNG Terminal

The terminal site is located adjacent to the Mississippi River, with the terminal berthing areas located in the Mississippi River. The terminal would have 7,000 feet of river frontage armored with rip-rap and a concrete revetment mattress to minimize erosion. At the terminal site, the Mississippi River is approximately 2,500 feet wide, and the federal navigation channel width ranges from 1,700 feet (River Mile Marker 54) to 1,900 feet (River Mile Marker 55). The federal channel depth is authorized to -55 feet Mean Low Gulf and maintained to a depth of -45 feet Mean Low Gulf. The LDEQ has established four designated uses for the Mississippi River at the

terminal site: primary contact recreation; secondary contact recreation; fish and wildlife propagation; and drinking water supply (table 4.3-2). Based on the numerical criteria established for these designated uses, water quality in the Mississippi River at the terminal site fully supports all four designated uses (LDEQ, 2018a). In addition to the Mississippi River, the terminal site is transected by a series of man-made interconnected drainage ditches (table 4.3-3 and, figure B-6 in appendix B). These drainage ditches are part of a larger system of levees and drainage canals that were constructed to create over 5,000 acres of fastlands that prevent flooding and facilitate agricultural use of the area. The drainage ditches connect to a series of canals that convey runoff from the terminal site generally eastward to a pumping station adjacent to Lake Judge Perez, approximately 2 miles east of the terminal site.

Table 4.3-2 Designated Uses for Waterbodies Within the Project Area				
Subsegment Name (Subsegment No.)/ Description	Project Component within Basin Subsegment	Milepost	Designated Use ^a	Water Quality Impairment
Barataria Basin				
Barataria Bay (021101)/Caminada Bay, Hackberry Bay, Bay Batiste, and Bay Long	Pipeline System Barge Access Channels	0.0-1.8 NA	A, B, C, E	None
Wilkinson Canal and Wilkinson Bayou (020904)/Wilkinson Canal and Wilkinson Bayou	Pipeline System Barge Access Channels	1.8 to 10.8 NA	A, B, C, E ^b	Fecal Coliform
Bay Sansbois, Lake Judge Perez, and Bay De La Cheniere (020907)/Bay Sansbois, Lake Judge Perez, Lake Five, Oaks Bayou, Lake Laurier, and Bay De La Cheniere	Terminal Site Barge Access Channels Pipeline System	NA NA 10.8 to 15.1	A, B, C, E	None
Mississippi Basin				
Mississippi River (070301)/Monte Sano Bayou to Head of Passes	Terminal Site	NA	A, B, C, D	None
a Louisiana State Water Quality Classifications (LDEQ, 2018a) designated uses include: A = Primary Contact Recreation B = Secondary Contact Recreation C = Fish and Wildlife Propagation D = Drinking Water Supply E = Oyster Propagation b Designated use is not fully supported due to fecal coliform impairment.				

Table 4.3-3 LNG Terminal Site Waterbodies						
Waterbody	Flow Regime	Description	Acres within Terminal Site	Acres of Permanent Fill	Acres of Permanent Modification Other than Fill	Acres of Temporary Impacts
LNG Terminal						
WB001	Perennial	Man-made Canal	1.9	0.0	0.0	0.0
WB002	Intermittent	Man-made Ditch	0.3	0.3	NA	NA
WB003	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB004	Intermittent	Man-made Ditch	0.2	0.2	NA	NA
WB005	Perennial	Man-made Canal	3.1	3.1	NA	NA
WB006	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB007	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB008	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB009	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB010	Intermittent	Man-made Ditch	0.2	0.2	NA	NA
WB011	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB012	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB013	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB014	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB015	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB016	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB017	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB018	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB019	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB020	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB021	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB022	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB023	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB024	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB025	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB026	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB027	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB028	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB029	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB030	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB031	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB032	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA

Table 4.3-3 LNG Terminal Site Waterbodies						
Waterbody	Flow Regime	Description	Acres within Terminal Site	Acres of Permanent Fill	Acres of Permanent Modification Other than Fill	Acres of Temporary Impacts
WB033	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB034	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB035	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB036	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB037	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB038	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB039	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB040	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB041	Ephemeral	Man-made Ditch	0.9	0.9	NA	NA
WB042	Perennial	Mississippi River	87.3	0.0	14.6	72.7
WB043	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB044	Ephemeral	Man-made Ditch	0.3	0.3	NA	NA
WB045	Perennial	Man-made Ditch	2.6	0.0	0.2	1.1
Eastern Workspace						
WB101	Perennial	Man-made Canal	>0.1	0.0	0.0	0.0
WB102	Perennial	Man-made Canal	0.6	0.0	0.0	0.0
WB103	Perennial	Man-made Canal	2.6	0.0	1.2	0.0
WB104	Perennial	Man-made Canal	<0.1	<0.1	NA	NA
WB105	Ephemeral	Man-made Ditch	0.2	0.2	NA	NA
WB106	Ephemeral	Man-made Ditch	0.4	0.3	0.0	0.0
Sources: SWCA, 2015; Venture Global, 2017						

Pipeline System

The pipeline system and barge access channels traverse wetlands, canals, and estuarine open waters within the Barataria Basin (figure B-6 in appendix B). The Barataria Basin lies in the eastern coastal region of Louisiana and is bounded to the north and east by the Mississippi River, to the west by Bayou Lafourche, and to the south by the Gulf of Mexico. The basin is approximately 120 miles long and ranges from 24 to 35 miles wide. Major features include natural and artificial levees, a central marsh landmass, and a chain of barrier islands. Elevations range from -2 feet to 4 feet above sea level. The USACE maintains several navigation channels in the basin, which include: the Barataria Bay Waterway; the Gulf Intracoastal Waterway; and the Empire-Gulf Waterway. Freshwater and sediment inputs into the Barataria Basin have been diminished by the construction of levees along the Mississippi River and the closure of Bayou Lafourche at Donaldsonville, Louisiana. The main source of freshwater for the basin is rainfall.

As presented in table 4.3-4, the pipeline system traverses the following LDEQ watershed subsegments within the Barataria Basin: Barataria Bay; Wilkinson Canal and Wilkinson Bayou; and Bay Sanbois, Lake Judge Perez, and Bay de la Cheniere (LDEQ, 2018a). The designated uses established for all three of these subsegments are primary contact recreation, secondary contact recreation, fish and wildlife propagation, and oyster propagation. Two of the three subsegments fully support all four functions. Wilkinson Canal and Wilkinson Bayou do not fully support oyster propagation due the presence of fecal coliform, but support the other three designated uses.

The pipeline system crosses approximately 12.1 miles of open water habitat. Table 4.3-4 presents the waterbodies traversed by the pipeline, aboveground facilities, and barge access channels (figure B-6 in appendix B). The table includes mileposts, description, type, and crossing method.

Table 4.3-4 Waterbodies Affected by the Pipeline System					
Waterbody^a	Crossing Length (feet)	TGP Milepost	Description	Type	Crossing Method/ Facility/Access Channel
WBB000	14,784	0.0 to 2.8	Bay Batiste	Open Water	Barge Lay
WBB000	7,920	2.8 to 4.3	Wilkinson Bayou	Open Water	Barge Lay
WBB000	23,232	4.3 to 8.7 ^b	Wilkinson Bay/North Wilkinson Bay	Open Water	Barge Lay
WBB000	8,448	9.2 ^b to 10.8	Raquette Bay	Open Water	Barge Lay
WBB000	2,640	10.8 to 11.3	Wilkinson Bayou	Open Water	Barge Lay
WBB000	232	11.4 to 11.5	Hermitage Bayou	Open Water	Push/Pull
WBB000	430	11.7 to 12.1	Bayou Tambor	Open Water	Push/Pull
WBB000	220	12.2 to 12.3	Bayou Tambor	Open Water	Push/Pull
WBB000	1,120	12.4 to 12.6	Bayou Tambor	Open Water	Push/Pull
WBB000	7,920	12.7 to 14.2	Mix of unnamed channels, wetlands ^c , and open water	Open Water/Wetland ^c	Push/Pull
WBB016	20	14.5 to 14.5	Unnamed Channel	Perennial Stream	Pipe Bridge
WBA056	26	14.8 to 14.8	Unnamed Channel	Perennial Stream	HDD
Aboveground Facilities					
WBB000	NA	0.0	Bay Batiste	Open Water	TGP Meter Station
WBB000	NA	3.3	Wilkinson Bayou	Open Water	TETCO Meter Station
Barge Access Channels					
WBB000	25,280	NA	Bayou St. Denis and Barataria Bay	Open Water	Barge Access Channel 1
WBB000	56,705	NA	Barataria Bay, Wilkinson Canal, Oaks Bayou, Lake Laurier, Wilkinson Bayou	Open Water	Barge Access Channel 2
WBB000	17,215	NA	Barataria Bay, Bay Batiste	Open Water	Barge Access Channel 3
a Field surveys conducted by Venture Global label all waters between TGP MP 00 and MP 14.8 as WBB000. This area is a mosaic of open water and wetlands. For the purposes of this table, we have sub-divided waterbody WBB000 to describe the named waterbodies traversed by the Project. The wetland portions of this area are discussed in section 4.4.1. b The saturated marsh between MP 8.7 and MP 9.2 will also be crossed via barge lay as the soils are too saturated to support push lay equipment. c The wetlands are discussed in section 4.4.1.					

Venture Global has indicated that the channel depth for five portions of the barge access channels, totaling 9.1 miles, is not sufficient to allow for delivery of pipe and equipment to the pipeline construction right-of-way. These areas would require dredging to facilitate access from the Intracoastal Waterway via Barataria Bay and Wilkinson Canal. Venture Global proposes dredging, with a mix of excavation and wheel washing (propeller wash agitation), to achieve the necessary channel depth. Table 4.3-5 presents the proposed dredging areas, types of dredging, and dredging impacts.

Table 4.3-5 Pipeline System Barge Access Channel Dredging Impacts					
Segment	Waterbody Name	Wheel Washing (linear feet)	Excavation (linear feet)	Total Length (linear feet)	Area of Disturbance (acres)
Barge Channel 1	Barataria Bay	1,200	11,913	13,113	86.3
Barge Channel 2					
Segment A	Barataria Bay	200	7,070	6,870	48.1
Segment B	Wilkinson Canal	1,095	550	1,095 ^a	7.5
Segment C	Lake Laurier	875	9,724	10,399 ^a	66.8
Barge Channel 3	Barataria Bay	6,688	9,870	16,538	113.9
Total		10,058	38,727	48,015	322.6
^a Total length is not a sum of the wheel washing linear feet and the linear feet of excavation due to overlapping areas where wheel washing and excavation are both proposed.					

4.3.2.2 Surface Water Impacts and Mitigation

Impacts on surface waters resulting from construction and operation of the LNG terminal and pipeline system and the measures proposed to avoid or minimize impacts on surface waters are described below.

LNG Terminal

Table 4.3-3 describes the surface waters that would be affected as a result of construction and operation of the LNG terminal. Potential impacts on surface waters during construction and operation of the LNG terminal are associated with construction of the LNG ship berthing facilities, vessel traffic, site modification and stormwater runoff, hydrostatic testing, and spills or leaks of hazardous materials. Venture Global does not propose any dredging of the berthing facilities, as the maintained depth and width of the Mississippi River is sufficient for LNG vessel operation.

Construction of the LNG Loading Docks and Ship Berthing Facilities

Construction of the LNG loading docks and ship berthing facilities would be conducted in two phases. Phase I would consist of construction of three temporary marine delivery facilities and two of the three LNG loading docks. Phase II would consist of constructing the last LNG

loading dock, removal of the temporary marine delivery facilities, and restoration of the area affected by the temporary marine delivery facilities.

The marine facilities would consist of a LNG loading docks, MOF, and two temporary berths (east and west). The number and size of piles required for each facility are shown in table 4.6-3. The MOF would consist of a concrete platform supported by large-diameter steel piles. Each of the three LNG loading docks would feature a concrete platform that would be constructed on steel piles, four breasting dolphins, and six mooring dolphins. The proposed marine facilities would occupy a portion of the approximately 7,000 feet of river frontage. The LNG loading docks and temporary marine delivery facilities (bulk carrier mooring facility, barge mooring facility, and MOF) would occupy an approximately 14.6-acre footprint in the river channel and in wetlands along the river bank. The loading docks would be connected to shore by pipe and access trestles. A separate jetty substation, located on steel piles, would provide electricity to the loading docks. Land-based access for each dock would be via a staircase, supported by a concrete and compacted fill base.

Construction of the LNG loading and ship berthing facilities would require over-water and land-based equipment installation (e.g., LNG loading platform, pipe and roadway trestle, marine gangway). A combination of conventional in-water marine construction equipment (e.g., barges, cranes, pile driving equipment) and shore-based construction equipment (e.g., backhoes, bulldozers) would be used to install the LNG loading docks, pilings, and over-water structures. Construction of the marine facilities would require temporary workspace within the river channel for anchoring of construction vessels, specifically barge mounted cranes for installation of the piles.

Construction of the LNG loading and ship berthing facilities would result in localized, temporary increases in turbidity and suspended sediment levels in the Mississippi River due to excavation and pile driving. However, these impacts are expected to be temporary (i.e., confined primarily to the period of in-water activity and shortly thereafter) and limited to the area within and immediately adjacent to the LNG loading and ship berthing facilities. No long-term or permanent water quality impacts are anticipated because there is no dredging required at the terminal.

Venture Global is required to obtain several permits that would address placement of the LNG terminal marine structures within the Mississippi River, including permits under section 404 of the CWA and sections 10 and 14 of the RHA of 1899 from the USACE. In June 2017, two Joint Permit Applications (JPAs) were submitted to the USACE and the LDNR; one for the LNG terminal and one for the pipeline system. These applications were submitted under sections 404 and 401 of the CWA, sections 10 and 14 of the RHA, and the Coastal Use Permit regulations. Revised applications were submitted in July 2016. In September 2017, a JPA was submitted to the USACE that combined the applications for the terminal and the pipeline. Venture Global received the section 401 Water Quality Certification from the LDNR for the LNG terminal and pipeline system on October 1, 2018. Venture Global anticipates receipt of the USACE permits in July 2019.

Vessel Traffic

Shoreline Erosion and Resuspension

The portion of the Mississippi River where the marine facilities are proposed has been modified by placement of rip-rap and a concrete revetment mattress along the river bank. These modifications are designed to minimize shoreline erosion along this major shipping lane. To minimize impacts on the existing revetment, Venture Global would repair any damage to rip-rap and concrete revetment mattress resulting from marine facility installation in accordance with necessary permit requirements; however, Venture Global is not proposing additional placement of rip-rap or revetment structures within the terminal marine facilities as the shoreline is already armored. Due to the previous armoring and Venture Global's commitment to repair or replace rip-rap and concrete revetment mattress, the new facilities would not result in additional erosion of the river bank.

To minimize erosion and sedimentation impacts on surface waters during construction, Venture Global would conduct land-disturbing activities in compliance with the LPDES program (Construction General Permit for storm water discharges and a Project-specific SWPPP), as required under the CWA and Louisiana law. Venture Global would install erosion control devices after initial clearing, but before soil disturbance, and maintain all erosion control devices in accordance with applicable permit conditions until restoration or surface stabilization is complete. Temporary erosion and sediment control devices and measures may include sediment barriers, storm water diversions, trench breakers, mulch applications, and revegetation.

The Mississippi River is maintained by the USACE to provide deep water access for maritime commerce. Ships calling on the LNG terminal during operations would be similar in nature to other existing ship traffic along this portion of the Mississippi River. LNG carriers transiting the Gulf of Mexico would use established shipping channels. As such, use of the waterways by LNG carriers, barges, and support vessels during construction and operation of the LNG terminal would be consistent with the planned purpose and use of active shipping channels, and associated impacts on water quality within the shipping channel would be minor.

Ballast Water Discharge

LNG carriers serving the LNG terminal would likely arrive with empty cargo tanks to be loaded with LNG destined for export. Vessels with empty cargo tanks ride higher in the water and can experience challenges associated with navigation due to the extra sail area (i.e., ship surface area above the water line). Challenges include the vessel being more susceptible to wind influences and less efficient as a result of reduced performance of the propeller, rudder, and propulsion system. To reduce or eliminate the challenges of navigating the ship without cargo aboard, water is often taken in from the surrounding waters and placed in ballast tanks to provide additional draft and improve navigation. To maintain a constant draft, ballast water is typically discharged below the water surface as the LNG cargo is loaded. The amount of ballast water discharged during LNG cargo loading would vary depending on the size of the LNG carrier. Venture Global estimates the ballast water discharge would not exceed 60,000 cubic meters (approximately 16 million gallons) per vessel.

As required by the USCG's regulations (33 CFR 151.2026), vessels equipped with ballast tanks must implement one of five specified options to control nonindigenous species in waters of the United States, including the introduction of invasive aquatic organisms into local waters. The International Maritime Organization (IMO) adopted this regulation and requires each vessel to install and operate a ballast water management system. These requirements would apply to all LNG carriers serving the Project.

Carriers calling at the LNG terminal would be required to comply with the USCG ballast water management regulations and procedures that establish a standard for the allowable concentration of living organisms in ships' ballast water discharged in waters of the United States. The USCG has also established engineering equipment requirements and an approval process for ballast water treatment systems installed on ships. All ships calling at U.S. ports and intending to discharge ballast water must either carry out open sea exchange of ballast water or ballast water treatment, in addition to fouling and sediment management. Venture Global would include these requirements in agreements for carriers calling at the LNG terminal. Therefore, any ballast water introduced into the Mississippi River would be primarily composed of open ocean water collected during ballast water exchange.

Ballast water discharges at the LNG terminal could impact water quality by changing the salinity, temperature, pH, and dissolved oxygen level of water within the vicinity of the LNG terminal loading docks in the Mississippi River. The physiochemical composition of ballast water in comparison to the water present within the Mississippi River would vary depending on the flow of the Mississippi River at the time of discharge.

The primary potential impact on water quality due to ballast water discharge would be a temporary increase in salinity level. As described above, the Mississippi River is usually freshwater at the terminal site; however, during periods of low flow, saltwater can push up the Mississippi River to the terminal site and beyond. Ballast water, which would generally consist of open ocean water, would have a salinity of approximately 35 parts per thousand (ppt) (NOAA, 2018). In general, ballast water would have a higher salinity than the surrounding water at the LNG loading docks. Natural flow would rapidly dilute the ballast water discharge and increased salinity would represent a temporary and minor impact on water quality within the Mississippi River.

Ballast water is stored in the ship's hull below the waterline; as a result, discharged water temperatures are not expected to deviate markedly from ambient water temperatures. The pH of the ballast water (reflective of sea water in open ocean conditions) is maintained in a fairly narrow range (8.1 to 8.5). The pH within the Mississippi River ranges from 7.2 to 7.9, with a median of 7.7 at Belle Chasse (USGS, 2013a), which is lower than seawater. Although the pH of the ambient water at the terminal site is anticipated to be lower than the ballast water, the difference in pH is minor and would be expected to quickly normalize.

Another water quality parameter that may be influenced by ballast water discharges is dissolved oxygen level. Dissolved oxygen levels in water are dependent upon many factors including temperature, rainfall, tidal magnitude, depth, currents, and phytoplankton activity. Ballast water would contain low dissolved oxygen levels and could decrease existing dissolved oxygen levels in the immediate vicinity of the discharge point. Although the dissolved oxygen of

the ambient water at the terminal site is anticipated to be higher than the ballast water, it is expected that the dissolved oxygen of the ballast water would quickly normalize.

The amount of ballast water discharged into the Mississippi River during each LNG carrier visit to the LNG terminal would make up a small percentage of the water within the Mississippi River, as the Mississippi River discharges, on average, nearly 400 billion gallons per day into the Gulf of Mexico (NPS, 2018). Venture Global estimates that ballast water discharges would not exceed 16 million gallons per vessel, and Venture Global anticipates approximately 310 vessels annually. At full capacity, the terminal could accommodate six carriers per week. Therefore, ballast water discharge events could occur up to six times per week. Due to the high volume of water that flows along the Mississippi River, we conclude that impacts on salinity, pH, temperature, and dissolved oxygen would be temporary and minor.

Site Modification and Stormwater Runoff

During site preparation at the LNG terminal, several drainage ditches would be filled. The terminal site has a grid of drainage ditches that are part of the fastlands system formerly created to facilitate agriculture and development in the Project area. This system of drainage ditches moves water from the fastlands to a pumping station near Lake Judge Perez, where the water is pumped into Lake Judge Perez. Table 4.3-4 presents all the waterbodies within the terminal site and the adjacent eastern workspace, as well as the proposed impacts on these waterbodies. Table 4.3-6 presents a summary of the temporary and permanent impacts on waterbodies at the terminal site, including the landward terminal facilities, marine facilities, and the eastern workspace.

Table 4.3-6 Summary of Waterbody Impacts in Acres at the Terminal Site								
Facility	Perennial		Intermittent		Ephemeral		Total	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Terminal Facilities	1.1	0.4	<0.1	0.8	0.1	13.1	1.2	14.2
Marine Facilities	72.7	14.6	0.0	0.0	0.0	0.0	72.7	14.6
Eastern Workspace	0.0	1.2	0.0	0.0	0.0	0.5	0.0	1.7
Total	73.8	16.2	<0.1	0.8	0.1	13.6	73.9	30.5

Since the landward terminal facilities south of SH 23 would be surrounded by a floodwall that is 28 feet above proposed grade, stormwater inside the terminal facilities would be collected through a series of ditches into a series of sumps. Sump pumps would pump the stormwater to the stormwater header, from which it would then be pumped to the Mississippi River. Sumps that service LNG spill impoundment basins and other facilities where hazardous materials may be present would be equipped with automatic shutoffs that activate when LNG or other solvents are present. This would prevent contaminated stormwater from being pumped from the facility. Stormwater from the LNG terminal marine facilities would be collected and processed through oil/water separators prior to discharging to the Mississippi River.

As described in section 4.2.2, Venture Global indicated that there are no contaminated soils within the LNG terminal site. Therefore, construction activities are not expected to introduce

contaminated sediments to adjacent surface waters or the Mississippi River. To minimize impacts on water quality due to increased stormwater runoff during construction, land disturbing activities would be conducted in compliance with: the LPDES General Permit for stormwater discharges from construction activities of 5 acres or more; Venture Global's Project-specific Construction SWPPP; and Venture Global's Plan and Procedures.

With implementation of the stormwater treatment system described above and adherence to Venture Global's SWPPP and LDEQ and EPA requirements, stormwater discharges resulting from construction and operation of the LNG terminal would result in temporary and minor impacts on surface waters.

Hydrostatic Testing

Venture Global proposes to appropriate surface water from a drainage canal located along the southern edge of the terminal property for hydrostatic testing of the LNG tanks (26,200,000 gallons), plant piping, and non-LNG storage tanks (50,000 gallons). Water would be withdrawn from the canal at a rate of 1,500 gallons per minute to minimize impingement of aquatic organisms and debris. The intake structure would be fitted with 0.25-inch to 1.0-inch screens to minimize entrainment of aquatic organisms and debris. Venture Global would utilize 26,200,000 gallons of water for hydrostatic testing of a single LNG storage tank. The water for LNG storage tank hydrostatic testing would be transferred between tanks to conserve water.

Small quantities of water used for hydrostatic testing may be discharged directly to the ground in well-vegetated upland areas in accordance with Venture Global's Procedures. Large discharges of hydrostatic test water would be treated, as necessary, and discharged to the Mississippi River, into adjacent drainage canals, or on-site in accordance with permit conditions. Pumps and energy dissipation devices would be used to control the discharge rate and limit scouring and erosion. Due to the large volumes of water needed, it would not be practical to transport this volume of water for disposal due to the limited capacity of tanker trucks.

Where water from the nearby drainage canal is used to hydrostatically test the LNG facilities, chemical additives may be required during the testing process to neutralize bacteria and other components that can be corrosive. Before returning hydrostatic water to its surface water source, Venture Global would pass the water through 25 to 50 micron filters and an active carbon medium to remove suspended solids and neutralize or biodegrade the chemical additives. Following completion of the hydrostatic testing and prior to discharge, the test water would be analyzed for total suspended solids, oil and grease, and pH in accordance with LDEQ LPDES general permit LAG670000. In accordance with general permit LAG670000, Venture Global will seek authorization from the LDEQ to use additives and would provide the specific additives and the intended concentrations as part of the permitting process. The withdrawal, testing, and discharge of hydrostatic test water would be conducted in accordance with LPDES permit requirements. Therefore, we conclude that impacts on surface waters as a result of hydrostatic testing would be negligible.

Spills

During construction and operation, hazardous materials resulting from spills or leaks flushed into the Mississippi River with stormwater could have an adverse impact on water quality. To prevent spills and leaks, Venture Global would implement its final Project-specific SPCC Plan during operation of the LNG terminal, which outlines potential sources of releases at the site, measures to prevent a release, and initial responses in the event of a spill. Given the impact minimization and mitigation measures described above, impacts on surface waters due to spills or leaks during construction and operation of the LNG terminal would be temporary and minor.

Pipeline System

Pipeline

The majority of the pipeline system (approximately 12.1 miles) would be constructed in open water, including bays, canals, bayous, and unnamed channels. Table 4.3-4 provides a list of affected waterbodies. In expansive open water areas, Venture Global would utilize a barge lay method (as described in section 2.5.2.4). Where open water channels are intermingled with wetlands, Venture Global would utilize a push/pull construction method (as described in section 2.5.2.5). Venture Global proposes to utilize conventional lay techniques for approximately 475 feet of the pipeline system route from Southwest Lateral TGP MP 14.3 to Southwest Lateral TGP MP 14.4, south of Lake Hermitage Road. North of Lake Hermitage road, the pipeline system would cross a levee and a perennial canal (WBB016) with a pipe trestle. From the pipe trestle to the LNG terminal, Venture Global would utilize HDD to cross a perennial canal (WBA056) and enter the terminal site.

The construction right-of-way for the barge lay construction technique would be 300 feet wide for each pipeline, with 250 feet of overlap, for a total construction right-of-way of 350 feet and 80 feet of permanent right-of-way. The construction right-of-way for the push/pull construction technique would be 130 feet wide. In total, approximately 505.4 acres of waterbodies would be temporarily affected by construction of the pipeline system. All impacts would be temporary in nature, and the right-of-way would be restored post-construction.

The two primary methods for open water construction, barge lay and push/pull, require excavating a trench to accommodate the pipeline. Additionally, some minimal vegetation clearing and grading may be necessary along some portions of the push/pull installation. Vegetation clearing and grading would occur along the 475 feet of conventional lay. Runoff from the construction right-of-way in the conventional lay areas could affect nearby surface waters. Vegetation clearing and grading, trenching, and backfilling could increase sedimentation rates and turbidity levels. These activities could also reduce dissolved oxygen in the water column and release chemical or nutrient pollutants from sediments. In addition, refueling of vehicles over or near open water and the storage of fuel, oil, and other hazardous materials near surface waters could result in accidental spills that could contaminate surface waters.

Dredging through excavation and wheel washing would be necessary along some of the barge access channel that would be utilized to transport pipe and equipment to the right-of-way. Table 4.3-5 presents the location and quantities of dredge that would be required. These dredging

activities could increase sedimentation rates and turbidity levels. These activities could also reduce dissolve oxygen in the water column and release chemical or nutrient pollutants from sediments.

Venture Global would minimize potential impacts on surface waters by implementing the Project-specific Procedures and the general and special conditions included in the USACE permit. In order to minimize potential impacts associated with an accidental spill of fuel, oil, or other hazardous materials, Venture Global would implement its Project-specific SPCC Plan, which identifies potential sources of hazardous materials present during construction activities and the measures that would be implemented to prevent, contain, and clean up accidental releases. With the implementation of this plan and the Project-specific Procedures, impacts on water quality in the event of a spill or leak are expected to be minor.

Impacts on surface waters are not expected during operation of the pipeline system because no further in-stream activities are expected. Because the pipelines would be installed at a sufficient depth below the beds of waterbodies, exposure of the pipe is not anticipated. In the event that a pipeline anomaly (e.g., corrosion, dent, rupture) is detected during routine inspections that could require pipeline excavation or replacement within a waterbody, impacts would be similar to those described above for construction.

Impacts on surface water resources due to construction and operation of the pipeline system would be temporary and localized. Venture Global would implement the Project-specific Plan and Procedures and SPCC Plan and follow all permit requirements to minimize impacts on water resources during construction and operation of the pipeline system. Therefore, we conclude that impacts on surface waters from construction and operation of the pipeline system would be minor.

Aboveground Facilities

Construction of the aboveground facilities (meter stations and stand-alone mainline valves) would affect waterbodies. The pipeline system would interconnect with existing TGP and TETCO pipelines at two separate open water locations in Bay Batiste and Barataria Bay, respectively, where the water depth averages 6 feet to 8 feet. A meter station would be constructed at each of the two locations. Venture Global would elevate the meter stations on pilings at a sufficient height above the water line to protect against storm surge. While the Southwest Lateral TGP platform would encompass 1.1 acres and the Southwest Lateral TETCO platform would encompass 1.3 acres, they would be fully supported on piles and no fill would be required for construction of either meter station. Thus, for each meter station, the actual acreage of surface water impact would be considerably less than the platform acreage.

Impacts on water quality associated with construction of the meter stations and mainline valves would be similar to those described above and would be minimized through the implementation of the Project-specific Procedures, the general and special conditions included in the USACE's permit, and Venture Global's Project-specific SPCC Plan (see "Pipelines," above). Therefore, we conclude that the impacts on surface waters from aboveground facility construction and operation would be minor.

Hydrostatic Testing

The lateral pipelines would be hydrostatically tested for structural integrity prior to being placed in service. Testing would be completed by capping installed pipe segments with test manifolds, filling these segments with available water, and pressurizing this water to levels beyond the maximum operating pressure of the pipeline. The water would be maintained at these pressure levels for a minimum of 8 hours. Hydrostatic testing must be conducted in a manner that meets or exceeds the DOT's "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards" (49 CFR 192). Venture Global estimates that 5,626,316 gallons of water would be required for hydrostatic testing of the Southwest Lateral TGP pipeline, and 3,997,658 gallons of water would be required for hydrostatic testing of the Southwest Lateral TETCO pipeline.

The Southwest Lateral TGP and Southwest Lateral TETCO HDD segments would be hydrostatically tested prior to installation. Water from the existing drainage canal (WBA056) along the south side of the LNG terminal (Southwest Lateral TGP MP 14.8) would be used as the test water source. The withdrawal location would be in the construction right-of-way. Like the water uptake for HDD mud preparation, the pumping rate would vary from 250 to 500 gallons per minute and the water would be passed through a 0.25-inch to 1.0-inch mesh screen to minimize uptake of various debris and aquatic biota. After testing, the water would be discharged back into the canal through an energy dissipating structure.

Apart from the HDD segments mentioned above (which would both be constructed in Phase I), hydrostatic testing of the Southwest Lateral TGP and the Southwest Lateral TETCO would occur during Phase I and Phase II, respectively. For each pipeline, water would be withdrawn near the TGP (Phase I) and TETCO (Phase II) platforms. The pumping rate would be up to 1,200 gallons per minute, and the suction end of the transfer hose would be equipped with screens ranging from 0.25 inch to 1 inch to minimize the uptake of various debris and aquatic biota. If necessary, a corrosion inhibitor would be added to protect the pipe. Prior to discharge, the water would flow through 25 to 50 micron filters to remove any entrained solids and an active carbon medium to remove chemical contaminants. The discharge location for Phase I would be the drainage canal along the south side of the terminal site at Southwest Lateral TGP MP 14.8. The discharge location for Phase II would be the mainline valve site at Southwest Lateral TGP MP 14.4 on the south side of Lake Hermitage Road.

Environmental impacts from the discharge of hydrostatic test water would be minimized by adoption of the measures prescribed in the Project-specific Plan and Procedures. Venture Global would locate hydrostatic test manifolds outside of wetlands and riparian areas, to the extent practicable, and would comply with all appropriate requirements of LPDES general permit LAG670000 for hydrostatic test wastewater discharges. By implementing the measures described above, we conclude that impacts on water resources as a result of hydrostatic testing would be minor.

4.3.2.3 Modifications to FERC Procedures

Venture Global developed Project-specific Procedures by modifying our Procedures as necessary for this Project. We have reviewed these modifications as they relate to waterbodies (sections I to V) and have found the majority of them to be justified, particularly given the

hydrology of the region. As we present in section 2.5.5.5, those proposed modifications that are substantive and for which we have determined Venture Global provided adequate justification are listed in appendix C, table 2. Some of the requested modifications are discussed below.

Time Window for Construction

Section V.B.1 of our Procedures require that instream work within cool-water and warm-water fisheries must occur from June 1 to November 30, unless expressly permitted or further restricted by the appropriate federal or state agency in writing on a site-specific basis. In the draft EIS, we recommended that Gator Express Pipeline should consult with the LDWF regarding the requested construction time windows for waterbody crossings or confirm that it would adhere to the warmwater fishery crossing time windows in the FERC Procedures. On January 24, 2019, Venture Global received approval from the LDWF to conduct instream work within the warmwater fisheries associated with the Project year-round.

Equipment Staging, Fueling, and Storage of Hazardous Materials

Section IV.A.1.d of our Procedures requires all equipment to 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. These activities can occur closer only if the EI determines that there is no reasonable alternative and the Project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill. In construction locations where there is no reasonable alternative other than to locate upland refueling sites less than 100 feet from wetlands or waterbodies, the Project would maintain at least a 10-foot setback. All refueling and equipment storage procedures, irrespective of proximity to wetlands or waterbodies, would be undertaken in accordance with Venture Global's SPCC Plan to reduce the potential for spills during construction and to mitigate the environmental impacts if a spill were to occur.

Section IV.A.1.e of our Procedures requires that hazardous materials, including chemicals, fuels, and lubricating oils, be stored at least 100 feet from a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials and does not apply to normal operation or use of equipment in these areas. Equipment used in wetlands and open water would often operate at long distances (up to several miles) from the nearest upland refueling station. To move the equipment out of the wetland or open water for refueling, possibly on multiple occasions, is logistically impractical and potentially more environmentally damaging than refueling in situ. To minimize the environmental damage caused by excessive relocation of equipment, towed fuel barges would accompany amphibious equipment as construction progresses. Equipment operators would be fully trained in refueling procedures and Venture Global's SPCC Plan.

Extra Work Space

Section V.B.2.A of our Procedures requires that additional temporary workspace (ATWS) be at least 50 feet from the water's edge except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. For this Project area, several ATWSs are located within waterbodies. The in-water siting of these ATWSs is due to either standing water or the lack of

cohesiveness in the saturated soil within the pipeline construction right-of-way and the consequent need for adjacent areas in which the additional volumes of loosely aggregated spoil generated at foreign pipeline crossings could be temporarily stored. These ATWSs would be used only for placement of spoil, and any equipment used for this purpose would work from barges or other similar platforms and would be within a secondary containment structure to reduce the risk of spills of fuels or other pollutants from entering the waterbody. The same secondary containment provisions would apply for equipment operating within the ATWS located at the meter station platforms and the barge staging area. Locations where Venture Global has proposed to place ATWSs areas in or within 50 feet of waterbodies are presented in table 4.3-7.

We have reviewed these proposed ATWS locations and conclude this modification has been adequately justified. Because the majority of the Project area consists of open water and coastal marsh, siting these ATWS areas in upland areas is not feasible for this Project.

Table 4.3-7 Proposed Locations of Additional Temporary Workspaces within Waterbodies							
TGP Approximate Milepost (direction from centerline) ^a	ATWS Dimensions (feet)	ATWS Acreage	Project Construction Activity	Waterbody Name	Waterbody Type and ID Number	Waterbody Impact Acreage	Justification
0.0	1,200 x 1,000	25.4	TGP Meter Station Platform	Barataria Bay	Subtidal WBB000	25.4	ATWS needed for placement of platform construction barge anchors and maneuvering of equipment and material barges during construction of meter station platform in open water.
3.4	1,400 x 1,400	37.1	TETCO Meter Station Platform	Barataria Bay	Subtidal WBB000	37.1	ATWS needed for placement of platform construction barge anchors and maneuvering of equipment and material barges during construction of meter station platform in open water.
7.0 (West)	2,335 x 50 and 840 x 250	7.4	Foreign Pipeline Crossing (Barge Lay)	Wilkinson Bay	Subtidal WBB000	7.4	ATWS needed for placement of additional spoil from new pipeline facilities crossing an existing foreign 8-inch-diameter pipeline.
7.0 (East)	2,290 x 50 and 675 x 250	7.3	Foreign Pipeline Crossing (Barge Lay)	Wilkinson Bay	Subtidal WBB000	7.3	ATWS needed for placement of additional spoil from new pipeline facilities crossing an existing foreign 8-inch-diameter pipeline.
9.0 (West)	250 x 137 – irregular shape	0.8	Foreign Pipeline Crossing (Barge Lay)	Upper Wilkinson Bay	Subtidal WBB000	0.3	ATWS needed for placement of additional spoil from new pipeline facilities crossing an existing foreign 6-inch-diameter pipeline.
9.0 (East)	250 x 338 – irregular shape	1.9	Foreign Pipeline Crossing (Barge Lay)	Upper Wilkinson Bay	Subtidal WBB000	0.1	ATWS needed for placement of additional spoil from new pipeline facilities crossing an existing foreign 6-inch-diameter pipeline.
11.0 (West)	500 x 1,788 – irregular shape	20.5	Barge Staging Area	Wilkinson Bay	Subtidal WBB000	20.5	ATWS needed for temporary placement of pipe and material barges during construction of pipeline segments in open water of Barataria Bay and Wilkinson Bay.
14.2 (West)	1,220 x 50 and 210 x 250	2.9	Foreign Pipeline Crossing (Push) and Pipe Bend Installation	Wilkinson Bay Tidal Area	Subtidal WBB000	1.1	ATWS needed for placement of additional spoil from new pipeline facilities crossing an existing foreign 20-inch-diameter pipeline.
14.2 (East)	1,080 x 50 and 160 x 250	2.4	Foreign Pipeline Crossing (Push) and Pipe Bend Installation	Wilkinson Bay Tidal Area	Subtidal WBB000	0.2	ATWS needed for placement of additional spoil from new pipeline facilities crossing an existing foreign 20-inch-diameter pipeline.
a All listed ATWS are located within waterbodies.							

4.4 WETLANDS

The USACE defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Environmental Laboratory, 1987).

At the federal level, wetlands are regulated under section 404 of the CWA, which establishes standards to evaluate and reduce total and net impacts on wetlands under the jurisdiction of the USACE. In general, wetland impacts need to be avoided, if possible. If avoidance is not possible, impacts are to be minimized, rectified, reduced, and mitigated in accordance with federal and state regulations, including our Procedures and the USACE's section 404(b)1 guidelines, which restrict discharges of dredged or fill material where a less environmentally damaging and practicable alternative exists. USACE jurisdictional wetlands potentially affected by the Project are subject to review by the USACE to ensure that wetland impacts are fully identified and that appropriate wetland restoration and mitigation measures are identified. The Project is located in the USACE New Orleans District.

Wetland impacts authorized under section 404 of the CWA also require state water quality certification under section of the CWA and a state-issued CUP from the LDNR Office of Coastal Management (OCM) for impacts on coastal wetlands. Venture Global received the section 401 Water Quality Certification from the LDEQ on October 1, 2018, for the LNG terminal and the pipeline system. The State of Louisiana defines coastal wetlands as wetlands less than 5 feet AMSL (roughly equivalent to 5 feet NAVD88) that occur within the designated coastal zone (Louisiana Revised Statute 49:214.2), unless designated as "fastlands." Coastal wetlands are under the jurisdiction of the LDNR Office of Coastal Management and the USACE. The USACE does not recognize the fastlands term. According to the revised June 7, 2012 Coastal Zone Inland Boundary, all Project components are located within the designated coastal zone.

Once the OCM completes its preliminary review, and the JPA CUP is deemed complete, it is forwarded to the USACE for concurrent review. In order to streamline the permit process, the program is executed jointly through an Interagency Joint Public Notice agreement with the USACE. As part of the Interagency Joint Public Notice system, the OCM submits basic project information to NMFS, FWS, EPA, LDWF, the Louisiana DOTD, SHPO, LDEQ Office of Environmental Services, and the Louisiana State Land Office. Coordination with local parishes is also required as part of the Louisiana Coastal Resources Program. Typically, these agencies submit comments or letters of no objection on projects or issue specific requirements or conditions that an applicant must comply with before the OCM will issue an authorization or permit.

In June 2017, two JPAs were submitted to the OCM: one by Plaquemines LNG for the LNG terminal (Permit Application No. P20170545), and one by Gator Express Pipeline for the pipeline system (Permit Application No. P20170543). Venture Global combined the two applications and submitted a single JPA application to the USACE in September 2017. The permit application is currently under review.

4.4.1 Existing Wetland Resources

Venture Global conducted wetland delineations at the terminal site in November 2015 and November 2016 (eastern workspace), and conducted delineations of the pipeline system in December of 2015 (figure B-6 in appendix B). Field teams employed two approaches when delineating wetlands within the Project boundary. For areas within the fastlands, the delineation involved a pedestrian survey that followed the standard wetland delineation methodology presented in the 1987 USACE Wetland Delineation Manual (Environmental Laboratory, 1987) and further defined in the Regional Supplement to the USACE Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (USACE, 2010). Outside of fastland areas, expansive coastal marshes are interspersed with canals and open water. In these areas, a desktop review of NWI maps and aerial imagery provided a baseline wetland map that the field teams used to field-verify wetland types as well as the boundaries between wetlands and open water while aboard an airboat.

Venture Global classified the wetlands and waterbodies within the Project area according to the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al., 1979). Representative species for each wetland type are presented in sections 4.5.1.1 (terminal) and 4.5.1.2 (pipeline). Five wetland types and one open water type were identified within the Project area, as described below.

- **Estuarine emergent (EEM)** wetlands, which include all tidal wetlands dominated by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens) and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salt is equal to or greater than 0.5 percent and that are present for most of the growing season in most years. Perennial plants usually dominate these wetlands.
- **Palustrine emergent (PEM)** wetlands, which include all tidal and non-tidal wetlands dominated by persistent, emergent, vascular plants, emergent moss or lichens, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salt is below 0.5 percent. Plants generally remain standing until the next growing season.
- **Estuarine scrub/shrub (ESS)** wetlands, which include all tidal wetlands dominated by woody vegetation less than 5 meters (16 feet) in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salt is equal to or greater than 0.5 percent. Total vegetation coverage in ESS wetlands is greater than 20 percent.
- **Palustrine scrub/shrub (PSS)** wetlands, which include all non-tidal wetlands dominated by woody plants less than 6 meters (20 feet) tall in which salinity due to ocean-derived salt is below 0.5 percent.
- **Palustrine forested (PFO)** wetlands, which include all non-tidal wetlands dominated by woody vegetation greater than 6 meters (20 feet) tall, in which salinity due to ocean-derived salt is below 0.5 percent.

- **Estuarine subtidal unconsolidated bottom (E1UB)**, which includes deepwater tidal habitats with continuously submerged substrate. Venture Global defined these areas as waterbodies (open water).

Three wetland areas were identified at the terminal site consisting of two PEM wetlands located on the southwestern two-thirds of the site and one wetland area exhibiting a mixture of PEM and PFO wetlands located on the eastern portion of the site parallel to the Mississippi River. In addition to the wetlands at the terminal site, four PEM wetlands were mapped within the eastern workspace adjacent to the terminal site. Wetland acreages are shown in table 4.4-1.

For the pipeline system, field surveys were generally conducted within a 400-foot study corridor to identify and map wetlands along the pipeline system routes. The width of the corridor was established to accommodate ATWS and any subsequent route refinements for construction rights-of-way. A reduced corridor width was used for portions of the pipeline system routes collocated with foreign utilities. In these areas, the survey corridor was offset from the collocated utility on the side along which the new pipeline would be installed. Within the construction footprint of the pipeline system, table 4.4-2 identifies wetland acreages along the pipeline system.

4.4.2 Wetlands Impacts and Mitigation

4.4.2.1 LNG Terminal

Construction of the LNG terminal would result in the permanent filling of wetlands, including impacts on wetlands within the eastern workspace as shown in table 4.4-1. All acres of permanent impacts as a result of permanent fill would be to PEM wetlands. In addition, PFO wetlands would be permanently converted to PEM/PSS wetlands (see table 4.4-1).

In addition to permanent impacts at the terminal site, temporary impacts would be required to construct the terminal facilities. These temporary impacts include PEM wetlands PFO wetlands. Once construction is complete, these areas of temporary impacts would be restored. Venture Global avoided impacts on 33.0 acres of on-site wetlands, including 18.5 acres of PEM wetlands and 14.5 acres of PFO wetlands, as part of its site selection process.

Construction at the terminal site has the potential to have secondary and indirect impacts on adjacent wetlands. Implementation of protective measures in the Project-specific Plan and Procedures, the SPCC Plan, and the SWPPP, including erosion and sediment controls, would minimize the effects to adjacent wetlands.

Table 4.4-1 LNG Terminal Wetland Impacts				
Wetland ID	Cowardin Classification ^a	Permanent Loss	Permanent Conversion	Temporary Impacts
Terminal				
WET001	PEM	259.3	0.0	3.2
WET002	PEM	80.8	0.0	0.0
WET003	PFO	0.0	2.8	7.5
WET003	PEM	0.0	0.0	1.3
Subtotal		340.1	2.8	12.0
Eastern Workspace				
wl101	PEM	18.6	0.0	0.0
wl102	PEM	4.0	0.0	0.0
wl103	PEM	2.4	0.0	0.0
wl104	PEM	3.0	0.0	0.0
Subtotal		28.0	0.0	0.0
TOTAL		368.1	2.8	12.0
a PEM = Palustrine Emergent Wetland, PFO = Palustrine Forested Wetland				

Construction of the LNG terminal would impact a substantial amount of wetlands. A permanent loss of 368 acres of wetlands would occur due to the LNG terminal facilities. As discussed below, Venture Global would be required to mitigate the impacts on wetlands through the USACE's permitting process. In its September 2017 section 404/10 permit application, Venture Global proposes to utilize the purchase of credits from mitigation banks as its mitigation method, which would be finalized as part of the USACE permit. If sufficient mitigation bank credits are not available to satisfy the mitigation requirements, Venture Global proposes to utilize a combination of mitigation bank credits and in-lieu program fees to satisfy wetland mitigation requirements. The permanent impacts would be primarily on wetlands within former pasture areas. These wetlands have been ditched and drained to facilitate agriculture use. This alteration has reduced the wetland function. These ditched wetlands are relatively common within fastland areas in the region. We conclude that wetland impacts would not be significant, and the impacts on wetlands would be further reduced with Venture Global's proposed wetland mitigation.

4.4.2.2 Pipeline System

Construction and operation of the pipeline system would result in the permanent filling of ESS wetlands and PSS wetlands. These permanent impacts are necessary to construct the mainline valves, permanent access road to the mainline valves, and portions of the pipe trestle over the levee near Lake Hermitage Road, although some impacts are avoided by the HDD into the LNG terminal site. Additionally, establishment of metering station platforms would encompass a total area of 2.4 acres within open waters. As these platforms would be installed on elevated piles, the actual footprint of disturbance would be considerably less. In addition to the permanent impacts, construction of the pipeline system would result in temporary impacts on wetlands and open water. See table 4.4-2 for a breakdown of acreages by wetland type.

Although the FERC Procedures specify a maximum pipeline construction right-of-way width of 75 feet in wetlands, an increase in the width can be approved if the applicant provides site-specific justifications. Venture Global has requested and provided justification for a 130-foot-wide pipeline construction right-of-way for portions of the pipeline where direct push installation would be utilized and a 300-foot-wide pipeline construction right-of-way for portions of the pipeline where the barge lay method would be utilized. We have reviewed the Project-specific Procedures and agree with Venture Global's justification for an increased construction right-of-way width. No permanent disturbance or right-of-way clearing would occur between HDD entry and exit pits. The FERC Procedures require Venture Global to restore preconstruction wetland contours to maintain the original wetland hydrology and to return all waterbody banks to preconstruction contours or to a stable angle of repose as approved by the EI.

To avoid the creation of linear channels of open water within the marshes, the LDWF requests that Venture Global install bank line stabilization material at the interface of marsh and open water. Venture Global would coordinate with the LDWF, USACE, and LDNR to identify bank stabilization specifications and the specific locations to be installed as part of the ongoing review of the Project's applications for a CWA Section 404 Permit and a CUP.

Ground-disturbing activities, including the clearing of temporary workspaces and excavation of the pipeline trench and flotation canals, could temporarily affect the rate and direction of water movement within wetlands. If contours and elevations are not properly restored, these effects could adversely impact wetland hydrology and revegetation by creating soil conditions that may not support wetland communities and hydrophytic vegetation at preconstruction levels. Mixing of soil layers could alter the biological components and affect the reestablishment of native wetland vegetation. The temporary stockpiling of soil and the movement of heavy machinery across wetlands could lead to inadvertent compaction and furrowing of soils, which could alter natural hydrologic patterns, inhibit seed germination, and increase seeding mortality. Heavy machinery could also introduce non-native and invasive species to the disturbed soil. Altered surface water flow patterns, stormwater runoff, runoff from disturbed areas, and accidental spills could also negatively affect wetland regeneration.

During the draft EIS comment period, the LDWF requested that Venture Global install a culvert every 500 feet under access roads in wetlands. Venture Global would install one permanent access road within wetlands to reach the mainline valve site located adjacent to Hermitage Road and would install a culvert at this location per the LDWF's request. The remainder of the permanent access roads associated with the Project are located in upland areas; however, Venture Global would install culverts where necessary to maintain existing drainage.

During and following construction, Venture Global would ensure that impacts are appropriately addressed through adherence to permit conditions and implementation of the protective measures in the Project-specific Plan and Procedures, construction SWPPP, and SPCC Plan. Protective measures include:

- minimizing vegetation clearing and disturbance;
- avoiding unnecessary vehicular traffic and equipment;

- installing and maintaining erosion and sedimentation control devices;
- restricting the duration of construction, to the extent practicable;
- using timber construction mats to create a temporary work surface in wet conditions; and
- using low-pressure ground equipment in wet conditions to minimize vegetation damage, soil compaction, and rutting.

During the draft EIS comment period, the LDWF requested that Venture Global use dredged material from the barge access channels to create/restore or nourish emergent marsh. However, the barge access channels would be constructed using a clam shell dredge, allowing the dredged material to be sidecast adjacent to the channel and used to backfill the channel following installation of the pipelines, as such, the spoil material would only be temporarily displaced. The permanent displacement of dredged materials associated with the barge access channels where the prop-washing method would be employed would involve less than 25,000 cubic yards of dredged material. This permanently displaced material would be spread out along the barge access channel system. We conclude that this is not practical due to the relatively small volume of material and the logistical challenges and increased environmental impacts of collecting and transporting the material.

Table 4.4-2 Summary of Wetlands on the Pipeline System (acres), Pipeline System Wetland Impacts													
		EEM		ESS		PEM		PSS		Open Water		Total	
		Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm
Southwest Lateral TGP													
Pipeline Facilities		22.4	0.0	1.0	0.0	0.1	0.0	1.1	0.0	108.2	0.0	132.8	0.0
Aboveground Facilities		0.0	0.0	0.0	0.4	0.0	0.0	0.0	<0.1	0.0	2.4	0.0	2.8
ATWS		29.3	0.0	1.9	0.0	<0.1	0.0	1.2	0.0	394.8	0.0	427.2	0.0
Access Road		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Access Channels		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	322.6	0.0	322.6	0.0
Subtotal		51.7	0.0	2.9	0.4	0.1	0.0	2.3	<0.1	825.6	2.4	882.6	2.8
Southwest Lateral TETCO													
Pipeline Facilities		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATWS		12.8	0.0	0.6	0.0	0.0	0.0	0.0	0.0	51.1	0.0	64.5	0.0
Subtotal		12.8	0.0	0.6	0.0	0.0	0.0	0.0	0.0	51.1	0.0	64.5	0.0
TOTAL		64.5	0.0	3.5	0.4	0.1	0.0	2.3	<0.1	876.7	2.4	947.1	2.8

4.4.3 Modifications to the FERC Procedures

As described above, Venture Global proposes to use its Project-specific Procedures by modifying our Procedures as necessary for this Project. We have reviewed these modifications and the site-specific justifications and have found the majority of them to be justified, particularly given the hydrology of the region, and adequately protective of the environment (see appendix C, table 2). Additional discussion on the most important of these modifications is presented below.

4.4.3.1 Site-specific Justification for Right-of-way Greater than 75 Feet

Section II.A.2 of our Procedures requires site-specific justifications for the use of a construction right-of-way greater than 75 feet wide in wetlands. Venture Global states that the Project requires a 130-foot-wide construction right-of-way for pipeline installation where the push method would be used, due to the need for a relatively wide and deep trench to ensure the required depth of cover in the wet, poorly cohesive, and easily sloughed substrate, and the consequent need for increased space to sidecast relatively high spoil volumes. Venture Global further states that the Project requires a 300-foot-wide construction right-of-way for pipeline installation in open waters, where the barge lay method would be used, to accommodate an approximately 100-foot-wide flotation channel for lay barge and supply barge access and up to approximately 100 feet on either side of the flotation channel for construction workspace to deposit sidecast trench material for later use in restoration. The 300-foot-wide construction right-of-way would allow for safe and wholly waterborne construction.

We accept that this proposed modification is necessary because the combination of pipe size, the inundated or saturated soil conditions, and the pervasiveness and extent of wetlands and open water in the Project area makes the 75-foot-wide right-of-way infeasible. Although the requirement to identify specific wetlands that require more than a 75-foot-wide right-of-way remains, in this Project area the prevalence of wetlands results in a fairly uniform construction footprint. As a result, Venture Global proposes to construct the pipelines in a 300-foot-wide right-of-way in open water from TGP MPs 0.0 to 11.3 and TETCO MPs 0.0 to 7.9. The construction right-of-way width would be reduced to 130 feet when constructing in marshes from TGP MPs 11.3 to 14.3 and TETCO MPs 7.9 to 10.9.

Construction Equipment Staging and Storage of Hazardous Materials

Section IV.A.1.d of our Procedures requires all construction equipment to be parked (overnight) and fueled at least 100 feet from a wetland boundary. In construction locations where there is no reasonable alternative other than to locate upland refueling sites less than 100 feet from wetlands or waterbodies, the Project would maintain at least a 10-foot-wide setback. All refueling and equipment storage procedures, irrespective of proximity to wetlands or waterbodies, would be undertaken in accordance with Venture Global's SPCC Plan to reduce the potential for spills during construction and to mitigate the environmental impacts if a spill were to occur.

Section IV.A.1.e of our Procedures requires all hazardous materials (e.g., fuels, oils) to be stored at least 100 feet from a wetland boundary. Equipment used in wetlands and open water would often operate at long distances (up to several miles) from the nearest upland refueling station. To track the equipment out of the wetland or open water for refueling, possibly on multiple

occasions, is logistically impractical and potentially more environmentally damaging than refueling in situ. To minimize the environmental damage caused by excessive tracking, towed fuel barges would accompany amphibious equipment as construction progresses. Equipment operators would be fully trained in refueling procedures and Venture Global's SPCC Plan.

Aboveground Facilities

Section VI.A.6 requires that aboveground facilities not be located in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with DOT regulations. Venture Global states that impacts on wetlands as a result of construction of the Project's aboveground facilities would be unavoidable and that all wetlands impacted would be appropriately mitigated. As a result, construction of the aboveground structures would result in no net loss of wetlands.

Extra Work Areas

Section VI.B.1.a requires applicants to locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. Due to the prevalence of open water and marsh in the Project area, several ATWSs are necessarily located in wetlands and waterbodies. These include ATWSs required at the mainline valve sites and HDD exit and/or entry locations, set-up sites for push method pipeline installations, bore exit and/or entry locations, and crossing sites of multiple foreign pipelines. Most of the ATWSs are required for HDD, push method pipeline installations, and bore crossings, methods that have been selected to minimize or avoid greater environmental impacts elsewhere. Locations where Venture Global has proposed to place ATWSs in or within 50 feet of wetlands are presented in table 4.4-3.

Table 4.4-3 Proposed Locations of Additional Temporary Workspace within Wetlands					
TGP Approximate Milepost^a	TETCO Approximate Milepost	Wetland ID	ATWS Size (acres)	ATWS Purpose	Justification
8.9	5.6	wlb007e	2.7	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
14.2	10.7	wlb002e, wlb002s, and wlb003s	5.4	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
14.4	11.1	wlb003s and wlb009s	1.4	Mainline Valve Site and Lake Hermitage Road crossing	Wetland expanse characterizes area. No upland alternative exists.
a All listed ATWS are located within wetlands.					

We have reviewed these proposed ATWS locations and conclude this modification has been adequately justified. Because the majority of the Project area consists of open water and coastal marsh, siting these ATWS areas in upland areas is not feasible for this Project.

Access Roads

Section VI.B.1.C of our Procedures requires that all construction equipment, other than that needed to install the wetland crossing, shall use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, all other construction equipment shall be limited to one pass through the wetland using the construction right-of-way located in upland areas. Venture Global's construction is primarily located within wetlands and waterbodies, and certain work areas may require access via the construction right-of-way across wetland areas or waterbodies. The push method would be used to install portions of the lateral pipelines with limited equipment traffic crossing the wetlands. At certain locations, such as tie-ins or foreign line crossings, additional equipment would be required to complete the pipeline installation. To access these locations, multiple passes of construction equipment through the wetlands would be required, using the construction right-of-way. Access channels through open water would be used to mobilize construction equipment to install the majority length of the lateral pipelines using the barge lay method.

Section VI.B.1.D of our Procedures states that the only access roads, other than the construction right-of-way, that can be used in wetlands are those existing roads that can be used with no modifications or improvements, other than routine repair, and no impact on the wetlands. The Project would require one new permanent access road to access two mainline valve sites during Project operation; this road would also be used during construction. The Project would require one new temporary access road to access the pipe bridge and HDD sites during construction. Both roads cross some wetlands, but they represent the shortest travel distance to the sites and, given the extensive wetlands in their area, there are no practicable alternative routes that would result in less impact on wetlands. All impacts would be appropriately permitted and mitigated in accordance with applicable regulatory requirements.

Section VI.B.2.D requires the applicant to minimize the length of time that topsoil is segregated and the trench is open, and the applicant should not trench the wetland until the pipeline is assembled and ready for lowering in. The Project would use the push method for portions of the Southwest laterals, requiring the excavation of the pipe trench prior to pipeline assembly in order for the assembled pipeline segment to be floated and lowered into the open trench.

Sediment Barriers

Section VI.B.3 of our Procedures states that sediment barriers will be installed immediately after initial disturbance of the wetland or adjacent upland. Venture Global proposes to install sediment barriers prior to the initial disturbance of wetlands or adjacent uplands. Subsections A, B, and C provide additional details regarding the construction of sediment barriers. Venture Global has accepted these, except in areas where the push method would be used for pipeline installation. In these areas, Venture Global would not install sediment barriers, as it would be unnecessary in areas sufficiently inundated to allow push construction.

4.4.4 Compensatory Mitigation

The USACE has a goal of “no net loss” of wetland function in the United States. This means that unavoidable wetland impacts must be offset by the creation, restoration, enhancement,

or preservation of at least an equal amount of wetlands, which is referred to as compensatory mitigation.

As discussed in section 4.4.2.1, construction and operation of the LNG terminal would result in the permanent loss of 368.1 acres of PEM wetlands and the conversion of 2.8 acres of PFO wetlands to PSS/PEM wetlands. Construction and operation of the pipeline system would result in the permanent loss of 0.4 acre of wetland.

As required by 33 CFR 332.3, Venture Global proposes compensatory mitigation that is commensurate with the amount and type of wetland impacts resulting from construction and operation of the Project. There are three mechanisms for providing compensatory mitigation: permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee mitigation. As part of the section 10/404 process, Venture Global is developing a Compensatory Mitigation Plan to mitigate unavoidable wetland impacts. Venture Global proposes to use mitigation banks, an in-lieu fee program, permittee-responsible mitigation, or a combination of the three to mitigate for the wetland impacts of the Project. The plan would be subject to the review and approval by the USACE, New Orleans District, as part of the section 10/404 process. We would require that all federal authorizations, including these permits, be received prior to construction of the Project.

Construction of the pipeline facilities would temporarily impact 947 acres of wetlands and open water; however, only 2.8 acres would be permanently impacted by the pipeline. The pipeline would be constructed according to Venture Global's Procedures and any other applicable permit conditions. Temporarily impacted wetlands would be restored and monitored until restoration is successful. As discussed above, Venture Global would mitigate the impacts on wetlands through the USACE permitting process. We conclude that wetland impacts from pipeline construction would not be significant, and would be further reduced with the proposed mitigation.

4.5 VEGETATION

The LNG terminal and the pipeline system would be situated in the Deltaic Coastal Marshes and Barrier Islands Level IV Ecoregion, within the larger Mississippi Alluvial Plain (EPA, 2013). The Deltaic Coastal Marshes and Barrier Island Ecoregion is described as a mix of brackish and saline marshes and areas that are inundated by water.

The Louisiana Natural Heritage Program (LNHP) of the LDWF recognizes 68 natural communities in Louisiana. Elements of the Project, specifically the LNG terminal berthing facilities and the pipeline system, traverse habitats that exhibit characteristics that are consistent with several of these natural communities, including batture, saltmarsh, brackish marsh, intertidal mollusk reef, bay, tidal channel/creek, and coastal live oak-hackberry forest. In addition to these natural areas, the majority of the terminal site and portions of the pipeline system have been significantly altered by levees and drainage ditches/canals to create fastlands for agricultural use, and portions of the pipeline system traverse man-made navigation channels.

4.5.1 Existing Vegetation Resources

4.5.1.1 LNG Terminal

The terminal site is located on the western bank of the Mississippi River, with a majority of the site located within fastlands. As defined by OCM, fastlands are lands surrounded by publicly owned, maintained, or otherwise validly existing levees or natural formations that would normally prevent activities within the surrounding area from having direct and significant impacts on coastal waters.

The terminal site and properties bordering the site were historically used for agricultural purposes, which is classified as cultivated crops in National Land Use Land Cover data. Currently, the majority of the terminal site consists of fallow grassland and cattle pasture that is bisected by a series of man-made drainage ditches and drainage canals. These fallow grasslands and cattle pasture fall within the cultivated crops National Land Use Land Cover data classification in section 4.8.1. The segments of the terminal site that are south of SH 23 consists of herbaceous vegetative cover, and the area of the terminal site north of SH 23 consist of a mix of herbaceous areas, scrub/shrub areas, and forested areas. The Mississippi River and coastal marsh are the primary habitat types surrounding the fastlands (or fallow grassland and cattle pasture) where the terminal site is located. Table 4.5-1 presents the habitat communities within the Project area based on field surveys. Land use and land cover impacts are discussed in section 4.8.1 and table 4.8-1.

Table 4.5-1 Habitat Communities Affected by Construction and Operation of the LNG Terminal and Pipeline System (in acres)		
Habitat Community	Construction Impacts	Operational Impacts
LNG Terminal Site, Water-based Marine Facilities, and LNG Terminal Workspaces		
Palustrine emergent wetland (pasture)	369.4	368.1
Palustrine forested wetland (batture)	10.3	4.1 ^a
Forested/scrub-shrub upland	85.7	82.6
Herbaceous upland (pasture)	158.9	151.2
Subtotal	624.3	606.0^b
Pipeline System		
Palustrine emergent wetland	0.1	0.0
Palustrine scrub-shrub wetland	2.3	<0.1
Estuarine emergent wetland	64.6	0.0
Estuarine scrub-shrub wetland	3.9	0.4
Forested/scrub-shrub upland	0.0	0.0
Coastal live oak-hackberry forest (upland)	4.0	1.7
Subtotal	74.9	2.2^c
TOTAL	699.2	608.1
^a The 2.8 acres of operational impacts are conversion of the PFO habitat to PSS/PEM habitat and not permanent fill. ^b The operational impact acreage of the terminal site is 636.5 acres; however, the entire operational area is not vegetated. Only 606.0 acres of the operational boundary are currently vegetated. The remaining 30.5 acres consists of open water or Mississippi River and developed commercial/industrial land that is not vegetated. ^c The operational impact acreage for the pipeline system only includes permanent impacts from aboveground facilities and 1.7 acres of forested habitat that would be converted to maintained right-of-way. The remainder of the pipeline system would either be in upland herbaceous/scrub-shrub habitats, developed commercial/industrial land, or open water habitats.		

Palustrine emergent wetland areas within the terminal site and adjacent workspace primarily consists of fallow pasture. These areas are located in the southwestern two-thirds of the Project area, south of SH 23. Venture Global suggests that the wetland hydrology for these areas appears to be a result of poorly maintained drainage ditches within the fastlands drainage system. According to Venture Global, the lack of maintenance has allowed these pasture areas to revert to wetlands. Species observed in these areas during field surveys include bigpod sesbania (*Sesbania herbacea*), eastern baccharis (*Baccharis halimifolia*), alligatorweed (*Alternanthera philoxeroides*), Bermuda grass (*Cynodon dactylon*), common rush (*Juncus effuses*), swamp smartweed (*Persicaria hydropiperoides*), mountain spikerush (*Eleocharis montana*), salt meadow cord grass (*Spartina patens*), great ragweed (*Ambrosia trifida*), coco yam (*Colocasia esculenta*), peppervine (*Ampelopsis arborea*), American buckwheat vine (*Brunnichia ovata*), and broadleaf cattail (*Typha latifolia*).

Palustrine forested wetlands within the terminal site are adjacent to the Mississippi River and consist of batture. Batture is a riverfront pioneer forest that occurs on newly formed sand bars and river margins between the natural levee crest and major streams/rivers. Canopy species observed in these areas during field surveys include black willow (*Salix nigra*), hackberry (*Celtis laevigata*), and American sycamore (*Platanus occidentalis*).

Forested scrub-shrub uplands at the terminal site occur on the northeastern portion of the site between SH 23 and the Mississippi River levee. The forested portions of this vegetation community consist of a woody canopy of green ash (*Fraxinus pennsylvanica*) greater than 20 feet in height with an understory of winged sumac (*Rhus copallinum*), poison ivy (*Toxicodendron radicans*), hyssopleaf thoroughwort (*Eupatorium hyssopifolium*), peppervine, muscadine (*Vitis rotundifolia*), southern dewberry (*Rubus trivialis*), and log fern (*Dryopteris celsa*). The scrub-shrub portion of this vegetation community consisted of woody shrubs less than 20 feet in height that consisted of Chinese tallow (*Triadica sebifera*), winged sumac, American beautyberry, black willow, green ash, and sawtooth blackberry (*Rubus argutus*) with a herbaceous understory that consisted of common carpet grass (*Axonopus fissifolius*), eastern woodland sedge (*Carex blanda*), and giant goldenrod (*Solidago gigantea*).

Herbaceous uplands (pasture) at the terminal site are located in the southwestern portion of the terminal site (south of SH 23). The vegetation composition is similar to the palustrine emergent wetlands described above. The dominant species observed consisted of rice button aster (*Symphyotrichum dumosum*), Bermuda grass, swamp smartweed, yellow foxtail (*Setaria pumila*), bahiagrass (*Paspalum notatum*), and great ragweed.

4.5.1.2 Pipeline System

The majority of the pipeline system is located in the Barataria Basin estuary system. This basin is bounded on the north and east by the Mississippi River, on the west by Bayou Lafourche, and on the south by the Gulf of Mexico (Lester, 2005). The Barataria Basin largely consists of bottomland hardwoods and fresh to brackish marshes. Vegetation communities crossed by the pipeline system include palustrine emergent wetlands (within fastlands near the LNG terminal), palustrine scrub-shrub wetlands (also within fastlands near the LNG terminal), estuarine emergent wetlands, estuarine scrub-shrub wetlands, and coastal live oak-hackberry forest.

The palustrine emergent wetlands along the pipeline system route are located adjacent to the terminal site within the fastlands system at Southwest Lateral TGP MP 14.4 and Southwest Lateral TGP MP 14.6. The vegetation within these areas is primarily herbaceous species consisting of Bermuda grass, bigpod sesbania, salt meadow cord grass, salt grass (*Distichlis spicata*), and common spikerush (*Eleocharis palustris*). Hydrology in these areas has been altered by ditching, pumping, and levees.

The palustrine scrub-shrub wetlands along the pipeline system route are within 0.5 mile of LNG terminal within the fastlands system at Southwest Lateral TGP MP 14.8. The dominant vegetation within these areas consists of maritime marsh elder (*Iva frutescens*), eastern baccharis, rattlebush (*Sesbania drummondii*), and Chinese tallow.

The estuarine emergent wetlands along the pipeline system route frequently occur between Southwest Lateral TGP MP 8.7 and Southwest Lateral TGP MP 14.3. This vegetative community type includes areas of salt marsh and areas of brackish marsh, which are both considered natural communities by the LDWF. The primary species observed in salt marsh areas include smooth cord grass (*Spartina alterniflora*), salt meadow cord grass, salt grass, and black rush (*Juncus roemarianus*). The primary species observed in brackish marsh areas include saltmarsh bulrush (*Schoenoplectus robustus*), smooth cord grass, salt grass, and salt meadow cord grass.

Estuarine scrub-shrub wetlands infrequently occur along the pipeline system route. Estuarine scrub-shrub wetlands are located at Southwest Lateral TGP MP 12.0 and from Southwest Lateral TGP MP 14.1 to Southwest Lateral TGP MP 14.3. This community consists of Jesuit's bark (*Iva frutescens*) and groundsel tree (*Baccharis halimifolia*). Other plants found to a lesser degree in these systems include dwarf palmetto (*Sabal minor*), deciduous holly (*Ilex decidua*), yaupon (*I. vomitoria*), and lantana (*Lantana camara*). In some instances, saplings and trees are found in the estuarine scrub-shrub wetlands delineated within the survey area. These saplings and trees include sugarberry (*Celtis laevigata*), live oak (*Quercus virginiana*), water oak (*Q. nigra*), sweetgum (*Liquidambar styraciflua*), and Chinese tallow. There is one area of coastal live oak-hackberry forest along the pipeline system route from approximately Southwest Lateral TGP MP 14.5 to Southwest Lateral TGP MP 14.6. This vegetation community is considered a natural community by the LDWF. The dominant canopy species include live oak (*Quercus virginiana*), water oak (*Quercus nigra*), and hackberry, with an understory of dwarf palmetto (*Sabal minor*) and eastern baccharis.

The majority of the pipeline system is located in estuarine open water, which occurs frequently from Southwest Lateral TGP MP 0.0 to Southwest Lateral TGP MP 13.8. This community is basically devoid of vegetation. Field surveys were conducted for submerged aquatic vegetation along the pipeline route and barge access channels; however, no submerged aquatic vegetation was encountered. The portions of the pipeline system mapped as estuary open water consist of intertidal mollusk reefs (oyster leases crossed by the pipeline system), bays, and tidal channels/creeks, which are all considered natural communities by the LDWF, as well as man-made navigation channels, canals, and existing pipeline rights-of-way.

4.5.2 Construction and Operation Impacts and Mitigation

As summarized in table 4.5-1, a total of 699.2 acres of vegetation would be cleared during construction of the LNG terminal and pipeline system. In addition, there would be 104.4 acres of impacts on open water at the LNG terminal (Mississippi River, streams, and canals) and 879.1 acres of impacts on estuarine open water along the pipeline system; however, these would not require any vegetation to be cleared and thus are not included in table 4.5-1. Following construction, 606.0¹ acres at the LNG terminal and 2.2 acres along the pipeline system of formerly vegetated areas would be converted to operational areas. About 18.3 acres of temporary impacts on vegetative communities at the LNG terminal site would be restored following construction, and about 72.2 acres of temporary impacts on vegetated communities within the pipeline system would be restored following construction.

4.5.2.1 LNG Terminal

A total of 624.3 acres of vegetation would be cleared during construction at the terminal site (see table 4.5-1). Following construction, the majority of the vegetation at the terminal (606.0 acres) would be permanently converted to industrial use associated with operation of the

¹ The operational impact acreage of the terminal site is 621.9 acres of land and 14.6 acres of water based facilities; however, the entire operational area is not vegetated. Only 606.0 acres of the operational boundary are currently vegetated. The remaining 30.5 acres consists of waterbodies or developed commercial/industrial land that is not vegetated.

facility, resulting in the permanent loss of wetland pasture, batture, shrub/shrub, forested upland, and herbaceous upland pasture.

Construction at the terminal site would result in temporary impacts on 1.3 acres of palustrine emergent wetlands and 7.5 acres of palustrine forested wetlands. These areas would be restored post-construction according to Venture Global's Project-specific Plan and Procedures. The majority of impacts on wetlands would be permanent, resulting in the loss of 368.1 acres of palustrine emergent wetlands and 4.1 acres of palustrine forested wetlands (batture) conversion to palustrine scrub-shrub/palustrine emergent wetlands. Venture Global is coordinating with USACE regarding the jurisdictional status of palustrine wetlands at the terminal site. It appears that these wetlands are a result of poorly maintained drainage ditches and fastland pumping systems. Mitigation for the loss of these palustrine emergent wetlands will be determined once coordination with the USACE is complete and permits have been issued. The conversion of the palustrine forested wetlands would be fully mitigated through implementation of Venture Global's Compensatory Mitigation Plan, which will require review and approval by the USACE New Orleans District. For a discussion of wetland mitigation, see section 4.4.4.

Venture Global's implementation of its Project-specific Plan and Procedures, which require the use of temporary and permanent erosion control measures, revegetation procedures, and post-construction monitoring, would further minimize impacts on vegetation communities within and adjacent to the terminal. Due to the limited vegetation diversity within the terminal site due to the nature of the land relative to the flood levee, we have determined that impacts on vegetation from construction and operation of the LNG terminal would be permanent, but minor.

4.5.2.2 Pipeline System

Wetland fragmentation would be minimized by routing the pipeline system through open water, where feasible. In emergent wetlands, vegetation within the construction workspace would be impacted during construction but would not be purposely cleared, other than through trench excavation. In forested areas, trees that must be removed would be cut flush with the ground, leaving the root system intact to minimize erosion, except in areas where root removal is required to create a safe and level work surface. Clearing and grading operations would incorporate procedures to:

- minimize vegetation removal from slopes, wetlands, and channel banks;
- prevent undue soil disturbance;
- restore ground contours to their original condition; and
- prevent topsoil erosion.

The pipeline system's permanent impacts on vegetation are associated with aboveground facilities and permanent access roads. The permanent pipeline right-of-way would be kept clear of trees in two 30-foot-wide corridors over each pipeline inside of the 80-foot-wide permanent right-of-way. Due to the operational needs of the pipeline system, <0.1 acre of palustrine emergent wetlands, 0.4 acre of estuarine emergent scrub-shrub wetlands, 1.7 acres of coastal live oak-

hackberry forest would be permanently impacted by aboveground facilities and/or converted to a maintained herbaceous state as part of the operational right-of-way. Additionally, 2.4 acres of open water would be shaded by aboveground facilities.

Collocation of the pipelines would minimize impacts on vegetation communities during construction and operation of the pipeline system. Venture Global would implement its Project-specific Plan and Procedures, which require the use of temporary and permanent erosion control measures, topsoil segregation in select areas, testing and mitigation for soil compaction, post-construction monitoring, and limited routine vegetation maintenance. All disturbed areas would be routinely monitored in accordance with the Project-specific Plan and Procedures until restoration and revegetation are successful.

With the implementation of the minimization efforts described above, we conclude that construction and operation of the pipeline system would have a permanent, but minor, impact on vegetation communities.

4.5.3 Exotic or Invasive Plant Communities and Noxious Weeds

Exotic plant communities, invasive species, and noxious weeds can out-compete and displace native plant species, thereby negatively altering the appearance, composition, and habitat value of affected areas. In accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701), 13 plants that could occur in Louisiana have been federally listed as noxious weeds (USDA NRCS, 2017), and one plant (Chinese tallow) has been designated as a noxious weed by the State of Louisiana (Louisiana Revised Statutes 3:1791).

Aquatic invasive species have been identified in the Barataria Basin and may occur in the Project area. These species include water hyacinth (*Eichhornia crassipes*), alligatorweed, common salvinia (*Salvinia minima*), and giant salvinia (*Salvinia molesta*) (LDWF, 2015a; Tulane/Xavier Center for Bioenvironmental Research, 2010). Field surveys at the terminal site and along the pipeline system route did not directly target invasive species; however, invasive exotic species were identified during the wetlands and waterbody field surveys. Surveys at the terminal site identified alligatorweed and Chinese tallow, and surveys along the pipeline system route identified Chinese tallow and lantana.

Venture Global would implement the Project-specific Plan and Procedures during construction and post-construction, which would include monitoring to ensure that ground disturbance and restoration activities minimize the spread of invasive species and noxious weeds. Section III.F.2 of the Project-specific Plan requires the development of specific procedures in coordination with the appropriate agencies to prevent the introduction or spread of invasive species, noxious weeds, and soil pests resulting from construction and restoration activities.

Venture Global has submitted a draft Noxious Weed and Invasive Plant Species Management Plan to the NRCS and LDWF for review. The Noxious Weed Plan was accepted by the agencies and includes the following mitigation measures:

- training EI and construction staff in the identification of noxious weeds and invasive species;

- cleaning construction equipment of vegetative debris when mobilizing;
- identifying and field marking of noxious weed locations;
- applying targeted herbicide or removal of noxious weeds;
- using weed-free materials for erosion control devices; and
- monitoring restoration activities.

4.5.4 Vegetative Communities of Special Concern

Vegetation communities of special concern may include ecologically important natural communities, threatened or endangered plant species, or other rare or imperiled plants in need of special protection or minimal disturbance.

Existing LNHP data (LNHP, 2015a), indicate that the pipeline system route would traverse an area of coastal live oak-hackberry forest. Observations during field surveys indicate that the pipeline system route traverses approximately 1,000 feet of this community (roughly between MPs 14.4 and 14.6 of the Southwest Lateral TGP). Coastal live oak-hackberry forest is considered imperiled with a state ranking² of S1S2 (critically imperiled/imperiled) and a global ranking of G2 (imperiled). This natural community is formed on abandoned beach ridges in coastal Louisiana. These areas serve as important storm barriers and important wildlife habitat, providing vital resting habitat for trans-gulf-migrating birds. Of the 100,000 to 500,000 acres in Louisiana, only 2,000 to 10,000 acres remain (2 percent to 10 percent of pre-settlement extent). Threats to this community include residential development, road and utility construction, overgrazing, and the introduction of invasive exotic species (LDWF, n.d.[a]).

Field surveys mapped 4.0 acres of coastal live oak-hackberry forest within the footprint of the pipeline system. Of the 4.0 acres, 1.6 acres would be avoided by HDD, 0.7 acre would have a temporary impact and allowed to recover after construction, and 1.7 acres would be permanently converted from coastal live oak-hackberry forest to herbaceous uplands. Impacts on this vegetation community are unavoidable, as the non-federal levee immediately adjacent to the south of this community would be crossed via a pipe bridge to avoid impacts on the non-federal levee. To allow space for the pipe bridge, the pipeline system would impact a small portion of the coastal live oak-hackberry forest to establish an HDD site. From the HDD drill site to the LNG terminal, the pipeline system would be installed beneath the remaining area of coastal live oak-hackberry forest within the Project footprint via HDD. Traversing a portion of this community via HDD minimizes impacts on this habitat type and reduces fragmentation of the community. While 1.7 acres would be permanently impacted, the impacts would be 1.4 percent of the coastal live oak-hackberry stand traversed by the pipeline system.

In addition to the coastal live oak-hackberry natural community, six other natural communities of Louisiana occur within the Project area. These include batture (terminal site), saltmarsh (pipeline system), brackish marsh (pipeline system), intertidal mollusk reef (pipeline

² Based on NatureServe Conservation Status Ranks: S=State, G=Global, 1=Critically Imperiled, 2=Imperiled, 3=Vulnerable, 4=Apparently Secure, and 5=Secure.

system), bay (pipeline system), and tidal channel/creek (pipeline system). The intertidal mollusk reef, bay, and tidal channel/creek natural communities are mostly unvegetated and are discussed further in section 4.6.1.

The batture habitat rarity rank for the state is S4S5 (apparently secure/secure), and the global ranking is G4/G5 (apparently secure/secure). This habitat type provides important wildlife habitat and serves to minimize erosion along major river channels. While important, this community is not rare in the state or globally.

Salt marsh has a state rarity ranking of S3/S4 (vulnerable/apparently secure) and a global ranking of G5 (secure). Brackish marsh has a state rarity ranking of S3S4 (vulnerable/apparently secure) and a global ranking of G4 (apparently secure). While globally secure, these habitat types are vulnerable in south Louisiana due to threats such as:

- shoreline erosion and subsidence;
- commercial and industrial development;
- construction of roads, pipelines, and utilities;
- hydrologic alteration (channelization, levee construction, and dredging);
- contamination from spills and industrial discharge;
- fire suppression; and
- invasive exotic species.

The pre-settlement extent of marshland in Louisiana is estimated to be 500,000 to 1,000,000 acres. Currently, approximately 50 to 75 percent of the pre-settlement marsh remains (LDWF, n.d.[b], n.d.[c]). To minimize impacts on salt marsh and brackish marsh, Venture Global routed the pipeline system in open water, where feasible (over 90 percent of the pipeline system impacts are in open water). Additionally, to avoid the creation of linear channels of open water within the marshes, the LDWF requests that Venture Global install bank line stabilization material at the interface of marsh and open water. Venture Global would coordinate with the LDWF, USACE, and LDNR to identify bank stabilization specifications and the specific locations to be installed as part of the ongoing review of the Project's applications for a CWA Section 404 Permit and a CUP.

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife Resources

Wildlife species occurring in the vicinity of the LNG terminal and pipeline system are characteristic of the habitats provided by the vegetative communities that occur in these areas. Section 4.5.1 provides detailed information on the vegetative communities present in the vicinity of the Project based on National Land Use Land Cover data. Habitat types were identified based on aerial photography and field surveys. These habitat types are not the same as the National Land Use Land Cover data described in sections 4.8.1, although some naming conventions overlap. Aquatic resources and protected wildlife species are discussed in sections 4.6.3 and 4.7, respectively.

4.6.1.1 Existing Wildlife Habitats

The wildlife habitat types present in the vicinity of the LNG terminal and pipeline system include herbaceous wetlands, scrub-shrub wetlands, forested wetlands, herbaceous uplands (pasture), scrub-shrub uplands, forested uplands, and open water. Typical wildlife occurring within these habitat types are described below.

Wetlands typically support a diverse ecosystem that provides nutrients, cover, shelter, and water for a variety of terrestrial and aquatic wildlife species, including waterfowl, wading birds, raptors, mammals, reptiles, and amphibians. Typical wildlife associated with palustrine wetlands include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), rice rat (*Oryzomys palustris*), swamp rabbit (*Sylvagus aquaticus*), wood duck (*Aix sponsa*), least bittern (*Ixobrychus exilis*), green heron (*Butorides striatus*), red-winged blackbird (*Agelaius phoeniceus*), southern leopard frog (*Rana utricularia*), bullfrog (*Rana catesbeiana*), cottonmouth (*Agkistrodon piscivorus*), and mud snake (*Farancia abacura*). Typical wildlife associated with estuarine emergent wetlands include raccoon, rice rat, nutria (*Myocaster coypus*), brown pelican (*Pelecanus occidentalis*), great blue heron (*Ardea herodias*), green heron, fiddler crab (*Uca rapax*), and salt marsh snake (*Nerodia clarkia*) (LDWF, 2014a, 2014b, 2014c; USGS, 2013b).

Herbaceous upland habitat is present at the LNG terminal site and consists of fallow pasture lands. No herbaceous uplands were identified along the pipeline system. Mammals typically associated with herbaceous upland habitat include white-tailed deer, striped skunk, spotted skunk (*Spilogale putorius*), cotton mouse, armadillo (*Dasypus novemcinctus*), raccoon, and eastern harvest mouse (*Reithrodontomys humulis*). Bird species include common yellowthroat (*Geothlypis trichas*), northern bobwhite, eastern bluebird (*Sialia sialis*), dickcissel (*Spiza americana*), rusty blackbird (*Euphagus carolinus*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), American robin (*Turdus migratorius*), cattle egret (*Bubulcus ibis*), and red-winged black bird. Typical reptiles and amphibians include chorus frog (*Psuedacris* spp.), western rat snake (*Pantherophis obsoleta*), and garter snake (LDWF, 2014a, 2014b, 2014c; USGS, 2013b).

Forested and scrub-shrub upland habitat is present at the LNG terminal site between SH 23 and the Mississippi River. Forested upland habitat is present along the pipeline system between

approximately TGP MPs 14.4 and 14.7. Scrub-shrub wetland habitat is present along the pipeline system at TGP MP 14.7 (small area) and from TGP MP 14.2 to TGP MP 14.4. Tree and shrub layers provide shelter and foraging habitat for various bird species and larger mammals. Organic material on the forest floor provides habitat for invertebrates, reptiles, smaller mammals, and amphibians. Mammals typically associated with forest habitat in the vicinity of the LNG terminal and pipeline system include white-tailed deer, gray fox (*Urocyon cinereoargenteus*), gray squirrel (*Sciurus carolinensis*), cotton mouse (*Sigmodon hispidus*), and striped skunk (*Mephitis mephitis*). Typical bird species include prothonotary warbler (*Protonotaria citrea*), wood thrush (*Hylocichla mustelina*), red-shouldered hawk (*Buteo lineatus*), Carolina chickadee (*Parus carolinensis*), loggerhead shrike (*Lanius ludovicianus*), eastern kingbird (*Tyrannus tyrannus*), brown-headed nuthatch (*Sitta pusilla*), pine warbler (*Dendroica pinus*), Northern bobwhite (*Colinus virginianus*), and tufted titmouse (*Parus bicolor*). Amphibians and reptiles include the green tree frog (*Hyla cinerea*), garter snake (*Thamnophis sirtalis sirtalis*), racer (*Coluber constrictor*), and pigmy rattlesnake (*Sistrurus miliarius*) (LDWF, 2014a, 2014b, 2014c; USGS, 2013b).

Open water present within the LNG terminal site includes the Mississippi River and several drainage ditches and canal that are part of the fastlands system. Estuarine open water present within the pipeline system is extensive and consists of tidal channels, navigation channels, and bays. Typical wildlife associated with open water habitat includes wading birds, waterfowl, nutria, and other wildlife species dependent on a water environment (see additional discussion in sections 4.6.1.1).

4.6.1.2 Impacts and Mitigation

Construction of the LNG terminal would require vegetation clearing, grading, and filling to level the site. Construction of the LNG terminal would affect over 600 acres of vegetated wildlife habitat and approximately 100 acres of open water habitat (see table 4.5-1), which would result in a permanent reduction of these habitat types in the general vicinity of the LNG terminal. Due to the site's previous use as fallow pasture, vegetation species diversity is low, which lessens its value as habitat for wildlife.

Impacts on wildlife from construction of the LNG terminal would include displacement, stress, and direct mortality of some individuals. Vegetation clearing would potentially reduce suitable cover, nesting, and foraging habitat for some ubiquitous wildlife species. More mobile wildlife, such as birds and larger mammals, may relocate to similar habitats nearby when construction activities commence. However, smaller, less mobile wildlife (e.g., reptiles and amphibians) could be inadvertently injured or killed by construction equipment. The permanent reduction in available habitat within the LNG terminal, as well as the influx of individuals to other nearby areas, may increase population densities for certain species, resulting in increased inter- and intra-specific competition and reduced reproductive success of individuals.

Pilings would be installed during LNG terminal construction using impact hammer methods. Noise from pile-driving activities has the potential to alter wildlife behavior, including foraging and nesting activities within the Project area. Pile-driving noise would be intermittent and temporary, and preparatory activities likely would encourage mobile species to leave the immediate area prior to pile driving commencing. Less mobile species would be subject to noise effects. During construction, Venture Global would implement noise mitigation measures to

reduce potential impacts on the human environment and wildlife from pile-driving activities. These measures may include use of one or more of the following:

- ramp-up procedures at the beginning of each pile installation or when a delay of 15 minutes or more has occurred; and/or
- a cushioning system to reduce noise and maintain effectiveness of pile driving.

Throughout construction and operation of the LNG terminal, Venture Global would follow its Project-specific Plan and Procedures and would implement protective measures for migratory and colonial nesting bird species. With adherence to the proposed mitigation measures and given the abundance of suitable habitat in adjacent areas, the impacts on wildlife habitats from construction and operation of the LNG terminal would be adequately minimized.

Wetland habitats support diverse ecosystems that provides nutrients, cover, shelter, and water for a variety of terrestrial and aquatic wildlife species. Construction and operation of the LNG terminal would result in the permanent loss of 340 acres of wetlands on the LNG terminal site. In addition, 28 acres of wetlands within the eastern workspace adjacent to the LNG terminal site would be permanently filled.

Operation of the LNG terminal would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to current industrial activities at other facilities along the Mississippi River, wildlife species in the area are expected to be acclimated to the noise and artificial lighting associated with these activities.

To minimize Project-related impacts on wildlife, Venture Global would implement its Project-specific Plan and Procedures, as well as its Spill Prevention Plan during construction, and would develop and implement an SPCC Plan for operations. Venture Global would also implement best management practices (BMPs), which typically include a combination of silt fencing, routine inspection, and good housekeeping techniques. A wetland compensatory mitigation plan would be developed by Venture Global to offset wetland impacts and their associated wildlife impact connection. Thus, we believe that impacts on wildlife associated with noise, light, and human activity would be expected to be minor.

4.6.2 Unique and Sensitive Wildlife Species

No public or conservation lands have been identified within or adjacent to the LNG terminal or pipeline system. Migratory birds may utilize portions of the Project area and areas adjacent to the Project area, as discussed below. Species protected under the ESA, the BGEPA, the MMPA, and by state endangered and threatened species regulations are discussed in section 4.7.

4.6.2.1 Migratory Birds

Migratory birds follow broad routes called flyways between breeding grounds in Canada and the United States and wintering grounds in Central and South America and the Caribbean. Additionally, several species migrate from breeding grounds in the north to winter along the Gulf Coast, where they remain throughout the non-breeding season. The LNG terminal and pipeline

system are within the Mississippi Flyway, which terminates at the Gulf Coast. Of the 650 species of birds known to occur in the United States, nearly 400 species occur along the Gulf Coast (Wilson and Esslinger, 2002). The Gulf Coast provides wintering and migration habitat for large numbers of continental duck and goose populations that use the Mississippi Flyway. The coastal marshes of Louisiana, Alabama, and Mississippi regularly hold half of the wintering duck population of the Mississippi Flyway (Wilson and Esslinger, 2002). For these reasons, the Gulf Coast is considered one of the most important waterfowl areas in North America.

Migratory birds are federally protected under the MBTA (16 U.S.C. 703-712). The MBTA, as amended, implements protection of many native migratory game and non-game birds, with exceptions for the control of species that cause damage to agricultural or other interests. The MBTA prohibits the take of any migratory bird, or their parts, active nests, and eggs, where to “take” means to “pursue, hunt, shoot, wound, trap, capture, or collect.”

Executive Order 13186 (January 2001) requires that all federal agencies undertaking activities that may negatively affect migratory birds take a prescribed set of actions to further implement the MBTA, and directs federal agencies to develop an MOU with the FWS that promotes the conservation of migratory birds. FERC entered into an MOU with the FWS in March 2011. The focus of the MOU is avoiding or minimizing adverse impacts on migratory birds and strengthening migratory bird conservation through enhanced collaboration between the two agencies.

Though all migratory birds are afforded protection under the MBTA, both Executive Order 13186 and the MOU require that Birds of Conservation Concern (BCC) and federally listed species be given priority when considering the effects on migratory birds. BCCs are a subset of migratory MBTA-protected species identified by the FWS as those in greatest need of additional conservation action to avoid future listing under the ESA. Executive Order 13186 states that emphasis should be placed on species of concern, priority habitats, key risk factors, and that particular focus should be given to addressing population-level impacts.

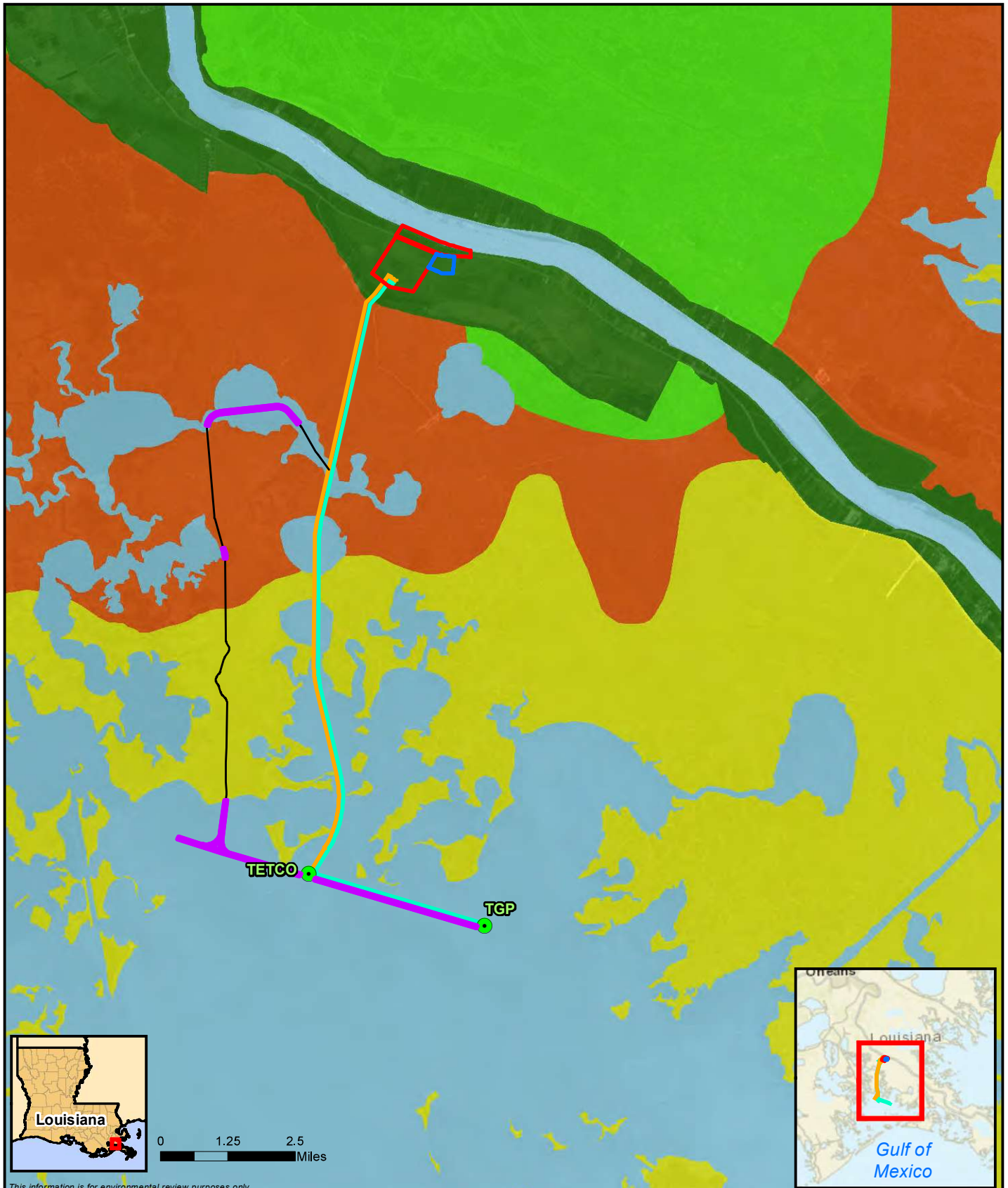
Bird Conservation Regions (BCR) are regions that encompass landscapes with similar bird communities, habitats, and resource management issues (North American Bird Conservation Initiative, 2017). BCRs were established to facilitate a regional approach to bird conservation and identify overlapping or conflicting conservation priorities. The terminal and pipeline system are within BCR 37 – Gulf Coastal Prairie (FWS, 2008). Typically 318 species of birds occur frequently within BCR 37 while another 45 species have migration patterns through BCR 37. Potential impacts on migratory birds that are also federally listed are described in section 4.7.1.2.

Colonial waterbirds, a subset of migratory birds, include a large variety of bird species that share two common characteristics: (1) they tend to gather in large assemblies, called colonies or rookeries, during nesting season, and (2) they obtain all or most of their food from the water (FWS, 2002). Colonial waterbirds demonstrate nest fidelity, meaning they return to the same rookery year after year. Rookeries are typically established in marshes or near the shores of ponds or streams. Although some colonial waterbirds (e.g., least terns) will nest in developed areas, many waterbirds (e.g., great blue heron, great egrets) are wary of human activity. Colonial nesting waterbirds that occur in the Project area include various herons, egrets, ibises, terns, gulls, pelicans, and other species. To minimize disturbance to nesting waterbirds, the FWS restricts construction

activity within 1,000 feet of rookeries to the non-nesting season in Louisiana (table 4.6-1) (FWS, 2017a). A possible colonial-nesting waterbird area on an island in Barataria Bay occurs within a 2-mile radius of the pipeline system. The island is located between 600 and 1,800 feet from the pipeline system. Figure 4.6-1 shows the marshes that would be crossed by the pipeline system.

Table 4.6-1 Non-nesting Period for Nesting Colonial and Non-colonial Birds	
Species	Period
Colonial Birds	
Anhinga	July to March 1
Cormorant	July to March 1
Great Blue Heron	August 1 to February 15
Great Egret	August 1 to February 15
Snowy Egret	August 1 to March 1
Non-colonial Birds	
Little Blue Heron	August 1 to March 1
Tricolored Heron	August 1 to March 1
Reddish Egret	August 1 to March 1
Cattle Egret	September 1 to April 1
Green-backed Heron	September 1 to March 15
Black-crowned Heron	September 1 to March 1
Yellow-crowned Heron	September 1 to March 15
Ibis	September 1 to April 1
Roseate Spoonbill	August 1 to April 1

In addition to the MBTA, the BGEPA provides additional protection to bald and golden eagles. Bald eagles nest in large trees near coastlines, rivers, and lakes. The bald eagle could winter or breed, and potential foraging and nesting habitat may exist, in areas near the LNG terminal site and pipeline route. The LDWF has not collected bald eagle survey data since 2008. However, during Venture Global's habitat surveys in 2015, numerous bald eagles were observed in the Project area. One inactive, 3-foot-diameter nest was observed during the survey. This nest could be from a bald eagle or other raptor species that occur in the Project area.



- Terminal Site Boundary
- Eastern Workspace
- SW Lateral TETCO
- SW Lateral TGP
- Barge Access Channel
- Barge Access Channel Dredging/Excavation Area
- Interconnect and Meter Station
- Intermediate Marsh
- Brackish Marsh
- Salt Marsh
- Non-marsh/other
- Water



Figure 4.6-1
Marshlands Crossed by the Project
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana

Source: Louisiana Department of Wildlife, Fur and Refuge Division, 2001.
 Louisiana Coastal Marsh Vegetative Type (poly), Geographic NAD83, LDWF (2001), Lafayette, Louisiana, US.

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4.6.2.2 Impacts and Mitigation

The increased presence of humans, noise, and vibrations associated with Project activities would likely cause sensory disturbances of migratory birds. The resulting negative effects are expected to be intermittent and short term, occurring during work hours and ceasing after construction activities have moved from a given area. Displacement and avoidance of the area are direct responses to sensory disturbances. Birds may be injured or suffer mortality as an indirect effect of fleeing an area of disturbance. Sensory disturbances to adults could also result in nest abandonment, affecting egg-laying and potentially causing the mortality of young. In most cases, Project activities would be short-term and episodic. As such, sensory disturbance effects associated with these activities may affect individuals but would not likely have notable effects on any local populations of migratory birds. Permanent aboveground structures, such as the LNG terminal and meter stations would create potential localized sensory disturbances for the operational life of the Project, and thus would have more permanent effects.

The vegetation communities within the LNG terminal and pipeline system facilities provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. However, much of the vegetated land associated with the LNG terminal and pipeline system facilities is previously disturbed, within or adjacent to existing facilities, and/or composed of agricultural land, all of which reduce bird nesting habitat value. Project construction would result in one-time direct impacts on migratory bird habitat due to vegetation clearing for the LNG terminal site. These construction activities could have indirect effects on migratory birds such as egg and young survival and result in bird displacement impacts on bird migration, nesting, foraging, and mating behaviors. Construction could also reduce the amount of habitat available for foraging and predator protection and would temporarily displace birds into adjacent habitats, which could increase the competition for food and other resources. The effect of clearing and grading for the LNG terminal would be permanent because these areas may not be restored to their preconstruction condition. Given the proposed mitigation measures above, we conclude that impacts on migratory birds from construction of the Project would largely be temporary and would not be significant.

To further minimize impacts on migratory birds, Venture Global would implement the following measures, where practicable, to avoid impacts on migratory birds:

- clear areas with potential nesting habitat outside of the approved nesting season from March 1 through July 31, as recommended by the FWS;
- conduct pre-construction nesting surveys and avoid active nests if migratory birds are observed;
- inspect construction equipment regularly for opportunistic wildlife species, including nesting migratory birds;
- follow reseeding recommendations from the NRCS for restoration of temporarily disturbed areas;

- stabilize the right-of-way to protect soil resources and promote restoration of temporarily disturbed areas; and
- adhere to the measures in Venture Global's Project-specific Plan and Procedures, as well as the Venture Global SPCC Plan and SWPPP to minimize impacts on sensitive habitats.

Many migratory birds use natural light from the sun, moon, and stars for navigation. Artificial lighting can hide natural light sources, having unknown effects on birds at the population level. Fatalities to avian species due to artificial light are well documented. Potential impacts specific to migratory birds include injury or disorientation due to flaring and other artificial illumination. Avian fatalities are associated with attraction to light sources, especially in low light, fog, and when there is a low cloud ceiling (Orr et al., 2013). The terminal is designed to limit flaring events only to LNG carrier gas up / cool down operations, which may occur up to forty times a year. During operation of the LNG terminal, use of the marine and emergency flares would only occur during process upset conditions. To the extent practical, use of the flares during initial facility start-up would be limited to daylight hours, limiting potential impacts on birds, and, to the extent practical, would be planned to avoid inclement weather when the risk of bird mortalities from attraction to the flares would be the highest. Given that flaring would be limited to the initial start-up of the facility and LNG carrier gas up / cool down operations, we do not expect substantial impacts on migratory birds.

The LNG terminal and pipeline facilities would require adequate lighting for operations and safety. During construction, Venture Global would direct all nighttime lighting towards construction activity and use the minimum light level necessary to ensure site safety and security. Venture Global submitted a Facility Lighting Plan that included measures to reduce the impacts of facility lighting including downward-facing lights with shielding needed to meet regulatory standards and minimize illumination specifications. Facility lighting would be chosen to minimize the horizontal emission of light away from intended areas, and shielding would help minimize impacts on birds and other wildlife while providing the illumination needed to ensure safe operation of the facility. Venture Global conducted a visual assessment evaluating anticipated nighttime lighting conditions at the LNG terminal (see detailed discussion in section 4.8.6). Based on our reviews of the Facility Lighting Plan and the visual assessment, we have determined that the overall increase in nighttime lighting during construction and operation of the LNG terminal would result in impacts on migratory birds.

To minimize the effects of artificial lighting on migratory birds, outdoor lighting at the terminal and pipeline meter stations would be limited, shielded, and downward-facing to facilitate safe operations at night or during inclement weather. This would include using only white or red strobe lights at night, using the fewest number of lights as practicable, and using the minimum intensity and number of flashes per minute allowable. Solid red or pulsating red warning lights would be avoided when possible. Perimeter lighting at aboveground facilities would be turned off at night and would be used only when necessary for work conducted at night. With the implementation of the mitigation measures described above, we conclude that operational impacts on migratory birds would not be significant.

Due to the prevalence of suitable bald eagle habitat in the Project area, Venture Global has committed to conducting pre-construction surveys to identify bald eagle nests in the Project area. If a bald eagle nest is identified within 660 feet of Project activities, Venture Global would implement the recommendations in the National Bald Eagle Management Guidelines (FWS, 2007), which includes mitigation measures such as maintaining a specified distance between the nest and Project activities; maintaining natural areas between the nest and Project activities; and avoiding specific activities during the breeding season. Based on these proposed measures, we conclude that the Project would not impact bald eagles.

4.6.3 Aquatic Resources

4.6.3.1 Existing Aquatic Resources

LNG Terminal

Habitat for aquatic resources present within the LNG terminal site include the Mississippi River and 43 man-made drainage ditches/canals that are part of the fastland system. Of the 43 man-made drainage ditches/canals delineated, 38 are ephemeral, three are intermittent, and two are perennial. Additionally, six man-made drainage ditches/canals were delineated within the eastern workspace adjacent to the LNG terminal site and consisted of four perennial canals and two ephemeral drainage ditches. PEM and PFO wetlands are present at the terminal, and PEM wetlands are present within the eastern workspace. The hydroperiod of these wetlands is not sufficient to provide consistent habitat for finfish; however, these areas can support aquatic invertebrates and amphibians.

Waterbodies within the LNG terminal site are contained within the fastlands levee system. The primary connection to downstream waters is through a pumping station approximately 2 miles east of the terminal site, adjacent to Lake Judge Perez.

The LNG terminal site has 7,000 feet of shoreline along the Mississippi River. The Mississippi River has been designated by the LDEQ as supporting primary contact recreation, secondary contact recreation, drinking water supply, and fish and wildlife propagation; the river fully supports these designations with no impairments. The Mississippi River at the terminal site typically consists of freshwater; however, a salt water wedge moves along the river bottom and advances up the Mississippi River during periods of low flow. During periods of extreme low flow, the salt water wedge can reach as far as New Orleans. As flows increase, the salt water wedge is pushed back downstream.

The depth of the Mississippi River ranges from 0 feet at the shoreline to approximately 45 feet in the navigation channel, and the substrate are composed mainly of unconsolidated bottom sediment. Unconsolidated sediments provide foraging habitat for benthic organisms and fish. Up to 150 fish species have been found in the lower Mississippi River, and most are freshwater fishes. Common game fish include black and white crappie (*Pomoxis* spp.), bluegill (*Lepomis macrochirus*), catfish (*Ictalurus* spp., *Pylodictus olivaris*), largemouth bass (*Micropterus salmoides*), white and striped bass (*Morone* spp.), red drum (*Sciaenops ocellatus*), and spotted sea trout (*Cynoscion nebulosus*). Bait fish include skipjack herring (*Alosa chrysochloris*), gizzard

shad (*Dorosoma cepedianum*), and threadfin shad (*Dorosoma petenense*) (Lower Mississippi River Conservation Committee, 2012).

Pipeline System

The pipeline system is located within the Barataria Basin and traverses 0.4 miles of palustrine wetlands and forested uplands from the LNG terminal to TGP MP 14.4, then from TGP MP 14.4 south to TGP MP 0.0, the pipeline system traverses a mix of estuarine scrub-shrub wetlands (brackish and salt marsh), estuarine emergent wetlands, and estuarine open water habitats with unconsolidated bottoms. Over 90 percent of the pipeline system traverses shallow open water.

The wetlands and open water habitats within the Barataria Basin traversed by the pipeline system are separated into subsegments by the LDEQ, with the designated uses for each subsegment defined individually. The subsegments crossed by the pipeline system include the following:

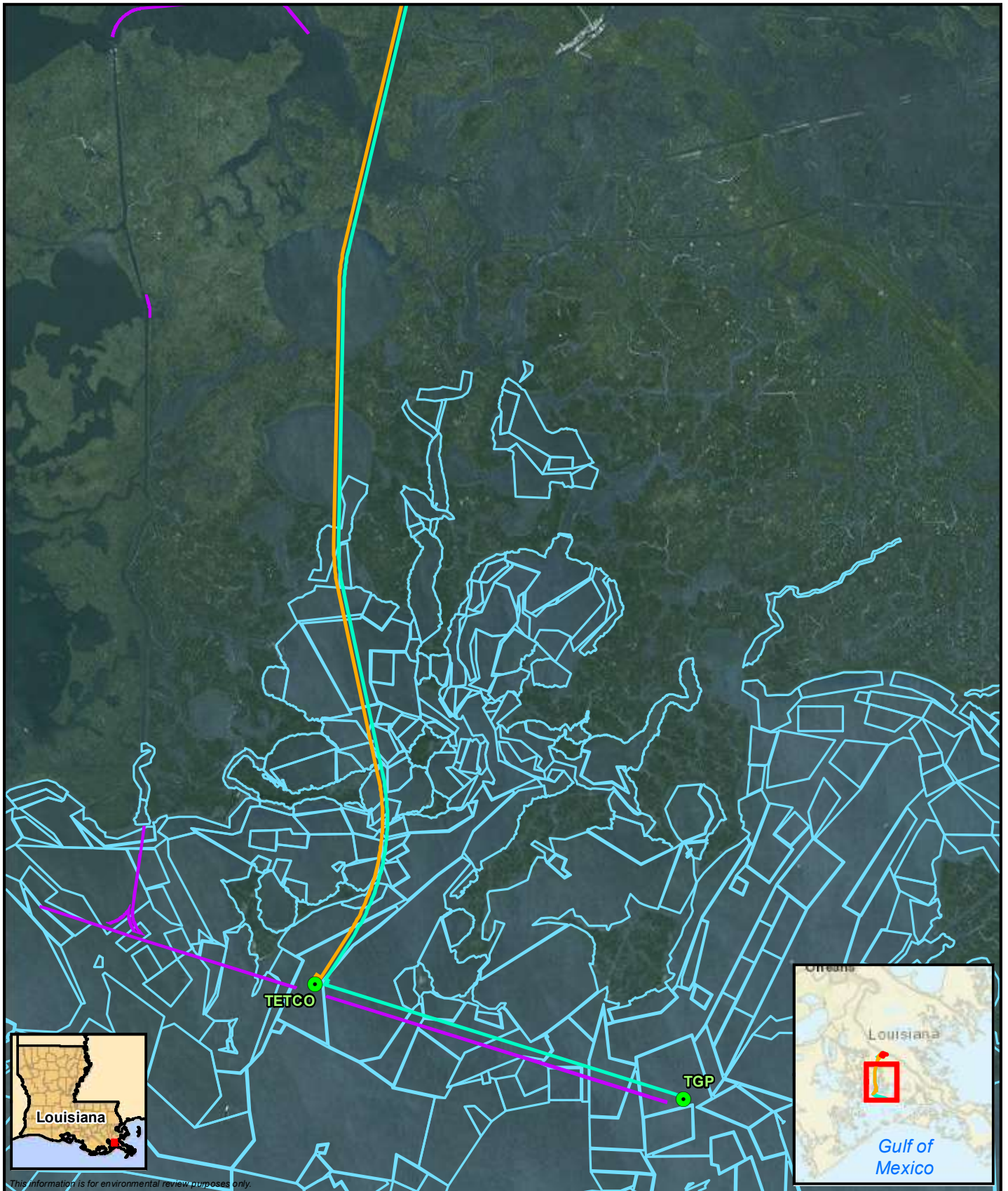
- Wilkinson Canal and Wilkinson Bayou;
- Bay Sanbois, Lake Judge Perez, and Bay De La Cheniere; and
- Barataria Bay.

The designated uses for all segments crossed include primary contact recreation, secondary contact recreation, fish and wildlife propagation, and oyster harvesting; the segments crossed by the pipeline system fully support all designated uses with no impairment. The estuarine wetlands and open waters provide appropriate habitat for many aquatic resources characteristic of south Louisiana estuarine marshes and open waters.

In shallow coastal estuaries, benthos is a key component of the ecosystem, and the Barataria Basin has a robust and diverse benthic community. Ninety-four different benthic species have been documented in Barataria Basin (Conner and Day, 1987). A commercially important benthic species within the Barataria Basin is the oyster (*Crassostrea virginica*). Though large oyster reefs are uncommon in the Barataria Basin, small oyster aggregations are common throughout the basin. Culling oysters in Louisiana is allowed only in designated, open public areas or private leased areas. The harvest season for oysters generally runs from the first Wednesday after Labor Day through April 30; however, the owner of an oyster lease or his duly authorized agents may harvest oysters during such times as are provided within the lease terms and conditions and as approved by the LDWF and LDNR (LDWF, 2015b). The Barataria Basin contains public oyster seed grounds and oyster leases as shown in figure 4.6-2. The pipeline system would not cross any public oyster areas but would traverse many private oyster leases. These private leases are identified in table 4.6-2 below.

Table 4.6-2 Private Lease Areas in Barataria Bay Crossed by Pipeline System				
Milepost In	Milepost Out	Lease ID	Oyster Lease Crossed by Pipeline (feet)	Direct Impact Acreage (Construction acres)
Southwest Laterals				
0.0	0.3	2801915	0	0.9
0.0	0.5	3361309	2,345	45.2
0.3	0.7	3463410	363	6.0
0.5	0.9	3253007	1,973	26.5
0.8	1.4	3463010	1,961	19.9
0.9	1.3	2790215	0	6.1
1.2	1.5	2668513	0	1.3
1.3	2.0	3316508	2,568	33.1
1.6	2.5	3330908	3,138	42.9
2.1	2.5	3187307	22	1.3
2.4	2.7	3330808	632	8.9
2.6	4.4	2843807	4,309	60.2
3.2	4.3	3222207 b	3,255	57.2
3.5	4.5	2805407	900	7.6
4.2	4.5	2760507	1,188	9.1
4.3	4.7	2883207	0	2.2
4.4	4.9	2989107	820	6.1
4.5	4.7	2901007	0	0.1
4.7	4.8	3003407	44	0.5
4.7	4.9	2989007	742	3.4
4.9	5.0	2989307	480	3.2
5.0	5.0	3210207	0	0.2
5.0	5.2	2904207	778	6.8
5.1	5.5	3003707	1,585	12.4
5.5	5.7	3003107	380	4.2
5.5	5.9	2747207	1,076	7.5
5.7	6.0	2997807	0	0.1
5.8	6.0	3002807	915	7.8
6.0	6.9	3133307	4,101	33.5
6.8	7.2	3003207	1,326	22.4
7.1	7.5	3522512	318	4.1
7.2	8.1	2872907	1,078	9.3
Barge Access Routes				
B0	B0.9	2732307 b	648	28.4
B0	B0.5	2829907	1,745	11.6
B0	B0.4	3366209	0	0.1
B0.7	B1.0	2814807 b	800	7.7

Table 4.6-2 Private Lease Areas in Barataria Bay Crossed by Pipeline System				
Milepost In	Milepost Out	Lease ID	Oyster Lease Crossed by Pipeline (feet)	Direct Impact Acreage (Construction acres)
B1.1	B1.4	3369909	811	5.6
B1.4	B1.5	3384309	68	0.6
B1.5	B1.7	2874907	1,115	7.6
B1.6	B2.2	3495511	2,339	15.3
B2.1	B2.3	2801607	570	4.3
BB10.0	BB10.3	2852607	278	1.9
BB10.1	BB10.3	2866507	588	4.1
BB10.3	BB10.6	3345108	941	6.5
Total			46,199	543.6



- Terminal Site Boundary
- Oyster Leases
- Interconnect and Meter Station
- SW Lateral TETCO
- SW Lateral TGP
- Barge Access Channel Excavation Area

0 0.5 1
Miles



Figure 4.6-2
Mapped Oyster Leases Crossed by the
Proposed Pipeline System
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana

Nektonic invertebrates such as shrimp and crabs are both ecologically and commercially important species in the Barataria Basin, with shrimp being one of the most dominant species in both numbers and biomass in the middle and lower Barataria Basin (Conner and Day, 1987) during certain periods of the year. Ecologically, these species are an important link in the estuarine food chain. Commercially important species include brown shrimp (*Penaeus aztecus*), white shrimp (*Penaeus setiferus*), and blue crab (*Callinectes sapidus*). The pipeline system is in Shrimp Area 09, Barataria Inside, which indicates that this shrimping area is within the Barataria Bay and inshore waters. Commercial and recreational shrimping occur in the Barataria Basin, with the spring shrimping season usually beginning in early to mid-May and extending to July, and the fall season usually beginning around mid-August and typically extending into December (LDWF, 2015c). The commercial crab season is open for most of the year. However, the LDWF has the authority to prohibit the use of crab traps in state waters for a maximum 16-consecutive-day period between February 1 and March 31 of each year and during a maximum 14-consecutive-day period, which includes the opening day of the spring inshore shrimp season (May), for the purpose of removing derelict or abandoned crab traps (LDWF, 2016).

Ninety-seven percent of commercially important species in the Gulf of Mexico depend on estuaries for some portion of their life cycle (Conner and Day, 1987). The Barataria Basin is an important nursery for commercially harvested fish species in the Gulf of Mexico. A total of 237 species of fishes have been recorded from the deltaic plain estuaries in Louisiana, with the Barataria Basin being the most diverse of any estuary in Louisiana (Connor and Day, 1987) with 186 species recorded. The composition of species within the Barataria Basin changes seasonally due to migratory patterns and life cycle of the species that inhabit the basin and prey availability. Representative species of finfish in the Barataria Basin include bay anchovy (*Anchoa mitchilli*), Atlantic croaker (*Micropogonias undulatus*), Gulf menhaden (*Brevoortia patronus*), spot (*Leiostomus xanthurus*), hardhead catfish (*Ariopsis felis*), sand seatrout (*Cynoscion arenarius*), Atlantic threadfin (*Polydactus octonemus*), striped anchovy (*Anchoa hepsetus*), gafftopsail catfish (*Bagre marinus*), Gulf pipefish (*Syngnathus scovelli*), spotted sea trout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), and black drum (*Pogonias cromis*).

4.6.3.2 Impacts and Mitigation

LNG Terminal

Direct and indirect impacts on fishery resources in the Mississippi River from construction of the LNG terminal and marine facilities loading docks and temporary berthing structures for construction delivery may include the following:

- permanent alteration, addition, or removal of aquatic habitat (e.g., benthic habitat loss from permanent pile placement, introduction of vertical substrate habitat from piles, and shading or lighting at the LNG loading docks);
- temporary loss of food resources in the form of relatively immobile prey in the benthic environment;
- temporary increases in sedimentation and water turbidity within and immediately surrounding the construction work area;

- temporary disturbance of normal activities (e.g., foraging) and increased stress during in-water construction for Marine Facilities in the Mississippi River;
- introduction of pollutants; and
- mortality to individuals due to contact with construction equipment or exposure to elevated sound pressure levels.

No shoreline excavation is expected to occur and no dredging is planned in the Mississippi River.

Construction of the marine facilities would result in a localized increase in turbidity and suspended sediment levels. However, these impacts are expected to be temporary (i.e., confined primarily to the period of in-water activity and shortly thereafter) and limited to the area within and immediately adjacent to the LNG loading and marine facilities. No permanent or long-term water quality impacts are anticipated. Impacts on fisheries resources and supporting habitat as a result of construction and operation would occur in the Mississippi River from construction of the marine facilities.

The presence of the LNG loading docks would alter the existing aquatic habitat. The loading docks would be raised approximately 25 feet above the water, creating shading effects over the river substrate. Unconsolidated sediments within the river provide foraging habitat for benthic (bottom-dwelling) organisms and fish and are designated as EFH for red drum, shrimp, and reef fish (see discussion in section 4.6.4.1). Substrates within the Mississippi River are considered early successional due to frequent disturbance from maintenance dredging, propeller wash, and vessel traffic. Installation of almost 500 piles to support the LNG loading docks would act both to reduce foraging and benthic habitat for fish and provide a vertical substrate for marine life; thereby creating additional shelter and foraging opportunities for fish and mobile benthic species.

Impacts on potential fish habitat would be associated with the permanent loss of excavated drainage ditches that cross the LNG terminal site and the installation of the three permanent LNG berthing docks in the Mississippi River. Due to hydrologic separation from natural drainage flows in the fastland drainage ditches, which are often ephemeral, these features provide limited fisheries habitat. Construction measures employed to protect water quality would minimize any impacts on local fish resources that may remain at the LNG terminal site. The LNG loading dock platforms would be fixed approximately 25 feet above the existing water level on pilings, which would provide a substrate for algae, invertebrates, and other potential food sources for fish. The pilings would provide shade and also an area of refuge and protection for fish and other motile biota. It is expected that the LNG loading dock platforms would increase habitat diversity in the Mississippi River and have a net beneficial effect on fisheries resources. No significant commercial or recreational fisheries resources occur in the vicinity of the LNG terminal.

Pile Driving

Pile driving during construction of the marine facilities would temporarily increase underwater noise levels within the Mississippi River. Venture Global would install a combination

of 72-inch-diameter, 66-inch-diameter, 48-inch-diameter, 36-inch-diameter, and 24-inch-diameter steel piles for the LNG loading docks, MOF, and temporary berthing structures (table 4.6-3). Piles would primarily be installed using an impact hammer during daylight hours. It is assumed that impact-driven piles would require approximately 4 hours of continuous driving for installation. Pilings would also be required for construction of the metering stations in Barataria Bay and are shown in table 4.6-3.

Table 4.6-3 Pilings Sizes and Installation Methods for Project Facilities			
Facility	Number	Size (inches)	Installation Method
LNG Loading Dock ^a	250	48	impact hammer
	66	36	impact hammer
	183	24	impact hammer
Material Offloading Facility	215	36	impact hammer
	55	48	impact hammer
Temporary Berth (west)	4	72	impact hammer
	8	66	impact hammer
Temporary Berth (east)	4	66	impact hammer
Metering Stations	615	12	Impact hammer/vibratory
a – LNG loading docks pile quantities include all piles located riverside of the federal levee.			

Fish can be affected by noise both physiologically and behaviorally. The majority of research involves studies of the physiological effect of impact pile driving on fish due to changes in water pressure. Fish with swim bladders are more vulnerable to such pressure changes, which can cause capillaries to rupture or the swim bladder to rapidly expand and contract (Caltrans, 2001). Temporary loss of hearing also may occur as a result of exposure to noise from impact pile driving (Popper and Hastings, 2009; Popper et al., 2005). When caged juvenile Coho salmon (*Oncorhynchus kisutch*) were placed as close as 6.6 feet (2 meters) to steel piles being impacted, no fish mortality was observed (Ruggerone et al., 2008).

Potential effects on fish from exposure to continuous sound include temporary threshold shift (TTS), physical damage to the ear region, physiological stress responses, and behavioral responses such as startle response, alarm response, avoidance, and perhaps lack of response due to masking of acoustic cues. Most of these effects appear to be either temporary or intermittent, and therefore, probably do not significantly impact fish at a population level. Fish do react to underwater noise from vessels and move out of the way, move to deeper depths, or change their schooling behavior. The received levels at which fish react are not known and apparently are somewhat variable, depending upon circumstances and species of fish. To assess the possible effects of underwater project noise, it is best to examine project noise in relation to ambient continuous noises routinely produced by other projects and activities, such as shipping and fishing, and pulsive noises produced by pile-driving activities.

Existing underwater sound levels can serve as a baseline from which to measure potential impacts associated with Project activities. Knowing the background noise of an area is important to understanding the overall impact that the introduction of more noise could have on fishes. If background noise levels in the vicinity of the Project exceed effects thresholds, then fish would not be affected by any sound less than the already existing dominant noise levels. However, there is no current information regarding measurements of background noise in the vicinity of the Project area. Therefore, while it can be assumed that vessel noise associated with the Project would not add greatly to the already existing background vessel noise in the region, it cannot be assumed that the sound produced by pile driving would be completely masked by vessel noise, especially close to the hammer.

Table 4.6-4 provides the underwater noise thresholds for injury and behavioral disturbance for fish during marine pile-driving activities. For purposes of this analysis, examples of injury include permanent hearing loss and mortality. Noise impact thresholds for fish were determined by Venture Global using a spreadsheet that NMFS developed to assess the potential effects on fishes exposed to elevated levels of underwater sound during pile driving (Washington State Department of Transportation, 2016). Table 4.6-5 provides the underwater noise thresholds for injury and behavioral disturbance for fish during marine pile-driving activities. For purposes of this analysis, examples of injury include permanent hearing loss and mortality. Examples of behavioral disturbance include increased vulnerability to predators, inability to communicate, movement away from feeding grounds, temporary injuries, and inability to sense the physical environment.

Table 4.6-4 Underwater Noise Thresholds for Fish During Pile Driving Activity		
Functional Hearing Group	Underwater Noise Thresholds ^a	
	Impact Pile Driving Disturbance Threshold	Injury Threshold
Fish $\geq$ 2 grams ^b	Behavior effects threshold 150 dB RMS	187 dB SEL _{cum}
Fish < 2 grams ^b	Behavior effects threshold 150 dB RMS	183 dB SEL _{cum}
Fish all sizes ^b	Behavior effects threshold 150 dB RMS	206 dB Peak
a From NMFS Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. b From Caltrans' <i>Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish</i> (Caltrans 2015). Key: dB = decibel Peak = peak sound pressure RMS = root-mean-square sound pressure SEL _{cum} = cumulative sound exposure level		

Table 4.6-5 Threshold Distance for Injury and Disturbance to Fish for Different Pile Diameters				
Type of Pile and Installation Method	Threshold Distance (feet/meters)			
	Physical Injury		Behavior Disturbance	
	Cumulative SEL dB re 1 µPA			
	Peak	Fish ≥ 2g	Fish < 2g	RMS
72-inch-diameter Steel Pile - Impact Driven	112 / 34	13,058 / 3,981	13,058 / 3,981	60,609 / 18,478
66-inch-diameter Steel Pile – Impact Driven	82 / 25	9,607 / 2,929	9,607 / 2,929	44,587 / 13,594
48-inch-diameter Steel Pile – Impact Driven ^a	59 / 18	6,865 / 2,093	7,065 / 2,154	32,800 / 10,000
36-inch-diameter Steel Pile – Impact Driven ^a	59 / 18	5,051 / 1,540	5,199 / 1,585	24,129 / 7,356
24-inch-diameter Steel Pile – Impact Driven ^a	39 / 12	1,935 / 590	2,414 / 736	28,132 / 8,577
12-inch-diameter Steel Pile – Impact Driven ^{a,b}	7 / 2	469 / 143	705 / 215	5,198 / 1,585
12-inch-diameter Steel Pile – Vibratory Driven	0.2 / <0.1	0.5 / 0.2	1.0 / 0.3	71 / 22
a Distances calculated using the NMFS Pile Driving Calculator.				
b 12-inch-diameter piles would be used for construction of meter stations in Barataria Bay.				
c Distances calculated using a formula for underwater practical spreading loss, $L_{\text{receiver}} = L_{\text{source}} - 15 \log (R_{\text{receiver}}/R_{\text{source}})$.				
Key:				
dB re 1 µPA = decibel re 1 micropascal				
RMS = root-mean-square sound pressure				
SEL = sound exposure level				

Table 4.6-6 provides an estimate of near-source (10-meter) unattenuated sound pressures for in-water pile driving. Since the average sound pressure levels for 48-inch-diameter piles were not readily available, levels for 60-inch-diameter piles were used instead.

Table 4.6-6 Summary of Near-source (10-meter) Unattenuated Sound Pressures for In-water Pile Driving			
Type of Pile and Installation Method	Average Sound Pressure Measured in dB ^{a,b}		
	Peak	RMS	SEL
60-inch-diameter Steel Pile – Impact Driven	120 ^b	195 ^c	185 ^c
36-inch-diameter Steel Pile – Impact Driven	210	193	183
24-inch-diameter Steel Pile – Impact Driven	207	194	178
12-inch-diameter Steel Pile – Impact Driven ^d	195	183	170
12-inch-diameter Steel Pile – Vibratory Driven ^d	171	155	155
a Data obtained from “Compendium of Pile Driving Sound Data” (Caltrans, 2007). b dB = decibel Peak = peak sound pressure RMS = root-mean-square sound pressure SEL = sound exposure level c No data are available for the 48-inch-diameter piles that are proposed for the Project, so levels for the 60-inch-diameter piles were used instead. d 12-inch-diameter steel piles would be used for construction of meter stations in Barataria Bay.			

Venture Global primarily proposes to use an impact driven installation method, which has a higher sound level than vibratory installation. Underwater noise from pile driving would exceed the behavioral disturbance threshold for fish in the vicinity of the Project. If unmitigated, much of the proposed pile driving would also exceed the injury threshold for fish and the Project would have adverse impacts on aquatic resources in the Project area due to pile driving noise.

Venture Global has submitted a draft Underwater Noise Mitigation Plan to the FWS, NMFS, and LDWF providing an updated analysis of underwater noise impacts due to pile driving, including assumptions and supporting calculations. The specific noise mitigations that would be implemented for underwater pile-driving as shown in this plan are as follows:

- adopting a 150-foot buffer around pile-driving locations for manatees, other marine mammals, and sea turtles, when present and ceasing work until the marine mammal or sea turtle moves outside of the buffer or had not been observed in the buffer for 30 minutes or sea turtles and manatees and 15 minutes for other marine mammals; and
- using soft starts at the beginning of each pile installation or when 15-minute or more delay in pile driving has occurred by gradually increasing the intensity of pile driving to allow free-swimming aquatic life to leave the area.

Other Underwater Noise Sources

Natural sources of ambient/background noise include biological sources (i.e., various biological species), wind, waves, water flow, and rain. Human-generated sources can include vessel noise (e.g., commercial shipping/container vessels) and maritime activities. Various factors contribute to the background noise within the Project area. One of the major contributors to background noise in the Project area is commercial shipping traffic associated with the Mississippi River and the Port of New Orleans. Project construction activities would be temporary and would occur in areas that currently experience underwater noise from commercial and recreational boaters. During operation, the noise generation associated with visiting LNG carriers would be consistent with that produced by the multiple large ships that travel through the heavily used section of the Mississippi River on which the LNG terminal site would be situated. Generally, it is expected that the background noise within the Mississippi River is dominated by large vessels (e.g., tankers, container ships) that produce source levels of 180 to 190 decibel (dB) re 1 micropascal root-mean-square (μPARMS) at frequencies between 200 and 500 hertz (Jasney et al., 2005). We conclude that the noise from Project construction (excluding pile driving) and LNG carriers during operations would not be excessive and would not result in negative noise impacts on the biological community.

Stormwater Runoff

Construction activities at the LNG terminal would require the removal of vegetation cover at the site and exposing the underlying soils to wind and rain, which would increase the potential for soil erosion and sedimentation of aquatic habitat. Similarly, during operation of the LNG terminal, 606.0 acres of currently vegetated land would be converted to impervious or semi-pervious surfaces associated with aboveground facilities and plant roads, which would increase

stormwater runoff into adjacent vegetated and open water habitats. Potential impacts from stormwater runoff on aquatic resources include increased turbidity and levels of suspended solids. To minimize impacts on aquatic resources due to stormwater runoff, Venture Global would conduct land-disturbing activities in compliance with its LPDES General Permit for stormwater discharges; Project-specific Construction SWPPP; and Project-specific Plan and Procedures. Based on the inherent environmental protection afforded by these regulations and permits, indirect impacts on aquatic species due to stormwater discharges are not expected to be significant.

Ballast Water

Ballast water would be discharged as an LNG carrier is loading cargo. The general use, discharge, and regulation of ballast water is discussed in section 4.3.2.2. Ballast water that would be discharged in the LNG berthing area would be composed mainly of Gulf of Mexico water, which would exhibit water quality parameter concentrations different from those of the Mississippi River. The effects of ballast water discharges on four ambient water quality parameters (temperature, pH, dissolved oxygen, and salinity) are described in section 4.3.2.2. Ballast water is stored in the ship's hull; as a result, the temperature of discharged water is not expected to deviate substantially from ambient water temperature. The pH of ballast water would be similar to or slightly higher than ambient water within the river. However, this difference would not be outside the tolerance range of resident species, and we believe impacts would be temporary and negligible.

Surface water within the Mississippi River is generally considered fresh, although a salt-wedge intrusion along the bottom can occur during periods of low rainfall and high tides. During and immediately following ballast water discharges, benthic aquatic species may be affected by higher salinity levels because the higher salinity ballast water would sink to the lower portion of the river due to its higher specific gravity relative to the ambient water. However, ships moving along the river near the berthing area would displace water, circulating it into, around, and out of the berthing area. Therefore, any increased salinity levels resulting from ballast water discharges would be temporary. Resident species within the river are euryhaline (able to live in waters with a wide range of salinity), and the salinity of seawater is well within their tolerance range. Therefore, we have determined that increases in salinity from ballast water discharges would be temporary and not likely to adversely affect aquatic resources.

Dissolved oxygen levels below 4 mg/L are generally considered unhealthy for aquatic life, and levels below 2 mg/L are considered hypoxic and inadequate to support most aquatic life. As discussed in section 4.3.2.2, ballast water would contain low dissolved oxygen levels and could decrease existing dissolved oxygen levels within the immediate vicinity of the discharge point. Depending on the oxygen levels present in both the ballast and ambient water at the time of discharge, aquatic resources present in the vicinity of the discharge point could be exposed to dissolved oxygen levels considered unhealthy for aquatic life. The adaptability of resident species in the Mississippi River to natural spatio-temporal variation in oxygen levels, and the ability to move over a short distance to more suitable conditions, would minimize the adverse impacts associated with ballast water discharges. Given that the amount of ballast water discharged into the river during each LNG vessel visit to the LNG terminal would make up only a very small percentage of the 400 billion gallons water flowing downstream, we conclude that impacts on aquatic resources from reduced dissolved oxygen would be temporary and minor.

Due to the volumes of ballast water often collected by vessels, a possibility exists that living marine organisms may enter ballast tanks. The larger macroorganisms that may be collected would likely die during transit; however, some of the smaller planktonic organisms could survive. An environmental concern associated with ballast discharge includes the risk of introducing exotic species in riverine and estuarine ecosystems. Loaded with water from the surrounding ports and coastal waters throughout the world, vessels can carry a diverse assemblage of marine organisms in ballast water that may be foreign and exotic to the ship's port of destination. Invasive aquatic species may cause algal blooms and hypoxic conditions, affecting all trophic levels and potentially resulting in a decline in biodiversity.

USCG regulations require that all vessels equipped with ballast water tanks that enter or operate in U.S. waters maintain a vessel-specific ballast water management plan and assign responsibility to the master or appropriate official to understand and execute the ballast water management strategy for that vessel (33 CFR 151.2026). Under these requirements, vessels must implement one of five strategies to prevent the spread of exotic aquatic nuisance species in U.S. waters. The IMO has adopted this regulation and requires each vessel to install and operate a ballast water management system (option 1 as currently defined).

Venture Global has stated that it would require LNG carriers to conduct complete ballast water exchange at least 200 nautical miles from any shoreline (option 4 as currently defined), except in extraordinary circumstances causing safety or stability concerns that would require a ballast exchange less distant from the shoreline, which is authorized under 33 CFR 151.2040. Venture Global has indicated that they adhere to all USCG ballast management regulations throughout the life of the Project.

Artificial Lighting (including flaring)

Temporary lighting would be installed and used during construction of the LNG terminal to facilitate construction activities during evening hours and meet applicable safety requirements. Construction of the LNG loading and ship berthing facilities would not require overwater lighting during the construction period, as all work here would be conducted during daylight hours. However, artificial light sources can have undesirable effects on aquatic resources, such as altering foraging behavior and spatio-temporal patterns of species density. Artificial light emanating from coastal infrastructure has the potential to alter the feeding behavior of predatory fish and affect prey fish behavior, particularly schooling (Becker et al., 2012). Illumination of surface waters in the vicinity could cause artificially induced aggregations of small organisms that rely on sun or moonlight to determine movement patterns, resulting in increased predation by larger species. Generally, impacts on aquatic species would be minor as these species may change their feeding habits over time. Due to the industrial nature of the area surrounding the LNG terminal, aquatic species within the Mississippi River are likely acclimated to ambient light from surrounding industrial sources.

To minimize potential impacts on aquatic resources, Venture Global would direct all nighttime lighting towards the construction activity being conducted. Venture Global's Facility Lighting Plan indicates that lighting would be chosen to minimize the horizontal emission of light away from intended areas, and over-water lighting would be limited to the extent necessary to carry out marine operations or facility maintenance and would be shielded. Based on the existing

light conditions along relevant portions of the Mississippi River and the likelihood that aquatic resources would acclimate over time to increased lighting at the LNG terminal, we have determined that impacts on aquatic resources from increased lighting during construction and operation of the LNG terminal would be minimized.

Mississippi River Traffic

LNG carrier visits to the LNG terminal would represent only a minor increase to the existing level of ship traffic in the Mississippi River; as such, operational impacts on fisheries resources (including those associated with noise as discussed earlier) are not anticipated.

Water Withdrawal and Discharge

Venture Global anticipates that water for hydrostatic testing of the LNG tanks, other storage tanks, and plant piping would be appropriated from the drainage canal south of the LNG terminal site. Water used for LNG terminal operations may be obtained from the Mississippi River, the Plaquemines Parish Water District, or a new well or wells to be located at the LNG terminal site.

The water withdrawal process could entrain fish eggs and juvenile fish present near the intake structures within the industrial canal. In accordance with its Project-specific Procedures, Venture Global would screen (0.25- to 1-inch mesh) intake hoses to limit the entrainment of larvae and pre-juvenile fish and invertebrates during water withdrawal. Venture Global would withdraw water at a rate of 1,200 gallons per minute and would place screened intake structures at the lowest possible elevation to reduce the impingement of biological organisms and debris on intake screens. Water intakes would be placed above the channel bed to avoid sediment disturbance. Also, test water would be transferred between LNG storage tanks to reduce the amount of water required for testing. With the implementation of these measures, impacts on aquatic resources as a result of water intake would not be significant.

Impacts associated with water discharges include local erosion and bed scour. Test water would be in accordance with the LPDES Hydrostatic Test Wastewater Discharge Permit requirements and would follow the Project-specific Plan and Procedures. The water would be tested for total suspended solids, oil and grease, and pH, and treated (if test results indicate that the water would not meet LPDES requirements) prior to being discharged to the Mississippi River. Therefore, we have determined that impacts on aquatic resources due to the discharge of hydrostatic test water would be temporary and negligible.

Inadvertent Spills

During construction and operation, hazardous materials resulting from spills or leaks entering the Mississippi River could have adverse impacts on aquatic resources. The impacts are caused by either the physical nature of the material (e.g., physical contamination and smothering) or by its chemical components (e.g., toxic effects and bioaccumulation). These impacts would depend on the depth and volume of the spill, as well as the properties of the material spilled. To prevent spills and leaks, Venture Global would implement its Project-specific Spill Prevention Plan during construction and its SPCC Plan during operation of the LNG terminal. These plans outline potential sources of releases at the site, measures to prevent a release, and initial responses

in the event of a spill (see detailed discussion in section 4.2.3). Given the impact minimization and mitigation measures described above, we conclude that impacts on aquatic resources would be temporary and minor.

Pipeline System

Waterbodies and wetlands that would be crossed by the pipeline system have the potential to support fish and other aquatic biota. Larval and juvenile fish rely on wetlands as refuge and foraging habitats. Pipeline construction impacts on fishery resources resulting from excavation/dredging for the pipeline and barge access routes would be temporary and may include the following:

- temporary noise disturbance during in-water construction;
- temporary increased sedimentation and water turbidity within and immediately surrounding the construction work area;
- direct mortality of individuals due to contact with construction equipment;
- temporary loss of food resources in the form of relatively immobile prey in the benthic environment;
- temporary and permanent alteration, addition, or removal of aquatic habitat cover; and
- introduction of pollutants.

Permanent impacts include the construction of the two meter stations in Barataria Bay. The meter station platforms would be raised approximately 25 feet above the water, thereby reducing shading effects to benthic habitat. The 12-inch-diameter piles supporting the platforms would act to remove or reduce benthic habitat used by fish for foraging, but would also provide a vertical substrate for marine life, creating additional fish foraging opportunities and shelter. No other impacts on fisheries resources are expected during daily operations. Some of the impacts mentioned above may occur during maintenance activities but would be infrequent, of limited duration, and therefore insignificant.

Pipeline system construction impacts on fisheries resources and habitat would occur primarily in estuarine wetlands and open water. Impacts would primarily be localized and temporary, with disturbed areas returning to preconstruction conditions following pipeline installation. The pipeline trench would be backfilled following construction, and the barge channels would backfilled with sidecast material. The push method or barge lay method would be used for trenched pipeline installation across most waterbodies and wetlands. These methods are designed to minimize equipment use and disturbance during pipeline construction, although the crossing methods could result in temporary loss or modification of aquatic habitat, increases in sedimentation and turbidity levels, and alteration of vegetative cover. The majority of fish present within the waterbody at the time of construction activities would likely be displaced to similar nearby habitats; however, stress, injury, or death of individual fish may occur. Increased suspended sediment and turbidity levels may cause degradation of benthic and spawning habitat

and decreased dissolved oxygen levels within and downstream of the crossing location. Temporary increases in suspended solids would decrease rapidly following the completion of in-water activities.

Venture Global has developed Project-specific Procedures as initially discussed in section 2.5.5.5. FERC's Procedure's require seasonal restrictions on construction within waterbodies, unless expressly permitted or further restricted in writing by the appropriate federal or state agency. Venture Global states that it would not adopt the seasonal construction restriction for its pipelines because of the length of the construction period and the need for an integrated schedule across the multiple Project facilities. In compliance with our Procedures, Venture Global obtained written approval from the LDWF to conduct in-water activities without a seasonal restriction. As such, impacts on aquatic resources associated with construction activities is expected to be temporary, short-term, and localized to the immediate vicinity of construction activities. Although the construction of each pipeline and deepening of discrete segments of barge access channels would take place over an extended duration, the construction activity at any single location along the pipeline route or barge access channels is likely to be limited to several days or weeks minimizing potential impacts on aquatic resources and recreational fishing. Access to the construction right-of-way and barge access channels would not be prohibited for fishing/crabbing/shrimping, except in the immediate vicinity of construction activities where necessary for safety reasons.

A PSS wetland, PEM wetland, and perennial stream (unnamed channel) would be crossed by the HDD method at the northern end of the pipeline route between MPs 11.3 and 11.5 of the Southwest Lateral TETCO and MPs 14.6 to 14.8 of the Southwest Lateral TGP, thereby avoiding direct impacts on these features. Venture Global estimates that HDD operations would require approximately 9.0 million gallons of water and hydrostatic testing of the pipelines would require approximately 9.5 million gallons of water (18.5 million gallons in total). Installing the pipelines using the HDD method would avoid or minimize impacts on fisheries, fish habitat, and other aquatic resources within and adjacent to waterbodies unless an inadvertent release of drilling mud were to occur. An inadvertent release of drilling mud (bentonite clay) into a stream would affect water quality and could impede fish movement, potentially resulting in stress, injury, and/or direct mortality of fish present in the vicinity of the release. Bentonite clay is non-toxic to aquatic organisms (Hair et al., 2002). However, bentonite clay sediment can interfere with oxygen exchange by gills and adversely affect filter feeders. If an inadvertent release occurs, Venture Global would implement the corrective action and cleanup measures outlined in its HDD Contingency Plan. We have reviewed this HDD Contingency Plan and find it acceptable. The HDD Contingency Plan would minimize potential impacts on aquatic resources, including the installation of berms, silt fence, and/or hay bales to prevent silt-laden water from flowing into waterbodies, or in the event of an in-water release, the use of temporary dams to isolate the drilling fluid and vacuum trucks to remove the released drilling mud.

Venture Global prepared a report identifying shoreline areas within the Barataria Basin (i.e., those land/water interfaces with a hydrological connection to the open waters of the Gulf) that have high re-oiling potential (i.e., areas that have experienced periodic remobilization of weathered oil). The report indicates all of the Project's shoreline crossings have a reoiling potential classification of "no oil observed." If weathered oil is encountered during construction, Venture Global would take the appropriate precautions to prevent resuspension of contaminated media and notify the appropriate authorities.

Impacts on surface water and wetlands associated with construction of the pipeline facilities during and following construction would be addressed through adherence to the USACE, New Orleans District/LDNR permit conditions, CWA section 401 water quality certification requirements, and implementation of the protective measures in the Project-specific Plan and Procedures along with our recommendation. The applicant would minimize impacts by developing site-specific crossing plans for major waterbodies and by adhering to the procedures set forth in its final SPCC Plan, SWPPP, and HDD Contingency Plan. Surface water and wetland impact avoidance, minimization, and mitigation measures are addressed in sections 4.3.2.2 and 4.4.2.2, respectively.

Pile Driving

During construction of the two meter stations in Barataria Bay, 615 12-inch-diameter steel piles would be installed during construction. Installation could result in noise impacts on fish similar to those discussed for the marine facilities in the Mississippi River (see above for LNG terminal). Currently, Venture Global plans to install the piles associated with the meter stations using either the impact hammer pile driving method or the vibratory pile driving method. Generally, vibratory pile driving takes much less time than impact-driven pile installation.

Underwater noise thresholds for injury and behavioral disturbance for fish and near-source (10-meter) unattenuated sound pressures for in-water pile driving are summarized in tables 4.6-5 and 4.6-6, respectively. Venture Global has submitted its Underwater Noise Mitigation Plan to the FWS, NMFS, and LDWF as described in section 4.6.2.3 to minimize and avoid impacts from marine pile driving.

Other Underwater Noise Sources

Underwater noise levels associated with barges and dredging/excavation in estuarine wetlands and open water along the pipeline system would also increase in the Project area during construction and intermittently during operation of the pipelines. Construction activities would be temporary and would occur in areas that currently experience underwater noise from other oil and gas operations in the vicinity. The mobility of marine species and the ability to leave any area of noise disturbance would minimize impacts from barge traffic and construction of the pipeline and meter stations.

Dredging of Barge Access Channels

Dredging within barge access areas would cross private oyster leases. According to the LDWF, lessees must be notified as part of the Coastal Use permitting process about projects occurring in their oyster lease. In addition, a water bottom assessment must be conducted on those portions of leases located within 1,500 feet of the pipeline system. Additional requirements to mitigate potential impacts on these oyster leases may be required by the LDWF as the permitting process continues. Further, in the event that Venture Global cannot reach an agreement within an affected oyster lease holder, Venture Global would seek a preliminary determination of damages through an arbitration process with the LDNR – Oyster Lease Damage Evaluation Board. The board would review the results of an initial biological survey of the area to be affected and would determine the amount of a damage estimate deposit to be held by the board and paid by Venture

Global prior to construction within the lease. The final damage payment to be made to each lease holder would be made following the construction activities and completion of a final biological survey subject to review by the board.

Hydrostatic Testing - Water Withdrawal and Discharge

Venture Global anticipates that water for hydrostatic testing of the pipeline system would be withdrawn from Barataria Bay near the TGP and TETCO meter stations. The two discharge locations are the industrial canal south of the LNG terminal site and at the mainline valve site. Impacts associated with water discharges include local erosion and bed scour. Hydrostatic testing activities would be in accordance with the LPDES Hydrostatic Test Wastewater Discharge Permit requirements and would follow the Project-specific Plan and Procedures. Water intakes would be screened to reduce or eliminate the entrainment of fish and other aquatic organisms. The discharge water would be tested for total suspended solids, oil and grease, and pH, and treated (if test results indicate that the water would not meet LPDES requirements) prior to being discharged. Therefore, we have determined that impacts on aquatic resources due to the intake and discharge of hydrostatic test water would be temporary and negligible.

Vessel Traffic

Increased vessel traffic as a result of pipeline construction would represent a minor increase to the existing level of commercial and recreation vessel traffic within Barataria Bay; therefore, impacts on fisheries resources as a result of construction vessel traffic (including those associated with noise as discussed earlier) are not anticipated. Once construction is complete, vessel traffic associated with operation of the pipeline system would be related to maintenance and would be negligible.

Inadvertent Spills

During construction of the pipeline system, a potential exists for the release of hazardous materials into canals and Barataria Bay, which could have adverse impacts on aquatic resources. These impacts would depend on the depth and volume of the spill, as well as the properties of the material spilled. To prevent spills and leaks during pipeline construction, Venture Global would implement its Project-specific SPCC Plan. Given the impact minimization and mitigation measures described above, we conclude that the probability of a spill of hazardous materials is small and any resulting impacts on aquatic resources would be temporary and minor.

4.6.4 Essential Fish Habitat

The MSA (Public Law 94-265 as amended through January 12, 2007), was established, along with other goals, to promote the protection of EFH during the review of projects to be conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined in the MSA as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Federal agencies that authorize, fund, or undertake activities that may adversely affect EFH must consult with NMFS. Although absolute criteria have not been established for conducting EFH consultations, NMFS recommends consolidated EFH consultations with interagency coordination procedures required by other

statutes, such as NEPA, the Fish and Wildlife Coordination Act, and the ESA, to reduce duplication and improve efficiency (50 CFR 600.920(e)). Generally, the EFH consultation process includes the following steps:

- notification – The action agency should clearly state the process being used for EFH consultation (e.g., incorporating EFH consultation into an EIS);
- EFH Assessment – The action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of impacts. Specifically, the EFH Assessment should include the following:
 - a description of the proposed action;
 - an analysis of the effects (including cumulative effects) of the proposed action on EFH, managed fish species, and major prey species;
 - the federal agency's views regarding the effects of the action on EFH; and
 - proposed mitigation, if applicable.
- EFH Conservation Recommendations – After reviewing the EFH Assessment, NMFS should provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH; and
- agency response – Within 30 days of receiving the recommendations, the action agency must respond to NMFS. The action agency may notify NMFS that a full response to the conservation recommendations would be provided by a specified completion date agreeable to all parties. The response must include a description of measures proposed by the agency to avoid, mitigate, or offset the impact of the activity on EFH. For each conservation recommendation that is not adopted, the action agency must explain its reason to NMFS for not following the recommendation.

As recommended by NMFS, we are incorporating EFH consultation for the Project into our responsibilities under NEPA and this EIS.

4.6.4.1 Existing Essential Fish Habitat

The Project is in Gulf of Mexico Ecoregion 4: East Texas and West Louisiana, Mississippi Delta to Freeport. NMFS mapping shows EFH within the Project area, including the Mississippi River and portions of the Barataria Basin (NOAA, 2014a). Figure 4.6-3 shows the extent of EFH relevant to the Project areas. Correspondence between Venture Global and NMFS (NMFS, 2017) indicate that the portion of the Mississippi River located in the Project area does not provide EFH since managed fish species would not be common this far upriver (river mile 55). Therefore, we conclude that the LNG terminal facilities located in the Mississippi River would not effect EFH.

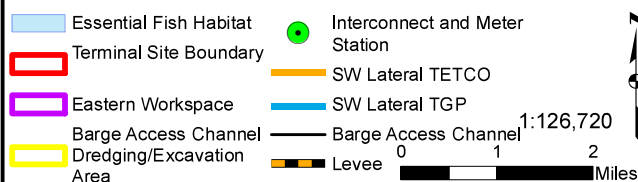
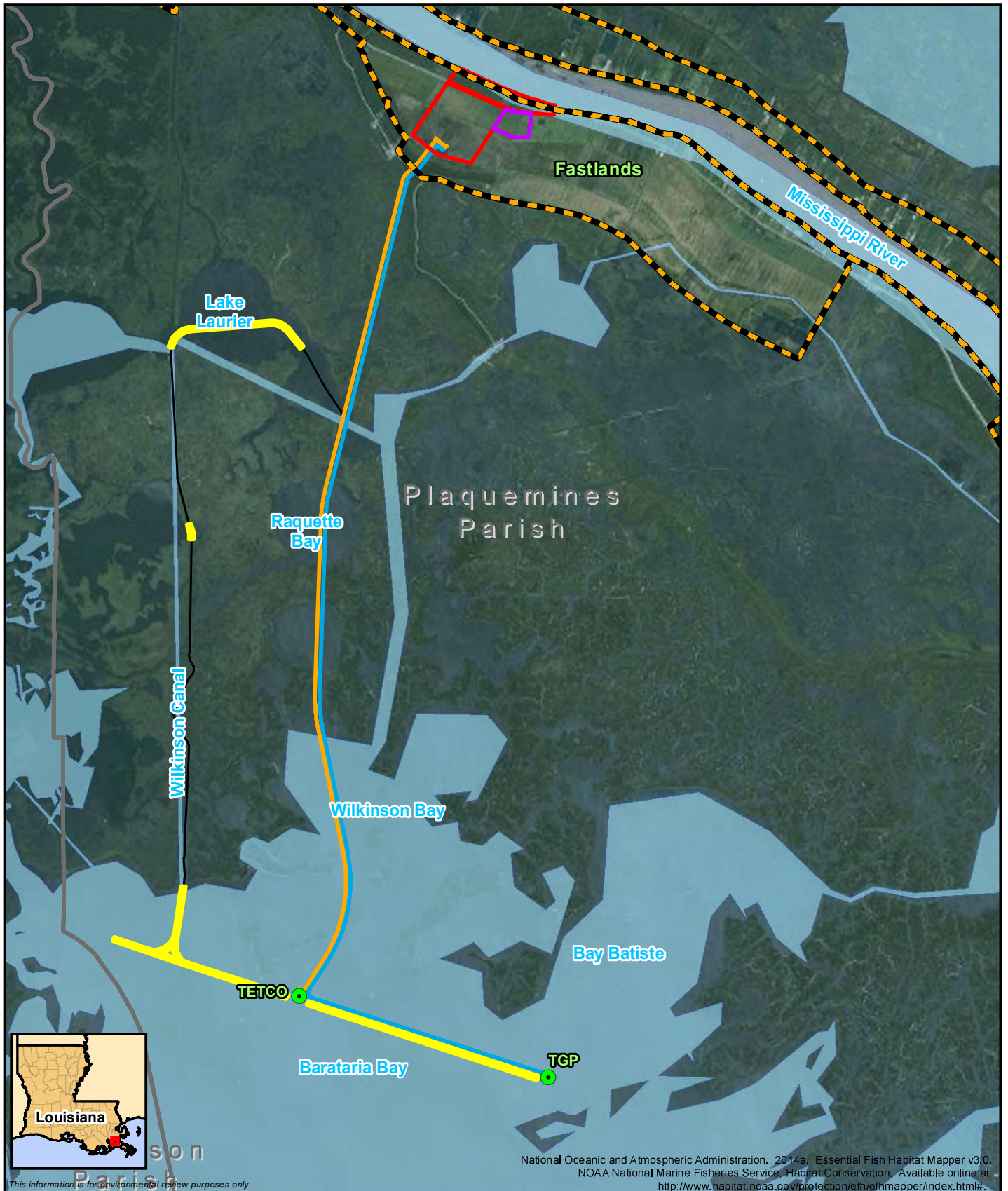


Figure 4.6-3
Mapped Essential Fish Habitat Crossed by the Project
Plaquemines LNG and Gator Express Pipeline Project
Plaquemines Parish, Louisiana

The remainder of the LNG terminal site lies adjacent to the Mississippi River on non-tidal fastlands that are hydraulically separated from surrounding marsh habitats. Correspondence between Venture Global and NMFS indicates that construction of the LNG terminal facility would not likely adversely impact habitat supportive of marine fisheries resources (NMFS, 2015a). The 80-acre eastern workspace adjacent to the LNG terminal site, like the LNG terminal, is also on non-tidal fastlands and, therefore, is not anticipated to affect EFH.

The pipeline system is in the Estuarine Zone, as defined by the Gulf Council (NMFS, 2015a). EFH in the region is designated by the Gulf Council and NMFS through Fishery Management Plans. NMFS, in a letter to FERC (NMFS, 2015a), indicated that wetlands along the majority of the pipeline system are categorized as EFH for post-larval and/or juvenile life stages of white shrimp, brown shrimp, and lane snapper (*Lutjanus synagris*); all life stages of red drum; and adult gray snapper. Additionally, primary categories of EFH within the Project area include estuarine emergent wetlands, estuarine water column, and estuarine mud bottoms. Though submerged aquatic vegetation (SAV) occurs within the Barataria Basin, no SAV was observed during field surveys for the pipeline system.

NMFS (NMFS, 2015a) indicated that wetlands in the vicinity of the pipeline system provide nursery and foraging habitats supportive of a variety of economically important marine fishery species, including striped mullet (*Mugil cephalus*), Atlantic croaker, Gulf menhaden, spotted and sand sea trout, southern flounder (*Paralichthys lethostigma*), and blue crab. Some of these species serve as prey for other fish species managed under the MSA by the Gulf of Mexico Fishery Management Council, such as mackerels, snappers, and groupers, as well as highly migratory species managed by NMFS, such as billfish and sharks.

4.6.4.2 Impacts and Mitigation

Construction of the pipeline system would impact EFH for post-larval and juvenile life stages of white shrimp, brown shrimp, and lane snapper, all life stages of red drum, and adult gray snapper. Affected EFH includes benthic substrates and/or water column habitats in estuarine open water (collectively referred to in this assessment as estuarine open water) and estuarine emergent wetlands. Potential adverse impacts on EFH would primarily be temporary, while some permanent impacts may be beneficial. Temporary adverse impacts during construction would be minimized through adherence to Venture Global's Project-specific Procedures, SWPPP, and SPCC Plan. Potential temporary and permanent impacts of pipeline system construction and operation on EFH are described below.

Temporary Habitat Modification

Approximately 775.4 acres of estuarine open water mapped as EFH and 423.9 acres of estuarine open water not mapped as EFH (in Lake Laurier, Barataria Bay, and Wilkinson Bay), along with approximately 64.5 acres of EEM wetlands, that can function as EFH, would be temporarily modified by dredging, excavation, and related activities within the workspace required for pipe installation, meter station construction, and barge access channels. Portions of the barge access channels would be dredged to increase the existing water depth (approximately 4 to 7 feet) to at least 8 feet to allow for passage of construction barges along the pipeline construction right-

of-way and in existing channels providing access to the right-of-way. Construction disturbance would be temporary and localized to the construction area.

Spoil resulting from the excavation of the flotation channel and pipe trenches would be temporarily placed on either side of the right-of-way centerline, keeping the spoil below the water surface, where feasible, to minimize wave-generated turbidity. After the pipe is lowered into the trench, the pipeline trench and flotation channel would be backfilled with previously excavated material. The trench and construction workspace would be returned to its previous contours to match the adjacent undisturbed portions of the wetland upon completion of restoration. The applicant would also install bank line stabilization at the water/marsh interface to facilitate restoration. Restoration of the temporarily impacted areas would be monitored and the successful achievement of pre-construction conditions will be determined after one full growing season post construction. For locations where pre-construction conditions are not achieved after one full growing season, Venture Global would work with the USACE and LDNR to determine the appropriate follow-up measures to restore the construction right-of-way.

Potential impacts on EFH include sediment disturbance and temporary changes in water depth from dredging/excavation, although the benthic substrate would offer fundamentally similar habitat prior to and after dredging. Along the Louisiana coast, SAV is largely limited to depths no greater than 3 to 4 feet (LDWF, 2012). Any increase in water depth beyond this level could preclude the growth of SAV. However, no SAV was identified during Venture Global's field surveys at proposed dredging/excavation locations (ERM, 2017); therefore, no impacts on SAV are expected. Given the type of sediments in estuarine open water environment, benthic communities are expected to quickly recolonize after construction. Wetlands would be returned to the previous grade and are expected to revegetate within one growing season. Therefore, we have determined that any adverse impacts on EFH would be minor because of their temporary nature and limited spatial extent.

Temporary Loss of Benthic Invertebrates

Dredging/excavation would have temporary and localized effects on benthic substrates in the estuarine zone. Invertebrate food resources would be expected to recolonize to their former status within a few seasons. Because the effects would be temporary and limited in spatial extent, temporary loss of benthic invertebrates is expected to have a minor adverse impact.

Temporary Increased Turbidity

The Project has the potential to produce temporary turbidity plumes in the water column during in-water work activities, including pipeline construction, barge channel excavation, and hydrostatic test water discharge. In-water work may cause localized increases of suspended sediment and nutrient levels in the water column, and decreases in dissolved oxygen. Turbidity effects would be temporary and limited in spatial extent and result in minor adverse impacts on EFH.

Introduction of Pollutants

Potential surface water quality impacts associated with accidental spills or leaks of hazardous liquids would be avoided or minimized by restricting the locations and use of refueling

and storage facilities, and by requiring cleanup in the event of a spill or leak. Additionally, shoreline crossings have a reoiling potential classification of “no oil observed.” Impacts on surface waters during construction and operation would be mitigated by adherence to the Project-specific Procedures, SWPPP, and SPCC Plan. Through implementation of the BMPs, potential impacts on EFH due to pollutants would be of short duration and minimal.

Permanent Habitat Modification

Approximately 2.4 acres of estuarine open water would be permanently modified through the construction of the two meter stations in Barataria Bay. The meter station platforms would be fixed approximately 25 feet above the existing water level on pilings, which would provide a substrate for marine algae, invertebrates, and other potential food sources for fish. The relatively close proximity of multiple pilings may also provide an area of refuge and protection for fish and other motile biota, while the platforms may offer some shading. Because the meter station platforms would increase habitat diversity in Barataria Bay, they would likely have a net beneficial effect on EFH.

Based on the information provided above, EFH, including estuarine emergent wetlands, benthic substrates, and water column habitats, would be affected by pipeline construction. Adverse effects would be temporary, localized, and minimal. Pre- and post-construction EFH acreage is not expected to change. Moreover, the pipelines have been routed through open water to the extent practicable, and construction methods have been selected that minimize potential degradation of EFH.

Following pipeline construction, affected wetlands and waterbodies would be returned to preconstruction conditions to the extent practicable, in accordance with the Project-specific Procedures and the conditions of USACE and LDNR permits. With the majority of wetlands in Barataria Bay being impacted by subsidence and erosion, complete restoration to pre-existing conditions is of concern, as noted by NMFS (2015). As noted above, if full recovery is not achieved within one growing season, Venture Global would consult with the USACE and LDNR to determine appropriate follow-up measures.

Marine Mammals

A total of 25 mammals protected under the MMPA may occur along the LNG transit routes in the Gulf of Mexico. Three of the species are also listed under the ESA and are addressed in section 4.7. The remaining 22 whale and dolphin species and their potential areas of occurrence along the LNG transit routes are described in table 4.6-7.

All marine mammals are federally protected under the MMPA. The MMPA established, with limited exceptions, a moratorium on the “taking” of marine mammals in waters or on lands under U.S. jurisdiction. “Take” is defined as the “harassing, hunting, capturing, or killing” of marine mammals. The 1994 Amendments to the MMPA define “harassment” as “any act of pursuit, torment, or annoyance” which:

- has the potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or

- has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild” (Level B Harassment).

LNG terminal operations would include LNG carriers moving between the Mississippi River and the Gulf of Mexico. As discussed for federally listed whales and sea turtles, there is the potential for interaction and injury during LNG carrier transit in the Gulf of Mexico. There is also a potential for bottlenose dolphins to occur in the Mississippi River, and they have been documented in Barataria Bay (Muth, 2016). Mitigation measures for non-listed marine mammals will be the same as those for listed whales and those noted in section 4.7.1.1 for manatees. Potential impacts on dolphins from pile driving during meter station construction would be similar to those discussed in section 4.7.1.1 for manatees.

Table 4.6-7 Non-ESA Listed Marine Mammals Potentially Occurring Along the LNG Transit Routes		
Common Name	Scientific Name	Area Where Mammal May Occur
Dolphins		
Atlantic Spotted Dolphin	<i>Stenella frontalis</i>	Gulf of Mexico
Bottlenose Dolphin	<i>Tursiops truncatus</i>	Terminal, Pipeline System, Mississippi River, Gulf of Mexico
Clymene Dolphin	<i>Stenella clymene</i>	Gulf of Mexico
False Killer Whale	<i>Pseudorca crassidens</i>	Gulf of Mexico
Frasier’s Dolphin	<i>Lagenodelphis hosei</i>	Gulf of Mexico
Killer Whale	<i>Orcinus orca</i>	Gulf of Mexico
Melon-headed Whale	<i>Peonocephala electra</i>	Gulf of Mexico
Pantropical Spotted Dolphin	<i>Stenella attenuate</i>	Gulf of Mexico
Risso’s Dolphin	<i>Grampus griseus</i>	Gulf of Mexico
Rough-toothed Dolphin	<i>Steno bredanensis</i>	Gulf of Mexico
Short-finned Pilot Whale	<i>Globicephala macrorhyncus</i>	Gulf of Mexico
Spinner Dolphin	<i>Stenella longirostris</i>	Gulf of Mexico
Striped Dolphin	<i>Stenella coeruleoalba</i>	Gulf of Mexico
Whales		
Blainville’s Beaked Whale	<i>Mesoplodon densirostris</i>	Gulf of Mexico
Bryde’s Whale	<i>Balaenoptera edeni</i>	Gulf of Mexico
Cuvier’s Beaked Whale	<i>Ziphius cavirostris</i>	Gulf of Mexico
Dwarf Sperm Whale	<i>Kogia sima</i>	Gulf of Mexico
Gervais’ Beaked Whale	<i>Mesoplodon europaeus</i>	Gulf of Mexico
Minke Whale	<i>Balaenoptera acutorostrata</i>	Gulf of Mexico
North Atlantic Right Whale	<i>Eubalaena glacialis</i>	Gulf of Mexico
Pygmy Sperm Whale	<i>Kogia breviceps</i>	Gulf of Mexico

Table 4.6-7 Non-ESA Listed Marine Mammals Potentially Occurring Along the LNG Transit Routes		
Common Name	Scientific Name	Area Where Mammal May Occur
Sowerby's Beaked Whale	<i>Mesoplodon bidens</i>	Gulf of Mexico
Source: NMFS, 2012		

4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are: federally listed and federally proposed species that are protected under the ESA, as amended; species that are currently candidates for federal listing under the ESA; state listed threatened or endangered species; and species otherwise granted special status at the federal or state level (e.g., protected under the MMPA).

Under section 7 of the ESA, as amended, federal agencies are required to ensure that any actions authorized, funded, or carried out by the agency would not jeopardize the continued existence of a federally listed threatened or endangered species, or result in the reduction or adverse modification of the designated critical habitat of a federally listed species. As the lead federal agency, FERC is required to coordinate with the FWS and NMFS to determine whether federally listed threatened or endangered species or designated habitat are found in the vicinity of projects and to determine potential effects on those species or critical habitats.

For actions involving major construction activities that may affect listed species or designated critical habitat, the lead federal agency must prepare a Biological Assessment and submit it to the FWS and/or NMFS. If the action would adversely impact a listed species, the federal agency must also submit a request for formal consultation. In response, the FWS and/or NMFS would issue a Biological Opinion as to whether or not the federal action would likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

As required by section 7 of the ESA, we are requesting that the FWS and/or NMFS accept the information provided in this EIS as the BA for the Project. Furthermore, we request concurrence with our determinations of effect for the federally listed and proposed species in table 4.7-1.

Based upon our review of publicly available information, agency correspondence, and field surveys, federally and/or state listed threatened or endangered species may occur in the vicinity of the terminal site and pipeline system. There is no critical habitat for federally listed species designated within the limits of construction for the Project.

Federal and State Listed Species Potentially Occurring in the Vicinity of the Project				
Common Name Scientific Name	Federal Status	State Status	Project Component	Determination of Effect
Mammals				
West Indian Manatee <i>Trichechus manatus</i>	Threatened ^c	Endangered	Pipeline	May affect, not likely to adversely affect
Blue Whale <i>Balaenoptera musculus</i>	Endangered ^c	Endangered	Terminal ^d	May affect, not likely to adversely affect
Fin Whale <i>Balaenoptera physalus</i>	Endangered ^c	Endangered	Terminal ^d	May affect, not likely to adversely affect
Sei Whale <i>Balaenoptera borealis</i>	Endangered ^c	Endangered	Terminal ^d	May affect, not likely to adversely affect
Sperm Whale <i>Physeter microcephalus</i>	Endangered ^c	Endangered	Terminal ^d	May affect, not likely to adversely affect
Birds				
Bald Eagle <i>Haliaeetus leucocephalus</i>	Delisted ^{a,b}	Endangered	Terminal and Pipeline	May affect, not likely to adversely affect
Brown Pelican <i>Pelecanus occidentalis</i>	Delisted	Endangered	Terminal and Pipeline	May affect, not likely to adversely affect
Eastern Black Rail <i>Laterallus jamaicensis jamaicensis</i>	Proposed	Not Listed	Terminal and Pipeline	May affect, not likely to jeopardize the continued existence
Peregrine Falcon <i>Falco peregrinus</i>	Delisted ^b	Threatened/ Endangered	Terminal and Pipeline	May affect, not likely to adversely affect
Piping Plover <i>Charadrius melodus</i>	Threatened	Threatened/ Endangered	Terminal and Pipeline	May affect, not likely to adversely affect
Red Knot <i>Calidris canutus rufa</i>	Threatened ^b	Not Listed	Terminal and Pipeline	May affect, not likely to adversely affect
Fish				
Gulf Sturgeon <i>Acipenser oxyrinchus desotoi</i>	Threatened	Threatened	Terminal and Pipeline	May affect, not likely to adversely affect
Pallid Sturgeon <i>Scaphirhynchus albus</i>	Endangered	Endangered	Terminal and Pipeline	May affect, not likely to adversely affect

Federal and State Listed Species Potentially Occurring in the Vicinity of the Project				
Common Name Scientific Name	Federal Status	State Status	Project Component	Determination of Effect
Oceanic White-tip Shark <i>Carcharhinus longimanus</i>	Threatened	Not Listed	Terminal and Pipeline	May affect, not likely to adversely affect
Giant Manta Ray	Threatened	Not Listed	Terminal and Pipeline	May affect, not likely to adversely affect
Reptiles				
Loggerhead Sea Turtle <i>Caretta</i>	Threatened	Threatened	Pipeline	May affect, not likely to adversely affect
Green Sea Turtle <i>Chelonia mydas</i>	Threatened	Threatened	Pipeline	May affect, not likely to adversely affect
Hawksbill Sea Turtle <i>Eretmochelys imbricate</i>	Endangered	Endangered	Pipeline	May affect, not likely to adversely affect
Kemp's Ridley Sea Turtle <i>Lepidochelys kempii</i>	Endangered	Endangered	Pipeline	May affect, not likely to adversely affect
Leatherback Sea Turtle <i>Dermochelys coriacea</i>	Endangered	Endangered	Pipeline	May affect, not likely to adversely affect
^a Species protected under the BGEPA. ^b Species protected under the MBTA. ^c Species protected under the MMPA. ^d Potential impact on whales from carriers in the Gulf of Mexico				

4.7.1 Federally Listed Threatened and Endangered Species

Review of the FWS Information for Planning and Conservation System database and the FWS Louisiana Ecological Services list of endangered, threatened, and candidate species by county identified ten species as potentially present in Plaquemines Parish, including the West Indian manatee, piping plover, red knot, Gulf and pallid sturgeon, and five species of sea turtles (FWS, 2018a). The NMFS Southeast Region lists 12 federally listed species as potentially occurring in the Project area or along the LNG vessel transit route in the Gulf of Mexico, including Gulf sturgeon, oceanic whitetip shark, giant manta ray, four species of whales, and five species of sea turtles (NMFS, 2018). The FWS proposed the eastern black rail for listing as threatened under the ESA in October 2018, and there is appropriate habitat for the eastern black rail within the project area.

Both the Gulf sturgeon and federally listed sea turtles are managed jointly by FWS and NMFS. The FWS jurisdiction over sea turtles is limited to their nesting habitat and there is no suitable nesting habitat in the Project area; therefore, sea turtles only fall under NMFS jurisdiction for the Project. Gulf sturgeon are under the FWS jurisdiction when in freshwater and NMFS when in estuarine waters. The FWS confirmed in correspondence with Venture Global that because the Mississippi River is freshwater at the LNG terminal site (river mile marker 55), it is under FWS jurisdiction (Trahan, 2016). However, along the majority of the pipeline route, NMFS has jurisdiction over Gulf sturgeon. Table 4.7-1 lists all of the federally listed species potentially occurring in the Project area.

No federally listed plant species were identified as occurring within 50 miles of the Project. A review of the FWS Environmental Conservation Online System indicated that designated critical habitat under FWS jurisdiction does not occur in the Project area and would not be affected by the Project (FWS, 2018b). In addition, the NMFS Southeast Region's GIS data for critical habitat only shows designated critical habitat for the loggerhead sea turtle in the vicinity of the Project area (NOAA, 2014b); however, this critical habitat is 12 miles south of the pipeline system.

Venture Global, acting as a non-federal representative of FERC initiated informal consultation with both the FWS and the NMFS. Based on correspondence with Venture Global (FWS, 2017b), the FWS indicated that the Project may affect four of the ten species identified above (West Indian manatee, red knot, piping plover, and pallid sturgeon). Venture Global submitted an informational and technical assistance request with the NMFS on September 24, 2015 and requested concurrence or additional comments from NMFS on January 18, 2017. Potential impacts from Project construction and operation on these federally listed species are discussed below.

During the draft EIS comment period, a commenter questioned the possibility of reintroducing oiled sediments from oil spills during pipeline installation. Venture Global prepared a report identifying shoreline areas within the Barataria Basin (i.e., those land/water interfaces with a hydrological connection to the open waters of the Gulf) that have high re-oiling potential (i.e., areas that have experienced periodic remobilization of weathered oil). The report indicates all of the Project's shoreline crossings have a re-oiling potential classification of "no oil observed." If weathered oil is encountered during construction, Venture Global would take the appropriate precautions to prevent resuspension of contaminated media and notify the appropriate authorities.

Thus, no impacts on threatened or endangered species (federal and state) from re-oiled sediments are expected.

4.7.1.1 Mammals

West Indian Manatee

The West Indian manatee is protected under both the ESA and the MMPA. In Louisiana, the manatee is regularly found in Lakes Pontchartrain and Maurepas and their associated coastal waters and streams (DOI, 2006). Manatees are found at depths ranging from approximately 5 feet to 20 feet in all types of coastal environments of the Gulf of Mexico and Atlantic Ocean (FWS, 1999). This species typically occurs in Louisiana coastal areas when water temperatures are warm. Fertl et al. (2005) reported that most manatee sightings in Louisiana occurred in June and July. Manatees are known to travel long distances up coastal waterways from the Gulf of Mexico (FWS, 2006). Year-round occurrence of manatees in the Project area is considered rare to uncommon, including in the Mississippi River and the bays of the Barataria Basin (NOAA, 2014b). The causes for the decline of manatees is generally related to human activity, entrapment in flood control structures, boat and barge collisions, poaching, habitat loss, and pollution (FWS, 1999). However, manatee occurrences in Louisiana appear to be increasing, having been regularly reported in southeastern Louisiana in the Amite, Blind, Tchefuncte, and Tickfaw rivers, as well as canals within the adjacent coastal marshes (FWS, 2013).

Project-related activities that could cause temporary impacts on manatees include:

- barge traffic associated with LNG terminal construction and operation of LNG carriers in Gulf of Mexico and Mississippi River shipping channels;
- pile installation during dock and meter station construction; and
- dredging/excavation associated with pipeline construction.

In areas of intense ship traffic, manatees can experience propeller or collision injuries; however, most of these injuries are caused by small, fast moving vessels. Increased traffic within the Mississippi River from LNG vessel transit to and from the LNG terminal could pose an increased risk to manatees from vessel strikes. Barges and LNG carriers could collide with manatees, which might cause injury or mortality, although such collisions would be unlikely on the Mississippi River, where established, well-traveled, deep-water shipping lanes are used. Although extremely rare in the general Project area, the manatee has been documented within local waterbodies and could occur along the portion of the LNG transit routes in Plaquemines Parish and the Gulf of Mexico. Even so, given the level of industrial activity and lack of foraging habitat within the Mississippi River, their presence near the terminal site and pipeline system is unlikely. Venture Global proposes to provide LNG ship captains with NOAA's Vessel Strike Avoidance Measures and Reporting for Mariners (NMFS, 2008), which outlines collision avoidance measures in order to minimize impacts on manatees from vessel strikes.

Pipe laying in coastal wetlands requires the use of barges and other equipment. Excavation and back-filling during pipeline construction through approximately 12 miles of open water could impact the West Indian manatee. Water depths in these area range from approximately 5 feet to 25 feet and could provide suitable habitat for manatees. About 8.9 miles of the existing navigation channel system in this area would be deepened by excavation/dredging to facilitate barge access to the construction right-of-way. Barge operation, excavation/dredging, and other construction activities could temporarily create disturbance and increase turbidity, which could displace manatees (if present), increase stress, and disrupt normal activities. These activities would be temporary, and conditions would return to normal shortly after construction. Operation of the pipeline system would not impact manatees.

Construction of the Project's LNG loading docks and temporary berthing structures on the Mississippi River, as well as meter station construction within Barataria Bay, would require pile installation. Temporary increased underwater noise levels could affect manatees and other marine mammals, including the bottlenose dolphin. Bottlenose dolphins, which are protected under the MMPA and managed by NMFS, are discussed later in this section.

Acoustical modeling and analysis was conducted by Venture Global using NMFS's Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS, 2016). Under the NMFS guidance, marine mammals are categorized as low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, Phocid pinnipeds, or Otariid pinnipeds. Because the manatee's hearing is most similar to mid-frequency cetaceans, for purposes of the hydroacoustical analysis, they were assessed for that group.

The underwater noise thresholds for injury and behavioral disturbance for mid-frequency cetaceans during pile driving activities are provided in table 4.7-2. For the purposes of this analysis, injury includes permanent hearing loss and mortality, and behavioral disturbances include movement away from feeding grounds, temporary injuries, increased vulnerability to predators, inability to communicate, and inability to sense the physical environment.

Table 4.7-2		
Underwater Noise Thresholds for Marine Mammals During Pile Driving Activity		
Functional Hearing Group	Underwater Noise Thresholds^b	
	Impact Pile Driving Disturbance Threshold	Injury Threshold
Mid-Frequency Cetaceans ^a	170 dB SEL _{cum} ; 224 dB Peak	185 dB SEL _{cum} ; 230 dB Peak
^a From NMFS Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. ^b dB = decibel Peak = peak sound pressure RMS = root-mean-square sound pressure SEL _{cum} = cumulative sound exposure level		

The near-source (10-meter) unattenuated sound pressures for in-water pile driving based on the impact pile driving method are provided previously in table 4.6-6. Table 4.7-3 provides a summary of the threshold distances for injury and disturbance of mid-frequency cetaceans during unmitigated impact pile driving.

Table 4.7-3 Threshold Distance for Injury and Disturbance to Mid-Frequency Cetaceans for Unmitigated Pile Driving		
Type of Pile and Installation Method	Threshold Distance ^a	
	Injury ^b (feet / meters)	Disturbance ^c (feet / meters)
60-inch-diameter Steel Pile – Impact Driven ^d	715 / 218	7,154 / 2,181
36-inch-diameter Steel Pile – Impact Driven	526 / 160.4	5,261 / 1,604
24-inch-diameter Steel Pile – Impact Driven	244 / 74.5	2,444 / 745
12-inch-diameter Steel Pile – Impact Driven ^e	71.5 / 21.8	715 / 218
12-inch-diameter Steel Pile – Vibratory Driven ^e	146.6 / 44.7	1,466 / 447
a Threshold distance for injury is the distance to which noise could result in injury (e.g., mid-frequency cetaceans within 715 feet may experience injury when 48-inch-diameter steel impact pile driving is occurring). Threshold distance for disturbance is the distance to which noise could result in deviation from normal behavior (e.g., mid-frequency cetaceans from 715 feet to 7,154 feet may deviate from normal behavior when 48-inch-diameter steel impact pile driving is occurring). b Distance calculated using the Companion User Spreadsheet to the NMFS Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. c Distances calculated by extrapolating the distance to permanent injury threshold according to the practical spreading loss equation, $L_{receiver} = L_{source} - 15 \log(R_{receiver}/R_{source})$. d No data are readily available for the 48-inch-diameter piles that are proposed for the Project, so levels for 60-inch-diameter piles were used instead. e No information was provided by the applicant – Venture Global would be required to supply complete data prior to publication of the final EIS.		

Impacts expected on manatees from pile driving activities suggest thresholds for injury and behavioral effects are possible if manatees are present in the Mississippi River or Barataria Bay. However, historical information on manatee distributions and occurrence previously presented supports the prediction that impacts would be highly unlikely from pile driving activities. Historically, manatees have not been common in these waterbodies, and the probability of their occurrence in the future is considered low. Additionally, food resources for manatees are not common in the Mississippi River or Barataria Bay, and manatees typically would not travel on a heavily industrialized portion of the Mississippi River where background noise levels are expected to be high. Also, in-stream noise at the terminal site is expected to attenuate to background levels within shorter distances than those presented due to channel sinuosity and the terminal location along the confined Mississippi River channel, which functions to attenuate the sound, resulting in a much more limited ensonified area. Where the meter stations are located in Barataria Bay, ambient noise conditions from oil and gas exploration activities and infrastructure are common and would likely mask pile driving noise levels.

The Underwater Noise Mitigation Plan submitted to the FWS, NMFS, and LDWF provides an updated analysis of underwater noise impacts due to pile driving, including assumptions and supporting calculations. The specific noise mitigations that would be implemented for underwater pile-driving is discussed in section 4.6.2.3.

In accordance with the Underwater Noise Mitigation Plan, an EI with marine mammal monitoring training and experience would be on-site during all pile-driving activities. The EI would observe the Mississippi River and estuarine open waters for marine mammals for 20 minutes prior to the onset of, and continuously during, pile-driving activities. If a manatee is

spotted within 150 feet of the active work area, work would not begin or would be halted until the manatee has moved out of this buffer zone.

Based on the manatee's characteristics and habitat requirements, the lack of foraging habitat along the LNG transit route, the rarity of manatees in the Project area, Venture Global's proposed avoidance and minimization measures (as referenced in the preceding paragraph), implementation of the FWS-recommended measures (as referenced in FWS correspondence dated February 2, 2017), and our recommendation in section 4.6.3.2, we conclude that the Project *may affect, but is not likely to adversely affect*, the West Indian manatee.

Whales

The four federally listed whale species, blue whale, fin whale, sperm whale, and sei whale, occur off the coast of Louisiana in the Gulf of Mexico (NMFS, 2018). Their distribution is limited to the offshore ocean environment in depths greater than 200 meters (640 feet) (NOAA, 2012). Because the terminal site and pipeline system are not offshore, there would be no impacts on whales from Project construction. LNG carriers would travel through the Gulf of Mexico to the terminal site during Project operation, the potential for collisions between LNG vessels and whales would be minimized by established measures and procedures, including Fisheries Southeast Region Vessel Strike Avoidance Measures and Reporting for Mariners (NMFS, 2008), during transit. These are standard measures to be implemented to reduce the risk associated with vessel strikes or disturbance of protected marine species. Measures include, but are not limited to:

- maintaining watch for protected species;
- maintaining a buffer zone if species are sighted;
- reducing engine speed; and
- reporting collisions or any sightings of injured or dead species protected under federal law.

Venture Global would provide the NMFS (2008) document to LNG carrier captains and would advocate compliance with the identified measures. Implementation of the above-mentioned measures would minimize the risk of collisions with the four whale species protected under the ESA, as well as with all marine mammals protected under the MMPA. Compliance with the NMFS (2008) directive would result in minimal impacts on marine mammals. Based on these factors, the Project *may affect, but is not likely adversely affect*, the four federally listed whale species.

4.7.1.2 Birds

Eastern Black Rail

The eastern black rail is a subspecies of black rail that occurs in salt, brackish, and freshwater wetlands in the eastern United States (east of the Rocky Mountains), Mexico, Central America, and the Caribbean (FWS, 2018c). On October 9, 2018, the FWS proposed the eastern black rail for listing as threatened under the ESA, with a final rule anticipated no later than October

2019 (83 FR 50610). Under the ESA, federal agencies are required to confer with the FWS on agency actions that may be likely to jeopardize a proposed species. The FWS would typically finalize or withdraw the listing about 12 months after the proposal depending on comments received; ESA protections become effective 30 days after the final listing rule is published.

Eastern black rails are found in a variety of salt, brackish, and freshwater marsh habitats that can be tidally or non-tidally influenced. Within these habitats, the birds occupy relatively high elevations along heavily vegetated wetland gradients, with soils that are moist or flooded to a shallow depth (83 FR 50610). Eastern black rails require dense vegetation cover that allows movement underneath the canopy. Plant structure is considered more important than plant species composition in predicting habitat suitability for the subspecies (83 FR 50610). Occupied habitat tends to be primarily composed of fine-stemmed emergent plants (rushes, grasses, and sedges) with high stem densities and dense canopy cover (83 FR 50610). However, when shrub densities become too high, the habitat becomes less suitable for eastern black rails. Soils are moist to saturated (occasionally dry) and interspersed with or adjacent to very shallow water (1 to 6 centimeters) (83 FR 50610).

Louisiana is not currently known to support a breeding black rail population (Watts, 2016). There are no confirmed breeding records and historic observations during the breeding season are rare. Most historic and recent records are from the Broussard Beach area of Cameron Parish (Watts, 2016), which is over 150 miles from the LNG facility site and the nearest point of the pipeline.

Primary threats to the eastern black rail include habitat loss due to continued alteration and loss of wetland habitats, land management practices that result in fire suppression (or inappropriately timed fire application that may cause direct mortalities), grazing, haying and mowing, and impounding of wetlands (FWS, 2018c). In addition, projected sea level rise and associated tidal flooding, increased temperatures, decreased precipitation, increased drought and severe weather events producing flooding or changes in wildfire frequency and intensity are all likely to have significant impacts on eastern black rail populations and their habitat (FWS, 2018c).

The eastern black rail is proposed for listing as federally threatened and may become listed prior to or during construction. Should the eastern black rail be listed, FERC staff would be required to complete any necessary Section 7 consultation for the Project. Although there are no known breeding black rail populations on Louisiana, there is potential habitat for the eastern black rail in the Project area. However, the historic and recent records of this species are more than 150 miles from the proposed facilities. Therefore, we conclude that the Project *may affect, but is not likely to jeopardize the continued existence* of the eastern black rail. .

Red Knot

The red knot, which is listed as threatened under the ESA, is a 9- to 11-inch medium-sized shorebird. It has a long, sharp bill and long legs (NatureWorks, 2017). During the breeding season, it has a rust colored face, chest, and undersides and dark brown wings. In winter, it has a gray head, chest, and upperparts and a white belly. This bird has long greenish legs and a pointed black bill. The red knot breeds in the central Canadian arctic but occurs in Louisiana during spring and fall migrations and winter months (generally September through March).

No critical habitat has been designated for the red knot. Red knot breeding and roosting habitat do not occur in the Project area. Outside of breeding season, it is primarily found in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays. Additionally, the Project would not impact any beach foraging habitat. The Project would have temporary impacts on potential salt and brackish marsh foraging habitat along the pipeline system right-of-way and barge access channels (FWS, 2015). Construction disturbance could temporarily displace individuals (if present) in marsh areas, resulting in increased stress and disruption of normal activities. The locations of the Project's aboveground facilities are not in areas that provide suitable habitat for the red knot, and suitable foraging habitat is abundant outside of the Project area. No permanent impacts on individuals of this species are anticipated.

No significant impacts on the red knot's breeding or nesting activities are expected based on temporary disturbance during pipeline system construction. As a result, we conclude that the Project *may affect, but is not likely to adversely affect* the red knot.

Piping Plover

The piping plover is listed as threatened under the ESA. The piping plover is a small shorebird approximately 7 inches long. These small, stocky shorebirds have a sand-colored upper body, a white underside, and orange legs (FWS, 2018d). During the breeding season, adults have a black forehead, a black breast band, and an orange bill. Breeding birds have a single black breastband, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill.

The piping plover overwinters but does not breed in Louisiana, feeding at intertidal beaches, mudflats, and sand flats with sparse emergent vegetation (FWS, 2018e). Piping plovers typically move among sites as conditions change, but studies have indicated that they generally remain within a 2-mile-long area along the beach (FWS, 2015). The main threat to piping plovers is habitat loss. Development on beaches has reduced the amount of suitable wintering areas available. Disturbance by humans and domestic animals forces wintering and migrating birds to increase their energy expenditure and can also cause breeding plovers to abandon nests and young. Other threats include predation from raccoons, skunks, and foxes (FWS, 2011).

The FWS has designated several areas as critical habitat for the piping plover on beach shorelines of barrier islands located near the Project. The nearest critical habitat for the piping plover occurs on an unnamed island in the southern portion of Barataria Bay that is located approximately 6.5 miles south of the pipeline system. This sandy beach habitat would not be impacted by the Project, and the river bank at the terminal site is composed of rip-rap and concrete mattresses; therefore, there is no foraging habitat at the terminal site. The pipeline system will not impact areas of foraging habitat, such as intertidal beaches, mudflats, or sandflats. Based on these findings, we conclude that the Project *may affect, but is not likely to adversely affect*, the piping plover and would have no effect on piping plover designated critical habitat.

4.7.1.3 Fish

Gulf Sturgeon

Historically, the Gulf sturgeon occurred from the Mississippi River to Charlotte Harbor, Florida (TNC, 2018). The species was listed as federally threatened in 1991. Presently, this

species' range is limited to the Suwannee River in Florida and west to the Pearl River in Mississippi and Louisiana. The FWS and NMFS share jurisdiction for the Atlantic sturgeon (Gulf subspecies), with the FWS having sole responsibility in fresh waters and NMFS having sole responsibility in marine waters. The two agencies share responsibility in estuarine waters based on the lead agency for the federal action. NMFS is responsible for all consultations with FERC for estuarine waters.

River systems supporting viable populations include the Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee rivers. The Gulf sturgeon rarely occurs in the Mississippi River, due to the lack of spawning habitat (TNC, 2018). The best river habitat for Gulf sturgeon is a long, spring-fed, free-flowing river with a hard bottom and steep banks. As months get warmer, Gulf sturgeon migrate into brackish and salt water during the fall and feed in these waters throughout the winter months. In the spring, they migrate into fresh water rivers and remain through the summer months (Wakeford, 2001). Gulf sturgeon move from the saltwater estuaries and Gulf of Mexico bays to the upper reaches of their natal freshwater rivers to spawn. After spawning, the sturgeon spends the summer in the lower reaches of the river before moving back to the Gulf of Mexico in the fall.

Historically, the range of the subspecies included the Project area; however, currently, the species no longer occurs in the Mississippi River or in the Gulf of Mexico west of the Pearl River. The Pearl River lies approximately 47 miles northeast of the Project area, and the nearest critical habitat is approximately 22 miles east in Lake Borgne, Louisiana. Given that the Project is outside the range for the Gulf sturgeon, construction of the LNG terminal and pipeline are not expected to affect the Gulf sturgeon. Gulf sturgeon could occur in areas of the Gulf of Mexico traversed by LNG vessels during operation. However, Gulf sturgeon are bottom feeders and tend to linger near the bottom of the water column. Considering the low probability of occurrence and the bottom-dwelling behavior of Gulf sturgeon, we conclude that the Project *may affect, but is not likely to adversely affect*, Gulf sturgeon.

Pallid Sturgeon

The pallid sturgeon was listed as endangered under the ESA on September 6, 1990 (55 FR 36641-36647). Since its listing, the status of the species has improved and is currently stable. New information related to habitat extent and condition, abundance, and potential recruitment in the Mississippi and Atchafalaya rivers has improved our understanding of the species in these areas (FWS, 2014).

Pallid sturgeon are a bottom-oriented, large-river obligate fish inhabiting the Missouri and Mississippi rivers and some of their tributaries from Montana to Louisiana (Kallemeyn, 1983). Pallid sturgeon evolved in the diverse environments of the Missouri and Mississippi river systems. Floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channel waters formed the large-river ecosystem that met the habitat and life history requirements of pallid sturgeon. Pallid sturgeon can be long-lived (15 to 20 years), with females reaching sexual maturity later than males (Keenlyne and Jenkins, 1993).

Habitat modification, including the construction of six Missouri River dams, as well as channelization in the lower Missouri and Mississippi rivers, has been the primary threat to the

pallid sturgeon (Krentz, 2004). The contemporary downstream extent of pallid sturgeon territory ends near New Orleans, Louisiana, which is upstream of the Project area. Additionally, Kilgore et al. (2014) reported that no pallid sturgeon have been collected below Mississippi River mile marker 81; this is approximately 25 river miles upstream of the Project area.

Impacts on the pallid sturgeon (if present) could include increased turbidity and noise disturbance from pile driving during dock construction. Due to the low probability of pallid sturgeon occurring within the Project area, and since no dredging would occur in upstream spawning habitat, and per concurrence with the FWS (2017), we conclude that the Project *may affect, but is not likely to adversely affect*, the pallid sturgeon.

Oceanic White-tip Shark

The oceanic white-tip shark, listed as threatened under the ESA, has a stocky build and characteristically rounded dorsal and pectoral fins that are white-tipped. The species is globally distributed in temperate, subtropical, and tropical waters (Castro 1983). In the western Atlantic, it occurs from Maine to Argentina, including the Caribbean and Gulf of Mexico (Young et al., 2018). The oceanic white-tip shark is usually found offshore in the open ocean, on the outer continental shelf, or around oceanic islands in water greater than 600 feet deep. It exhibits a strong preference for the surface-mixed layer in warm waters above 68°F. However, it is capable of deep dives into cooler waters for brief periods of time.

The primary threat to the oceanic white-tip shark is overutilization of the species for commercial purposes (Young et al., 2018). It is harvested for its fins and suffers direct mortality as by-catch as part of commercial fish-harvesting practices.

Since the oceanic white-tip shark is primarily found in deep ocean habitats, we anticipate construction of the terminal and pipeline system would have no effect on the oceanic white-tip shark. Additionally, operation of the pipeline system would have no effect on this species. Once operational, LNG carriers that would call on the LNG terminal would traverse oceanic white-tip shark habitat. The LNG carriers would not likely have a direct effect on individuals. However, the LNG carriers have the potential to indirectly affect individuals by temporarily disrupting foraging. Therefore, we conclude that Project *may affect, but is not likely to adversely affect*, the oceanic white-tip shark.

Giant Manta Ray

The giant manta ray, listed as threatened under the ESA, is found worldwide in temperate, subtropical, and tropical waters (Miller and Klimovich, 2016). The manta genus is distinctive due to its size, terminal mouth, and long cephalic fins. There are two species in the manta genus—the giant manta ray and the reef manta ray (*Manta afredii*). The giant manta ray can reach a width of 22 feet and weigh up to 1.5 tons. Its range in the western Atlantic extends from New Jersey in North America to Uruguay in South America and includes the Caribbean and Gulf of Mexico (Miller and Klimovich, 2016). According to Miller and Klimovich (2018), sightings are, with a few exceptions, often sporadic despite its large range. The areas presented by Miller and Klimovich where sightings are more frequent do not include the northern Gulf of Mexico. The giant manta ray is usually found offshore near productive coast lines within its range; however the

giant manta ray has been observed in estuarine waters near ocean inlets (Miller and Klimovich, 2018).

The primary threat to the giant manta ray is overutilization for of the species for commercial purposes through direct harvest and as a result of by-catch. It is especially susceptible to purse seines and gillnets.

Since the giant manta ray is primarily found offshore and occasionally in estuarine environments, it is unlikely that construction of the terminal would affect this species. Since part of the pipeline system would be constructed in open, estuarine water, there is the potential that construction of the pipeline could affect individuals. However, this is unlikely since the southern extent of the pipeline system is over 7 miles from the nearest ocean inlet. We do not anticipate the operation of the pipeline system to affect the giant manta ray. Once operational, LNG carriers that would call on the LNG terminal would traverse giant manta ray habitat. The LNG carriers would not likely have a direct effect on individuals; however, the LNG carriers have the potential to indirectly affect individuals by temporarily disrupting foraging. Therefore, we conclude that Project *may affect, but is not likely to adversely affect*, the giant manta ray.

4.7.1.4 Reptiles

Sea Turtles

The FWS and the NMFS share federal jurisdiction for sea turtles per a 1977 MOU established joint jurisdictional authority for both the FWS and NMFS, with FWS responsible for sea turtles on land (nesting habitat) and the NMFS responsible for sea turtles in marine habitats (NMFS and FWS, 2015). Nesting in coastal Louisiana is extremely rare and has been observed at only two locations in recent years. In the summer of 2015, two loggerhead sea turtles nested on Grand Isle (Thibodeaux, 2016), which is over 10 miles from the Southwest Lateral TGP meter station. The second closest nesting habitat is located east of the Mississippi River in the Breton National Wildlife Refuge on the Chandeleur Islands (Dow et al., 2007). Based on the geographic separation between the Project area and these locations, facility construction and operation is not likely to impact adult nesting sea turtles. No critical habitat for nesting sea turtles occurs in Louisiana. The nearest critical habitat for the any sea turtle is LOGG-S-02 Sargassum for loggerhead sea turtles, which is a large section of the offshore Gulf of Mexico. This area occurs approximately 12 miles south of the pipeline system (NMFS, 2014). Based on this information, there would be no impacts on nesting sea turtles or nesting habitat. The discussion below concerns the potential presence of, and impacts on, sea turtles in marine/estuarine habitat in the Project area.

All of the five federally listed sea turtles (leatherback sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, green sea turtle, and hawksbill sea turtle) are common to both estuarine and marine environments along the southeastern coast of Louisiana. The presence of sea turtles in the Mississippi River at the terminal site is not documented (NOAA, 2014b) and, because of the consistent freshwater environment, their presence is considered unlikely and no impacts are expected from construction at the LNG terminal site. All five species occur in portions of the Project area that would be crossed by the two lateral pipelines (Southwest Lateral TGP and Southwest Lateral TETCO), including Barataria Bay and Wilkinson Bay (NOAA, 2014b).

The endangered leatherback sea turtle is named for its unique shell, which is composed of a layer of thin, tough, rubbery skin strengthened by thousands of tiny bone plates that makes it look “leathery.” The carapace is dark grey or black with white or pale spots, while the plastron is whitish to black and marked by five ridges (Sea Turtle Conservancy, 2017). They are commonly regarded as open-ocean, pelagic animals, but are also known to forage in coastal waters during breeding. The leatherback sea turtle is highly migratory, preferring open ocean habitat outside of breeding season. The only known breeding sites identified in North America include southeast Florida, Puerto Rico and the U.S. Virgin Islands. The species is considered rare along the Gulf Coast; however, juveniles or adults can be present year-round (January through December) (NOAA, 2014b).

The endangered Kemp’s ridley sea turtle is one of the smallest of the sea turtles, with adults reaching about 2 feet in carapace length and weighing up to 100 pounds. It has been documented off the coast of Louisiana more than any other sea turtle. Nesting occurs from April to June, during which time the turtles appear off the Tamaulipas and Veracruz coasts of Mexico. This species is not known to nest on the Louisiana coast; however, it could utilize the estuarine and offshore waters for foraging and migration during the non-nesting season. Juvenile Kemp’s ridley sea turtles are common and considered abundant in the coastal waters of Barataria Bay and Wilkinson Bay from April through September, and adults are common during the spring and summer near the mouth of the Mississippi River (NOAA, 2014b; Fuller et al., 1987). This species’ foraging habitat is the nearshore and coastal waters of the northern Gulf of Mexico (especially Louisiana waters) as well as the Gulf of Campeche in the southern Gulf of Mexico. Kemp’s ridleys are often found in salt marsh habitats.

The threatened loggerhead sea turtle prefers to feed in coastal bays and estuaries, as well as in shallow waters of the continental shelf, and may occur in estuaries, coastal streams, salt marshes, and river mouths. The distribution of loggerheads in Louisiana coastal waters is similar to that of Kemp’s ridley sea turtles; however, their abundance is greater west of Freeport, Texas. Within Barataria Bay and Wilkinson Bay, both juveniles and adults are common, occurring from March through November (NOAA, 2014b). Although designated critical habitat (LOGG-S-02) for the loggerhead sea turtle occurs in waters just offshore of the Mississippi River delta, the Project would not impact this designated critical habitat.

Green sea turtle (threatened) adults are 3 to 4 feet in carapace length and the largest of the Cheloniidae family. Green sea turtles are found in all temperate and tropical waters throughout the world. In the Gulf of Mexico this species has been primarily documented in Texas embayments where they frequent shallow water areas where marine grasses and algae occur. They are rare in the open ocean and are not common to Louisiana coastal waters. Green sea turtles nest on open, sloping beaches that have minimal disturbance. Adults and juveniles are occasionally found in Barataria Bay and Wilkinson Bay between the months of March and November (NOAA, 2014b).

The endangered hawksbill sea turtle is one of the smaller sea turtles, with adults approximately 2.5 to 3 feet in carapace length. Hawksbill sea turtles are widely distributed throughout the Caribbean Sea and western Atlantic Ocean. They occur in shallow coastal areas, oceanic islands, rocky areas, and coral reefs. This species is not common in both inshore or offshore waters of Louisiana, and their occurrence in Barataria Bay and Wilkinson Bay is considered very rare. If present, they would occur from March through October (NOAA, 2014b).

During construction of the pipeline system in estuarine open waters, temporary impacts on sea turtles, including reduced water quality or interactions with barges and other vessels, could result from pipe trenching and dredging/excavation for barge flotation channels. Pile driving activities for meter station construction would increase in-water noise levels and could result in potential injury or behavioral changes. If sea turtles are present at the time of construction, these activities could temporarily cause displacement, increase stress, and/or disrupt foraging. The meter stations are located in a portion of Barataria Bay where oil and gas exploration activities and infrastructure are common and where operational maintenance regularly occurs. As a result, impacts would be short term and minimal. The following provides information related to pile driving impacts on sea turtles based on Venture Global's analysis.

Anthropogenic noise effects on sea turtles is largely unknown. Moein et al. (1995) and McCauley et al. (2000) showed that sea turtles avoid seismic signals at levels between 166 dB re 1 micropascal (μPA) and 179 dB re 1μPA. For this analysis, an un-weighted sound pressure level of 166 dB re 1 μPA_{RMS} has been used as the criterion for onset of behavioral effects. Per Popper et al. (2014), sound pressure levels of 210 dB cumulative sound exposure level (SEL_{cum}) re 1 μPa²s and 207 peak sound pressure level (dB Peak) re 1 μPA are used as the criterion for injury to sea turtles.

Sea turtle threshold distances for physical injury and behavior disturbance are based on the pile types and installation methods associated with the Project. The measured single-strike level SEL_{cum} at 10 meters for vibratory-driven 12-inch-diameter piles has been adjusted to 196.6 dB based on the equation,

$$SEL_{cum} = SEL_{single\ strike} + 10 * \log (14,400 \text{ seconds of driving per day}).$$

Underwater noise levels expected to be generated from pile driving is provided in table 4.7-4. These noise levels are not expected to disturb sea turtles beyond the immediate vicinity of the proposed activity. Venture Global has submitted an Underwater Noise Mitigation Plan to the FWS, NMFS, and LDWF as discussed in section 4.6.2.3 including noise mitigation measures that it would implement during pile-driving activities, which would minimize the impacts on all aquatic resources, including sea turtles.

Table 4.7-4 Threshold Distance for Injury and Disturbance to Sea Turtles for Different Pile Types			
Type of Pile and Installation Method	Threshold Distance (feet / meters) ^a		
	Physical Injury		Behavior Disturbance
	Peak (207 dB)	Cumulative SEL (210 dB)	RMS (166 dB)
12-inch-diameter Steel Pile – Impact Driven ^b	5.2 / 1.6	32.8 / 10	446 / 136
12-inch-diameter Steel Pile – Vibratory Driven ^b	0.3 / 0.1	4.3 / 1.3	6.6 / 2
^a dB = decibel Peak = peak sound pressure RMS = root-mean-square sound pressure SEL = sound exposure level ^b Distances calculated using a formula for underwater practical spreading loss, $L_{receiver} = L_{source} - 15 \log (R_{receiver}/R_{source})$.			

Injury or mortality to sea turtles from dredging/excavation activities is not expected. The barge-mounted clam-bucket (or equal) dredge proposed for pipeline construction is not known to cause sea turtle mortality because the slow speed of the barge allows sea turtles to disperse in advance of construction activities (NMFS, 2015b). Dredging/excavation could have indirect temporary impacts on foraging habitat by disturbing vegetation and increasing turbidity. Impacts on sea turtles and their habitat would be insignificant given the abundant foraging habitat in adjacent areas, the turtles' ability to disperse to adjacent habitats, and the temporary nature of the impacts.

Impacts on sea turtles from collisions with barges or other construction and operation vessels could result in sea turtle injury or mortality. The relatively slow speed and sea turtle maneuverability would make the chance of striking a sea turtle unlikely. Adoption of NMFS guidance (NMFS, 2008) would minimize the potential for injury and mortality of sea turtles from vessel strikes; therefore, we conclude that the Project *may affect, but is not likely to adversely affect* leatherback, Kemp's ridley, loggerhead, green and hawksbill sea turtles.

Although Venture Global has received concurrence from the FWS in a letter dated February 3, 2017, this correspondence is more than 1-year old and needs to be updated to confirm that no new species have been listed that could be present in the Project area.. In addition, the eastern black rail has been proposed for listing since the issuance of the draft EIS. We have also not yet completed consultation with the NMFS. To ensure compliance with section 7 of the ESA, **we recommend that:**

- **Venture Global should not begin construction of the Project until:**
 - a. **FERC staff receives comments from the FWS and NMFS regarding the proposed action;**
 - b. **FERC staff completes formal consultation or conference with the FWS and NMFS, if required; and**
 - c. **Venture Global has received written notification from the Director of OEP that construction or use of mitigation may begin.**

4.7.2 State-listed Species

Based on information obtained from the LDWF, 16 state listed threatened or endangered species are known to occur within Plaquemines Parish (LDWF, 2018a). Twelve of the 15 state listed species (see table 4.7-1) are also federally listed and are discussed above in section 4.7.1. No impacts on state listed species are expected from construction or operation of the Project.

Louisiana statutes governing wildlife species protection status are contained in Louisiana Revised Statutes (LRS) 56 (Wildlife and Fisheries), while relevant rules and regulations adopted by the Louisiana Wildlife and Fisheries Commission and the Secretary of the LDWF are found in LAC 76.

Take or harassment of wildlife species listed by the State of Louisiana as endangered or endangered or under the federal ESA is a violation of state law. Three state-listed species are known to occur in Plaquemines Parish:

- bald eagle – state endangered;
- brown pelican – state endangered; and
- peregrine falcon – state threatened/endangered.

The potential presence of bald eagles in the Project area and potential impacts on the species, along with mitigation measures to be implemented, are discussed in sections 4.6.2.1 and 4.6.2.2, respectively. The two remaining species, peregrine falcon and brown pelican, are discussed below.

Peregrine Falcon

During migration periods, the peregrine falcon is present throughout Louisiana. The bird may overwinter in coastal marshes and lakes, but is considered rare in the Barataria Basin. It is most often observed over marshes, mudflats, and beaches during migration, where it feeds on shorebirds and waterfowl (Conner and Day, 1987). Peregrine falcons can be found overwintering in areas with available prey, including farmland, marshes, lakeshores, river mouths, and tidal flats, all of which could occur in the Project area. Peregrine falcons were observed during applicant-directed habitat surveys of the Project area in December 2015.

Potential impacts on peregrine falcon are similar to those discussed for other birds and wildlife in section 4.6, including temporary noise and other disturbance from construction activities, temporarily altered foraging and roosting habitats, and permanent loss of foraging and roosting habitats. Mitigation measures to reduce impacts on peregrine falcon are the same as those described in section 4.6.2.2 for birds and other wildlife.

Brown Pelican

The brown pelican was listed as endangered under the ESA in 1970, but was delisted in 2008 due to recovery. The brown pelican is currently a state listed “rare” species. Today, the brown pelican primarily occurs in coastal marine and estuarine environments along the Gulf of Mexico coast from Mississippi to Texas, as well as along the Pacific Coast from Canada to South America, and in the West Indies. Nesting colonies primarily occur on offshore islands away from terrestrial mammal predation and human disturbance, and could occur on the island in Barataria Bay where a colonial-nesting waterbird area has been documented by the LNHP (Venture Global, 2017). Brown pelicans were observed during applicant-directed field surveys of the Project area in December 2015.

Potential impacts on brown pelicans are similar to those discussed for birds and other wildlife in section 4.6.2.1, including temporary noise and other disturbance from construction activities and temporarily altered marine and estuarine habitats from construction of the pipeline system. There would be no permanent loss of marine and estuarine habitats. However, nesting

colonies of brown pelicans could be affected should they occur adjacent to the Project area on the island in Barataria Bay.

Mitigation measures to reduce impacts on brown pelican are the same as those described in section 4.6.1.2 for birds and other wildlife and in section 4.6.2.2 regarding the colonial-nesting bird area.

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

4.8.1 Land Use

Venture Global leases the terminal property and would construct its facilities on primarily undeveloped land on the west side of the Mississippi River at mile marker 55. The LNG terminal would be on land bounded by undeveloped land and coastal marshlands to the south and west and fastlands to the east.

The Project would affect seven general land use types based on the National Land Use Land Cover (LULC) database (USGS, 2011). The definitions of each land use type is as follows:

- **Cultivated Crops:** Includes active cropland, pasture, and or hayfields;
- **Developed Commercial/Industrial:** Includes power or utility stations, manufacturing or industrial plants, paved areas, commercial facilities, and roads;
- **Herbaceous:** Includes non-forested uplands;
- **Open Water:** Includes waterbodies such as bays, bayous, and streams;
- **Wetlands:** Includes emergent, scrub-shrub, and wooded wetlands;
- **Shrub-Scrubland:** Includes upland shrub-scrubland; and
- **Forest:** Includes upland forest.

Table 4.8-1 summarizes the acreage of each land use type that would be affected by the LNG terminal and pipeline system. For a discussion on habitat types and field surveys, see section 4.5.1.

Table 4.8-1 Land Use Requirements for the Project ^{a, b}										
Site Component	Cultivated Crops (acres)	Developed Commercial/ Industrial (acres)	Herbaceous (acres)	Open Water (acres)	Wetland (acres)	Scrub- Shrub (acres)	Forested (acres)	Total (acres)		
									Temp / Perm	Temp / Perm
Terminal Site										
Terminal Facilities	0.0 / 438.9	0.0 / 10.1	0.0 / 2.0	0.0 / 0.0	0.0 / 6.0	0.0 / 1.3	0.0 / 76.2	0.0 / 534.5		
Land-Based Marine Facilities	0.0 / 0.0	0.0 / 1.1	0.0 / 0.0	0.0 / 0.0	0.0 / 6.3	0.0 / 0.0	0.0 / <0.1	0.0 / 7.4		
Temporary Workspace	2.0 / 0.0	4.3 / 0.0	0.0 / 0.0	1.3 / 0.0	5.5 / 0.0	0.0 / 0.0	<0.1 / 0.0	13.1 / 0.0		
Water-Based Marine Facilities	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 10.7	0.0 / 3.9	0.0 / 0.0	0.0 / 0.0	0.0 / 14.6		
Utility Workspace	4.1 / 0.0	2.3 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	6.4 / 0.0		
Eastern Workspace	0.0 / 80.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 80.0		
Marine Workspace	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	69.9 / 0.0	2.8 / 0.0	0.0 / 0.0	0.0 / 0.0	72.7 / 0.0		
Terminal Total	6.1 / 518.9	6.6 / 11.2	0.0 / 2.0	71.2 / 10.7	8.3 / 16.2	0.0 / 1.3	<0.1 / 76.2	92.2 / 636.5		
Pipeline System										
Southwest Lateral TGP										
Pipeline	0.0 / 0.1	0.0 / 0.1	0.0 / 33.0	281.2 / 92.6	38.5 / 2.2	0.0 / 0.0	0.0 / 0.0	319.7 / 128.0		
Meter Station, MLV Site	0.0 / 0.0	0.0 / 0.3	0.0 / 0.0	62.5 / 8.9	0.0 / 0.1	0.0 / 0.0	0.0 / 0.0	62.5 / 9.3		
ATWS	0.0 / 0.0	0.2 / 0.0	1.8 / 0.0	35.2 / 0.0	9.2 / 0.0	0.0 / 0.0	0.0 / 0.0	46.4 / 0.0		
Access Road and Barge Channels	0.0 / 0.0	0.0 / <0.1	0.1 / 0.0	322.5 / 0.0	0.7 / 0.0	0.0 / 0.0	0.0 / 0.0	323.3 / <0.1		
Southwest Lateral TETCO										
Pipeline	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	40.1 / 0.0	19.9 / 0.0	0.0 / 0.0	0.0 / 0.0	60.0 / 0.0		
Meter Station, MLV Site	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0		

Table 4.8-1 Land Use Requirements for the Project ^{a, b}											
Site Component	Cultivated Crops (acres)	Developed Commercial/ Industrial (acres)	Herbaceous (acres)	Open Water (acres)	Wetland (acres)	Scrub- Shrub (acres)	Forested (acres)	Total (acres)	Temp / Perm	Temp / Perm	Temp / Perm
	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm	Temp / Perm
ATWS	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	3.0 / 0.0	1.7 / 0.0	0.0 / 0.0	0.0 / 0.0	4.7 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0
Access Road and Barge Channels	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0
Pipeline Total	0.0 / 0.1	0.2 / 0.4	1.9 / 33.0	744.5 / 101.5	70.0 / 2.3	0.0 / 0.0	0.0 / 0.0	816.6 / 137.2	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0
PROJECT TOTAL	6.1 / 519.0	6.8 / 11.6	1.9 / 35.0	815.7 / 112.2	78.3 / 18.5	0.0 / 1.3	<0.1 / 76.2	908.8 / 773.8	<0.1 / 76.2	<0.1 / 76.2	<0.1 / 76.2
a An "undisturbed area" totaling 77.0 acres located within the LNG terminal site is not included in this table because it will not be impacted.											
b Construction impacts acreages are the sum of the temporary and operational impact acreages.											

4.8.1.1 LNG Terminal

The LNG terminal, including adjacent workspaces, would permanently occupy 625.8 acres of land, the water-based marine facilities would permanently occupy 10.7 acres, and an additional 92.2 acres would be temporarily occupied by workspaces. The site is currently zoned as Heavy Industrial and is primarily undeveloped. The majority of the permanent terminal site, including adjacent workspaces (approximately 525.0 acres, or 82 percent), is cultivated cropland that historically has been used for sugar cane production but currently used for cattle grazing and hay production. The remainder of the terminal site, including adjacent workspaces, includes 76.2 acres of forested land, 17.8 acres of developed commercial/industrial land, 24.5 acres of wetland, 1.3 acres of scrub-shrubland, and 2.0 acres of herbaceous land. Figure 4.8-1 shows the detailed land uses at the LNG terminal. Each of these detailed land uses fall within one of the seven general categories

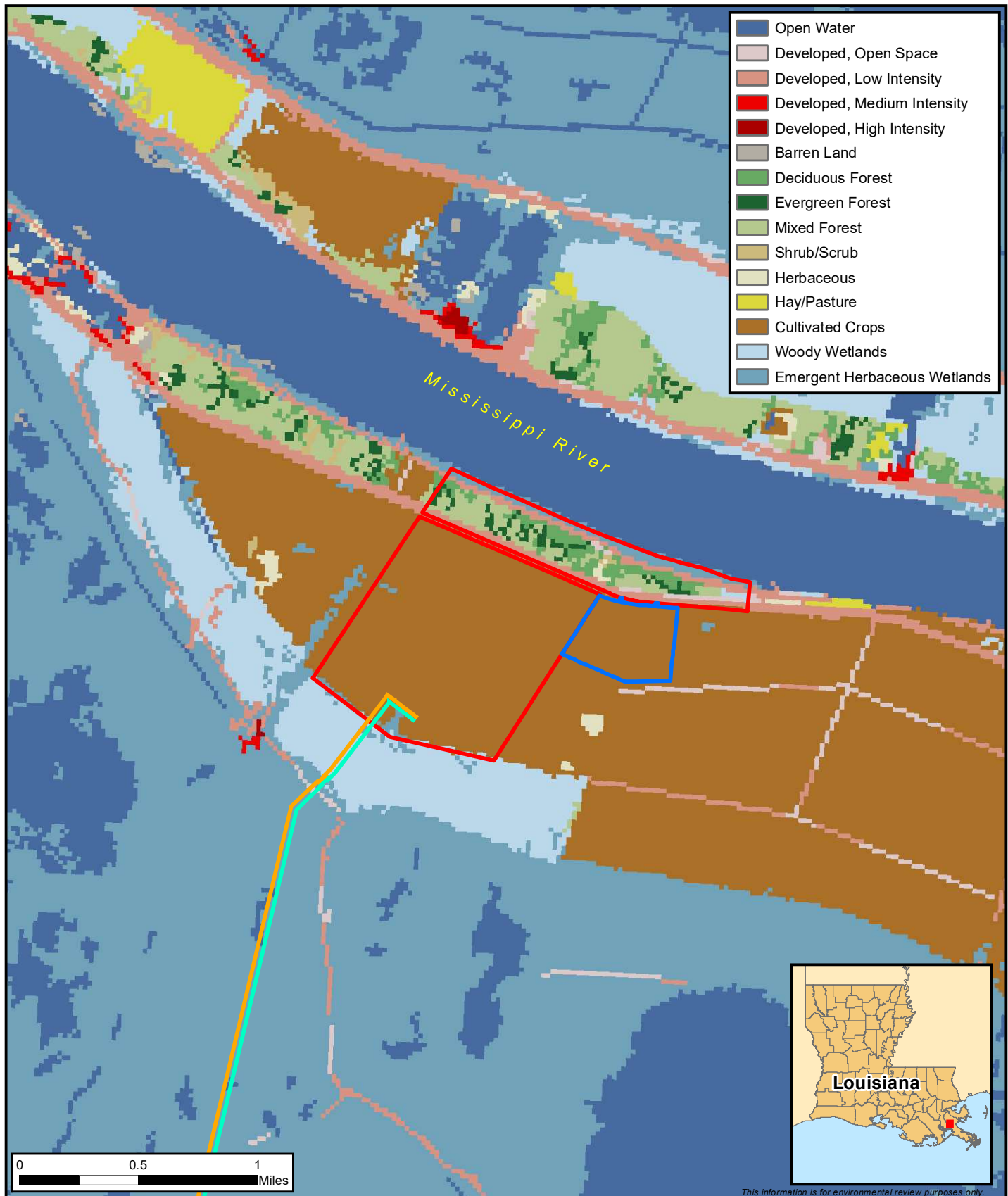
Access Roads

The proposed terminal site would be accessed via SH 23 in addition to two permanent access roads that would be constructed for the terminal site. The permanent access road impacts are included in the previously provided terminal acreages and primarily consist of cultivated cropland.

4.8.1.2 Pipeline System

The proposed 15.1-mile-long, Southwest Lateral TGP and 11.7-mile-long Southwest Lateral TETCO would be collocated and constructed on newly created right-of-way. The pipelines would generally require a total construction corridor ranging from 130 feet to 300 feet, depending on the construction method used for a particular section. The conventional lay method and push lay methods would require a construction corridor of 130 feet, consisting of a permanent right-of-way of 80 feet plus 50 feet of temporary construction workspace. The 300-foot-wide construction right-of-way required for the barge lay sections of each collated pipeline would overlap by 250 feet, resulting in a total construction right-of-way width of 350 feet. The permanent right-of-way at these locations would be 80 feet wide. Construction of the Southwest Lateral TETCO during Phase II would disturb an 80-foot-wide portion of the same construction right-of-way used for the Southwest Lateral TGP during Phase I for conventional lay and push lay segments. For barge lay segments, construction of the Southwest Lateral TETCO during Phase II would disturb a 250-foot-wide portion of the same construction right-of-way used for the Southwest Lateral TGP during Phase I.

The predominant land use types affected by construction of the pipeline, including the construction right-of-way, would be open water (846.0 acres), wetlands (72.3 acres), and herbaceous land (34.9 acres). Cultivated cropland and developed commercial/industrial land would account for just 0.1 acre and 0.4 acre, respectively. Figure 4.8-2 shows the detailed land uses along the pipeline system. Each of these detailed land uses fall within one of the seven general categories



- Terminal Site Boundary
- Eastern Workspace
- SW Lateral TETCO
- SW Lateral TGP



Figure 4.8-1
USGS Land Cover Types at the Terminal Site
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana

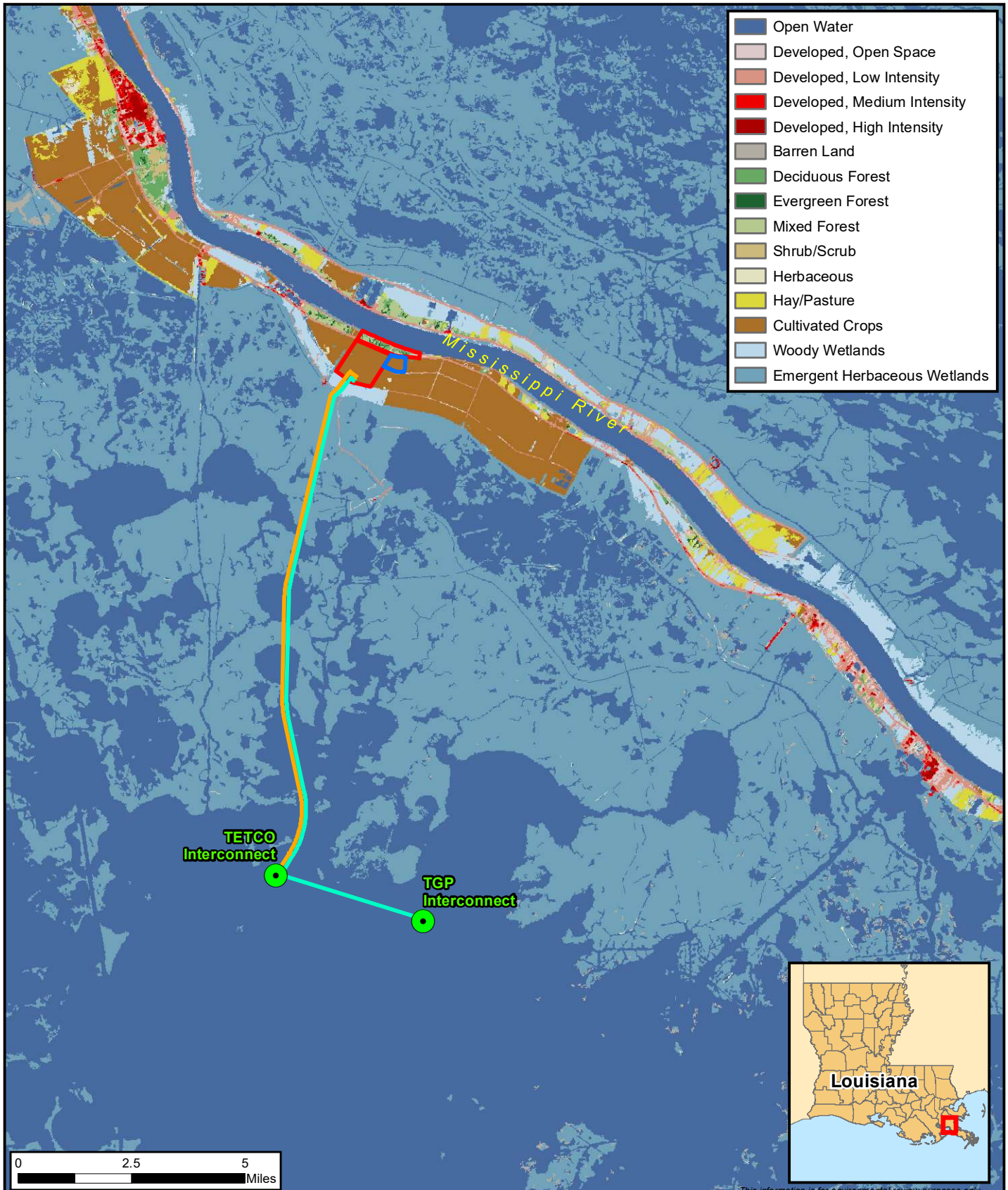


Figure 4.8-2

USGS Land Cover Types for the Pipeline System
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana

- Terminal Site Boundary
- Eastern Workspace
- SW Lateral TETCO
- SW Lateral TGP
- Interconnect



Access Roads

The Intracoastal Waterway would be used for delivery of coated pipe via barge to the Project area. Walker Road and SH 23 would likely serve as the primary routes to transport the joints from the barge dock location to the pipe stringing areas. One temporary and one permanent access road would be required for the pipeline system. The permanent access road would impact less than 0.1 acre of land, while the temporary access road would impact 0.7 acre of land primarily consisting of wetlands.

4.8.1.3 Land Use Impacts and Mitigation

Impacts on cultivated cropland, developed commercial/industrial, herbaceous land, and forest are discussed below. Impacts on open waters and wetlands are discussed in sections 4.3.2.2 and 4.4.2, respectively.

Cultivated Cropland

LNG Terminal

The LNG terminal would be located on cultivated croplands historically used for sugar cane production and cattle grazing. Soils classified as prime farmland would be affected by the Project (see section 4.2.1.2). However, no specialty crops would be affected during construction or operation of the Project facilities.

Construction at the proposed terminal site would permanently affect approximately 518.9 acres of cultivated cropland, while 6.1 acres would be temporarily affected. Impacts on cultivated cropland within the terminal site would include the permanent loss of production during construction and after construction is completed. Impacts could also include soil rutting or compaction due to construction equipment. Operation of the Project would result in the permanent conversion of the 518.9 acres of agricultural lands to industrial/commercial use.

Although construction and operation of the LNG terminal represents a permanent loss of cultivated cropland, the Project would be consistent with the Port of Plaquemines Master Plan as being fully developed and not designated as future agricultural uses. Therefore, the Project would not represent a significant impact on agricultural uses within the area.

Pipeline System

The Southwest Lateral TGP pipeline would affect approximately 0.1 acre of cultivated cropland within the 130-foot-wide right-of-way. The Southwest Lateral TETCO would be collocated within the same right-of-way as the Southwest Lateral TGP and construction of the Southwest Lateral TETCO would not affect any additional cultivated croplands. Impacts on 0.1 acre of cultivated cropland would include the permanent loss of production and could include soil rutting or compaction due to construction equipment. Operation of the Project would result in the conversion of only 0.1 acre of agricultural land to industrial/commercial.

Although construction and operation of the pipelines represent a permanent loss of agricultural land, the Project would be consistent with the Plaquemines Parish Master Plan for

development. Therefore, the Project would not represent a significant impact on agricultural uses within the area.

Developed Commercial/Industrial

LNG Terminal

Construction of the LNG terminal would affect 17.8 acres of developed commercial/industrial lands. The majority of this land consists of roads and levees along the Mississippi River. Construction impacts on these industrial/commercial areas during construction would include increased dust from exposed soils, construction noise, and traffic congestion. Dust and noise levels would be minimized, as described in section 4.11.1.4 and 4.11.2.3, respectively. Impacts on traffic are discussed in section 4.9.8.1. Operation of the LNG terminal would permanently affect 11.2 acres and would remain developed commercial/industrial use.

Pipeline System

Construction of the Southwest Lateral TGP would permanently affect 0.6 acre of developed commercial/industrial land, consisting largely of roads. No additional developed commercial/industrial land would be affected by construction of the Southwest Lateral TETCO. Impacts during construction could include increased dust from exposed soil, construction noise, and impacts on traffic flow.

Herbaceous Lands

LNG Terminal

Herbaceous land at the terminal site primarily includes open herbaceous areas located north of SH 23. Herbaceous land totaling 2.0 acres would be affected by construction and operation of the LNG terminal. Construction impacts would include clearing of vegetation, and the lands would be permanently converted from open lands to industrial/commercial.

Pipeline System

Herbaceous lands affected by the pipelines would include 34.9 acres of open herbaceous area to the south of Lake Hermitage Rd. The affected open herbaceous land would all be located within the right-of-way for the pipeline, temporary access roads, and ATWS. Construction-related impacts on herbaceous open land would include the removal of vegetation and disturbance of soils. However, following construction, the 33.0 acres within the permanent right-of-way used for pipeline construction and the 1.9 acres temporarily used for access and ATWS would be allowed to revert to preconstruction condition.

Scrub-Shrub

LNG Terminal

One small patch of scrub-shrub land at the terminal site is located between the Mississippi River levee and SH 23. This area is 1.3 acres in size and is located within the operational footprint

of the LNG terminal. This would result in the scrub-shrub land being converted to herbaceous land or developed commercial/industrial land.

Pipeline System

No scrub-shrub land would be affected during construction or operation of the pipeline system.

Forest

LNG Terminal

Forest land at the terminal site is primarily located north of SH 23 and includes deciduous, evergreen, and mixed forest. Construction and operation of the LNG terminal would affect 76.2 acres. An additional 12.0 acres of forest at the terminal site would remain undisturbed. All of the forest land within the liquefaction site would be permanently converted to developed commercial/industrial land. Construction impacts on disturbed forest land would result in the permanent removal of trees and other vegetation.

Pipeline System

No forest land would be affected during construction or operation of the pipeline system.

Residential

LNG Terminal

Some low-density residential areas are located approximately 0.2 mile off of Lake Hermitage Road to the west and southwest of the terminal site. However, no residential land is located within or adjacent to the terminal site.

Pipeline System

Similar to the terminal, the closest residential area is located off of Lake Hermitage Road. Residential areas are not located within or adjacent to the pipeline system rights-of-way. Venture Global is not anticipated to require any residential properties for construction access. Construction impacts on these residential properties during construction would include construction noise and traffic congestion. Dust and noise levels would be minimized, as described in section 4.11.1.4 and 4.11.2.3, respectively.

4.8.2 Landowner and Easement Requirements

4.8.2.1 LNG Terminal

Venture Global currently leases the 632-acre site for the proposed terminal site. The property is owned by the Port of Plaquemines. A lease option agreement grants Venture Global the exclusive right to lease the terminal site for up to 70 years. Additionally, a USACE maintained levee along the Mississippi River is controlled by the federal government but resides within port

owned property. Aside from the Port of Plaquemines and the USACE, no lands owned or managed by federal, state, or local agencies would be directly affected by the LNG terminal.

4.8.2.2 Pipeline System

Construction and operation of the Southwest Lateral TGP and Southwest Lateral TETCO would require a total of 953.9 acres of land, with all but one parcel being privately owned land. Venture Global would need to secure easements that convey temporary and permanent rights-of-way. For the aboveground facilities, Venture Global would obtain easement agreements or purchase the land outright.

An easement agreement would specify compensation to a landowner for the right of Venture Global to use the property during construction and operation of the pipeline system. The easement agreement would address damages to property during construction, restrictions on permitted uses within the permanent right-of-way, and post-construction restoration specifics.

If an easement cannot be negotiated with a landowner and the Project has been certified by FERC, Venture Global could use its right to eminent domain under section 7(h) of the Natural Gas Act and the procedure set forth under the Federal Rules of Civil Procedure (Rule 71A) to obtain the right-of-way and construction areas. Venture Global would still be required to compensate the landowner for the right-of-way and any damages incurred during construction. The level of compensation would be determined by a court according to state or federal law.

4.8.3 Planned Developments

4.8.3.1 LNG Terminal

There are no residential areas or subdivisions currently proposed within a 0.25-mile radius of the terminal site according to the Plaquemines Parish Department of Permits, Zoning, and Planning. There are also no commercial/industrial projects planned or announced within a 1-mile radius of the terminal site. The closest commercial/industrial facility planned near the terminal site is the proposed Gulf Coast Methanol Complex, which would be located 2.2 miles northwest. Upgrades to existing levees planned by USACE, as well as relocation of existing drainage canals by the Plaquemines Parish Government, are adjacent to the terminal site. Each of these projects, as well as other planned commercial/industrial development projects in the broader area, are discussed in the cumulative impact analysis provided in section 4.13.

Plaquemines Parish published a draft, final Comprehensive Master Plan in 2012, which designates future land uses on all developable properties within the parish. The plan's future land use maps are included in the "Land Use" technical addendum to the "Community Assessment." The LNG terminal site has three future land use designations on different portions of the site, including "port terminal complex," "major industries," and "business park." The LNG terminal, a private port terminal with a major industrial component, is largely consistent with the future land use designations. The majority of the site is designated "port terminal complex" and "major industries," while a minority portion is "business park," itself a type of non-residential/ non-agricultural use.

4.8.3.2 Pipeline System

There are no residential areas or subdivisions currently proposed within a 0.25-mile radius of the pipeline system nor commercial/industrial projects planned or announced within a 1-mile radius of the pipeline system, according to the Plaquemines Parish Department of Permits, Zoning, and Planning. Upgrades to existing levees adjacent to the pipeline system are planned by the USACE. Plaquemines Parish is relocating drainage canals adjacent to the pipeline system as a result of the USACE levee project. These canals would not be affected by the Project. These projects, as well as other planned commercial/industrial development projects in the broader area, are discussed in the cumulative impact analysis provided in section 4.13.

4.8.4 Recreation and Special Interest Areas

Construction and operation of the LNG terminal and pipeline system would not directly affect designated recreational areas or special interest areas. There are three wildlife refuges, a private conservation area, one historic park and preserve, five restoration areas, and three public marinas located in proximity to the Project. These recreational and special interest areas are discussed below and shown in figure 4.8-3.

Wildlife Refuges and Preserves/Conservation Area

There are no wildlife refuges, preserves, or conservation areas located within 16 miles of any Project workspace. The three wildlife refuges located in Plaquemines Parish Breton National Wildlife Refuge, Delta National Wildlife Refuge, and Pass A Loutre State Wildlife Refuge, are all located over 35 miles from any Project workspace and would not be impacted by Project construction or operation activities. A private conservation area, Woodland Trail and Park, and a preserve, Jean Lafitte National Historic Park and Preserve are both located over 16 miles from any Project workspace and would not be impacted by Project construction or operation.

National Estuary and Restoration Areas

The Barataria-Terrebonne National Estuary is located between the Mississippi and Atchafalaya Rivers in south Louisiana. The estuary's watershed includes the terminal site and pipeline system right-of-way. The Barataria-Terrebonne estuarine complex became a National Estuary in 1990, and the Barataria-Terrebonne National Estuary Program was created under the EPA administered National Estuary Program (NEP). The goal of the NEP is the prevention of activities that: (1) threaten an estuary's public water supply; (2) are harmful to shellfish, fish, and wildlife populations; and (3) negatively impact recreational opportunities for estuary residents. Venture Global would be required to adhere to any NEP recommendations that have been adopted by LDEQ, LDNR, and/or USACE as conditions to a permit.



This information is for environmental review purposes only.

- Terminal Site Boundary
- SW Lateral TETCO
- SW Lateral TGP
- Interconnect and Meter Station



Figure 4.8-3
Recreational Use Areas within 5 miles of
Proposed Project
 Plaquemines LNG and Gator Express Pipeline Project
 Plaquemines Parish, Louisiana

Construction of the pipelines would require dredging of channels within the Barataria-Terrebonne estuary to provide temporary access for pipeline lay barges and support vessels. Trenching would also be required in areas where the pipeline would be located in open water. Recreational boaters in the Barataria-Terrebonne estuary may be temporarily prevented from using channels during dredging operations. Users may also observe a temporary increase in barge traffic during construction of the pipeline system. Venture Global would mark construction areas with warning signs and navigation lights to ensure the safety of recreational boaters. Impacts on boaters would be temporary and minor.

Several existing and proposed restoration sites managed by the Louisiana Coastal Protection and Restoration Authority are located in the Barataria Basin near the pipeline system. Barataria-Terrebonne National Estuary Program Gulf Ecological Management Site is located approximately 1.0 mile from the pipeline system. The Barataria-Terrebonne National Estuary Program Gulf Ecological Management Site Program is an initiative of the Gulf of Mexico Foundation, the EPA Gulf of Mexico Program, and five Gulf of Mexico states to restore lost or damaged sensitive habitats. Impacts on the restoration area are expected to be minor and temporary.

Lake Hermitage Marsh Creation (BA-42), Fringe Marsh Repair, West Pointe à la Hache Siphon Diversion, and Bayou Grande Cheniere Marsh and Ridge Restoration are four other restoration areas located between 3.0 miles and 7.7 miles from any Project component. No impacts are anticipated at these restoration areas from either direct contact or indirect tidal influences.

Public Marinas

West Pointe à la Hache Marina is located 0.4 mile northeast of the terminal site. The marina is located off of the Back Levee Canal that parallels the east bank of the Mississippi River. Lake Hermitage Marina is located 1.8 miles to the east of the Southwest Lateral TGP. The marina consists of a boat launch off of West Bayou Lane in the Hermitage Bayou. St. Jude Hump Public Boat Launch is located 1.8 miles southeast of the terminal site. Woodland Plantation is located 0.8 mile east of the terminal site. None of these facilities are expected to be impacted by the Project.

Military Installations

The Military Aviation and Installation Assurance Siting Clearinghouse coordinated with the DoD for an informal review of the Project. In correspondence sent to the Commission on June 4, 2018, the Military Aviation and Installation Assurance Siting Clearinghouse concluded that the Project would have a minimal impact on military training and operations conducted in the area. No mitigation was recommended, but further communication with the Military Aviation and Installation Assurance Siting Clearinghouse was requested. As such, we have continued to include the Military Siting Clearinghouse in all notifications associated with the NEPA process.

4.8.5 Hazardous Waste Sites

Review of regulatory databases revealed two hazardous waste sites located within 5.0 miles of the terminal site. Both sites, Elmwood Marine Services and International Marine Terminals, are located over 1 mile from the terminal site and are reported to be in compliance, with no

violations. Although not anticipated, if hazardous waste is encountered during construction, Venture Global would stop work in the vicinity of the hazardous waste and implement the Project's SPCC Plan outlining the steps to be taken, including reporting, coordination, and clean up.

4.8.6 Visual Resources

"Visual resources" refers to the composite of basic terrain features, geologic features, hydrologic features, vegetation patterns, and anthropogenic features that influence the visual appeal of an area for residents or visitors. In general, impacts on visual resources may occur during construction when large equipment, excavation activities, spoil piles, and materials are visible to local residents and visitors. During operation, impacts on visual resources would occur when facilities, or portions of facilities, and their lighting are visible to residents and visitors. The degree of visual impact resulting from the Project would be highly variable among individuals, and would typically be determined by the general character of the existing landscape and the visually prominent features of the Project facilities.

The region of influence for the evaluation of visual resources includes a 2-mile buffer around the Project. This distance provides for the maximum distance at which the tallest Project feature would be visible and recognizable. This area also comprises the Project viewshed (i.e., the area that would have visibility of the Project).

4.8.6.1 LNG Terminal

The area surrounding the LNG terminal site includes industrial operations, agricultural and undeveloped land, and a few residential communities. Traveling 6 miles north of the site on SH 23 viewers can see the largest existing industrial operation in the area, a petrochemical plant (Phillips 66 Alliance Refinery). Closer to the LNG terminal site, just over one mile north, is a coal transfer facility, International Marine Terminals. Across the river is another coal transfer facility, United Bulk Terminal, and a cargo handling terminal, Associated Terminals, both within two miles. Visible on-site features at the coal transfer facilities include large coal stockpiles, conveyance systems, permanent metal office buildings, temporary office buildings, docks, berthing areas, and dirt or gravel piles. The cargo handling terminal on the other side of the river specializes in the transfer of grain between barges and ocean vessels, and its most conspicuous features are numerous rows of floating barges and a massive floating grain elevator. Although Phillips 66 Alliance Refinery is 6 miles from the Project site, the visible facilities include aboveground storage tanks, stacks, permanent metal and brick office buildings, temporary office buildings, berthing areas, dock loading arms/cranes, and large graveled parking and laydown areas. Directly across the Mississippi River from the LNG terminal site is fallow and unmaintained agricultural land. The LNG terminal site, itself, is currently unmaintained agricultural, bounded by more agricultural land on both sides. The primary viewers within the terminal site viewshed include local residents, drivers (including business owners and employees), visitors for the existing industrial businesses along SH 23 and within the vicinity of the terminal site, and recreational and commercial users of the Mississippi River and its local environs.

After completion of construction, the LNG terminal would include four LNG storage tanks (188 feet tall), as well as cold flare (280 feet tall), warm flare (280 feet tall), low-pressure flare

(175 feet tall), and marine vapor control (100 feet tall) facilities. Lighting also would be used at the terminal site during evening activities and for safety.

Venture Global conducted a visual assessment for the terminal site and pipeline system, which included the review of views from ten key observation points (KOPs). The assessment considered viewer sensitivity (i.e., expectations of the observed areas) and visual quality. Visual impacts were described as minor, moderate, or significant utilizing the definitions provided below.

- **Minor Impact:** The Project would be minimally visible to a low number of sensitive viewers, and distance or compatibility with existing land uses would not make the Project stand out.
- **Moderate Impact:** The Project would be minimally visible to a moderate number of sensitive viewers; Project elements would result in an increase in the industrial viewshed that is incompatible with existing land uses.
- **Significant Impact:** The Project would be highly visible to a large number of sensitive viewers and would negatively affect the quality of the visual landscape.

The ten KOP locations included the following:

- KOP-1 End of Squirrel Road – View to Northeast – Towards Terminal Site;
- KOP-2 Mainline Valve Site – View to Northwest – Towards Lake Hermitage Road;
- KOP-3 Lake Hermitage Road – View to Northeast – Towards Terminal Site;
- KOP-4 Lake Hermitage Road and East Shirley Road – View to East – Towards Terminal Site;
- KOP-5 End of Suzie Street – View to Southeast – Towards Terminal Site;
- KOP-6 SH 23 – View to West – Towards Terminal Site;
- KOP-7 Shed off SH 23 – View to West – Towards Terminal Site;
- KOP-8 Griffen Community Center – View to South – Tree buffer;
- KOP-9 Davant Park – View to South – Tree buffer; and
- KOP-10 SH 15 Towards United Bulk Terminal – View to West - Existing Industrial View.

Based on a review of these KOPs, visual impacts associated with the terminal site would be experienced during construction, when the site landscape would be temporarily dominated by heavy equipment, materials storage, and infrastructure. These impacts would be at least partially visible to local residents, drivers/visitors along SH 23, visitors to nearby marinas, and boaters on the Mississippi River and on open waters south of the terminal site. Other potential viewers

include users of those areas developed for industrial purposes along the Mississippi River north of the terminal site. Viewers would not likely be present in the remaining areas surrounding the terminal site, as these areas largely consist of marsh and pasture land.

Residents would have views of the terminal site during construction. The closest residence is 0.14 mile southwest of the site, and low-lying vegetation would not block the entirety of construction activities especially when coupled with the elevated nature of most residential structures in the area. Visual screening may be present for other residences at ground level with existing scrub-shrub and tree cover.

Residential views of the facility would include the construction of the trestle bridge crossing SH 23 and the federal levee on the Mississippi River. The temporary aerial conveyor system would be visible, as well. This conveyor system would be situated approximately 370 feet north of the trestle bridge and would be supported on a similar trestle system. Construction lighting also may be visible, as temporary light-emitting diode fixtures would be installed on buildings or wooden poles, and portable lighting would also be installed. Increased barge traffic during construction also may be visible from some of the residential areas near the terminal site.

Drivers (including residents, commuters, business owners and employees, and/or visitors) along SH 23 would be able to see the terminal site on either side of the highway. As previously noted, SH 23 is a National Scenic Byway. While this area of the byway is dominated by industrial views and zoned for future industrial projects, Project construction (and eventual operation) would be visible. Among the features that would be visible would be the trestle bridge, the aerial conveyor, the perimeter wall, and other infrastructure. The perimeter wall would provide some visual buffer, although it would not shield the full view of the terminal site.

Two recreational use areas are within the 2-mile evaluation area for visual resources (Griffen Community Center and the Davant Community Center), and construction lighting may be visible to recreational users in these locations. In addition, recreational boaters on the Mississippi River would have views of the construction activities and equipment at the terminal site as well as the progressing infrastructure. Some visual screening would be present due to existing tree lines and the levee on the east bank of the river and the sunken grade of land north of the levee but would not fully conceal the LNG storage tanks.

In general, construction would be anticipated to generate minor impacts due to the industrial nature of the terminal site and its surroundings, as well as the temporary nature of the activities and presence of construction equipment. The primary land use and planned future use is industrial, due to the presence of commercial shipping, oil and gas facilities, coal facilities, and agricultural industries. In this manner, the construction activities would not detract from the overall industrial appeal of the area. While views of the terminal site from SH 23 are present, the existing views are of industrial facilities and activities. The construction at the terminal site would add to these occurrences, but the Project construction would not be inconsistent with the surroundings (i.e., minor impact).

During operation, views of the operating LNG terminal may include exterior plant lighting, air navigation lighting, LNG storage tanks, electric power generation facilities, liquefaction heat exchangers, air coolers, and the flare stack. Exterior plant lighting would primarily consist of full

cutoff types that would be directed toward the ground. Where possible, floodlight mast locations would be directed to avoid light emissions on land and water. According to Venture Global, flaring would be anticipated to occur twice a year for start-up and shutdown purposes, while marine flaring would be estimated to occur up to 12 times per year. Views of the flaring would be visible to some viewers, but it also would be partially obscured by the floodwall. The floodwall crest is anticipated to be +26 feet NAVD88 at the terminal site.

Other views during operation would include intermittent views of the LNG carriers that would be docked at the LNG terminal. These views would occur along the stretch of the Mississippi River between the Gulf of Mexico and the terminal site. Residents and recreational boaters may have views of these activities.

During operation, the facilities at the terminal site would be visible to residents, drivers, and recreational/commercial users. As the terminal site is a greenfield location, additional lighting and facilities would be added to the local environment. Although the area is considered industrial in nature, there are presently no industrial facilities of this magnitude visible from the nearest residences nor from other locations to the south of the terminal site such as Woodland Plantation. Therefore, the LNG facility could have a minor adverse impact on the residents, drivers, and recreational/commercial users of the area. Views from elevated residential structures and views from large distances would not be afforded the benefit of vegetative mitigation and therefore impacts at nearby elevated points of view would also be minor and permanent. Impacts at locations of larger distances, such as Woodland Plantation, would also be minor and permanent although to a lesser degree than those of locations within 2 miles of the terminal site.

4.8.6.2 Pipeline System

As noted in section 4.8.6.1, a visual resource assessment was conducted to evaluate the potential of the Project to impact visual resources. For this assessment, the pipeline system was considered with regard to its construction and operation.

The study area for this assessment included portions of the 2-mile area used for the terminal site as well as the footprint of the pipeline system and its immediate surroundings. The pipeline system generally would be located in rural areas and, in some locations, areas previously disturbed by other development. The viewer groups associated with these areas primarily would include residents and recreational or commercial boaters. The closest local residences are located on Gator Road, approximately 0.3 mile northwest of the HDD crossing of Lake Hermitage Road; another residence is located approximately 0.8 mile from the pipeline system.

Visual impacts associated with construction of the pipeline system would be anticipated to include the removal or alteration of existing vegetation and the exposure of bare soils, as well as earthwork and grading scars associated with heavy equipment tracks, trenching, and machinery and tool storage. These activities may be visible to observers, including residences located within 1.0 mile of the pipeline system. Existing vegetation outside of the workspaces may provide some buffer, but noticeable changes would result from the changes within the footprint and workspaces of the pipeline system or the construction of the pipeline system.

Barges associated with construction of the pipeline system would utilize open water areas associated with the barge access channels. A short-term change in visual resources would be noticeable to recreational and commercial boaters in proximity to the workspaces due to the activity. Occupants of other vessels traveling on the barge access channels would be able to see large equipment, pipe joints, and materials being transported to the active construction sites.

As part of pipeline system construction, a pipe bridge also would be built. This bridge would be located approximately 80 feet north of Lake Hermitage Road and would be visible to residents living in the Deer Range neighborhood and Suzie Bayou Campsites. These are neighborhoods with a mix of recreational camps and permanent residences. KOP 2 was used to evaluate the potential for impacts associated with this Project component. While the bridge would be noticeable during construction and operation, the analysis showed that existing tree cover and vegetation offered effective screening, thereby preserving the mix of rural and industrial features within the landscape.

Due to the temporary nature of construction and Venture Global's plans to restore areas to pre-construction conditions (following the Project-specific Plan and Procedures), impacts associated with construction of the pipeline system on visual resources would be minor.

Operational impacts associated with the pipeline system would be anticipated to occur in locations surrounding the permanent aboveground facilities, including the meter stations, mainline valves, and the pipe bridge. The meter stations would be situated in open areas and would be seen by recreational or commercial boaters. As shown by the description of the surrounding area, similar aboveground pipeline infrastructure is common in this area of Louisiana; therefore, the presence of these stations would not detract from the overall industrial nature of the area. The mainline valve site located south of Hermitage Road would not be anticipated to create a visual disturbance due to its relatively small size. While the pipe bridge would be noticeable, as aforementioned for construction, existing vegetation would provide a small visual cover.

As much of the pipeline system is located in rural or industrial areas, the Project would be anticipated to cause minor impacts with regard to visual resources. Existing vegetation would help to provide some visual buffer from the operation of the pipeline system. In addition, for those areas where vegetation would be removed or altered, pre-Project conditions would be restored.

4.8.7 Coastal Zone Management

The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active state involvement in achieving those goals. As a means to reach those goals, the CZMA requires participating states to develop management programs that demonstrate how those states will meet their obligations and responsibilities in managing their coastal areas. In Louisiana, the OCM administers the state's Coastal Zone Management Program and is the lead state agency that performs federal consistency reviews. As such, the LDNR evaluates activities or development affecting land within Louisiana's coastal zone for compliance with the CZMA through a process called a "federal consistency" review.

The Project is entirely located within the Louisiana Coastal Management Zone. A CUP would be required from the LDNR for development activities taking place in the coastal zone. The Project would be designed and built in compliance with conditions set forth in by the CZMA. On June 8, 2017, Venture Global submitted an application to the LDNR for a CUP, which also seeks a consistency determination for CZMA. Venture Global agrees to construct and operate the project in compliance with conditions that would be set forth in the FERC authorization, the USACE section 404/10 and 408 permits, and the LDNR OCM's CUP. Venture Global would be required to obtain all relevant federal permits before receiving FERC authorization to proceed with construction including a determination of consistency with the Coastal Zone Management Plan issued by LDNR. **We recommend that:**

- **Venture Global should not begin construction of the Project until it files with the Secretary a copy of the determination of consistency with the Coastal Zone Management Plan issued by the LDNR.**

4.9 SOCIOECONOMICS

Construction and operation of the terminal site and the pipeline system could affect socioeconomic conditions in the region. We estimate the duration of these effects—temporary, short term, long term, or permanent—and their intensity—negligible, minor, or significant. In this context, short-term impacts could continue for up to 5 years following construction, and long-term impacts could continue beyond 5 years but less than the operational life of the Project. These definitions differ from those given in the introduction to section 4.0 because the timescale of socioeconomic conditions differs from that of natural environmental resources. We determined intensity levels by reviewing quantitative and contextual data and making qualitative assessments. Negligible indicates an impact would not be noticeable or measurable. A minor impact would be a noticeable change but would not affect the overall function or quality of the socioeconomic resource (e.g., housing market, public service provision, economic activity, etc.) at the community scale. A significant impact would change, either positively or negatively, the function or quality of the socioeconomic resource at the community scale for the duration indicated. We also describe impacts as direct or indirect, or beneficial or adverse, when the distinctions are appropriate or clarifying.

Given the scale of the Project, the affected area is defined as three contiguous parishes, including Plaquemines (the location of the Project), Jefferson, and Orleans Parishes. Figure B-7 in appendix B, depicts the region of influence discussed in this document. While the emphasis of this assessment is on Plaquemines Parish, the three parishes listed above all contain communities within commuting distance of the Project, and, thus, are places where workers and workers' families would seek housing and public services. While some of the benefits and pressures of the Project may occur throughout the region, the strongest economic effects from increased demand for workers, materials, and services along the supply chain would likely occur in the affected area. These communities would likely capture most of the local tax revenues stemming from the Project, but they would also take on new public service expenditures. In addition, the affected area could experience transportation effects on roads and waterways.

We gave special consideration to the area referred to as the southern west bank of Plaquemines Parish, directly south of the Project, which is composed of 26 named communities

and an estimated 4,828 residents. These residents rely on SH 23 for conveyance outside the southern west bank, and are vulnerable if travel on SH 23 becomes blocked or restricted. The Point à la Hache ferry south of the terminal site provides transport between the east and west banks, but only transports about 40 vehicles at a time. We also evaluated the potential for the Project to disproportionately affect nearby populations that qualify as environmental justice communities.

4.9.1 Population

Table 4.9-1 provides selected population, density, and land area statistics for the affected area and the state.

Table 4.9-1 Population, Density, and Land Area Statistics in the Affected Area					
Geographic Area	Population 2000^a	Population 2010^b	Population 2016, Estimate^c	Population Density 2016, Estimate (persons per square mile)	Land Area^b (square miles)
Louisiana	4,438,976	4,533,372	4,645,670	108	43,204
Plaquemines Parish	26,757	23,042	23,584	30	780
<i>Belle Chasse</i>	<i>9,848</i>	<i>12,679</i>	<i>13,709</i>	-	-
<i>Census Tract 504^d</i>	<i>3,428</i>	<i>3,069</i>	<i>3,676</i>	-	-
<i>Southern West Bank^e</i>	<i>10,456</i>	<i>3,013</i>	<i>4,828</i>	-	-
Jefferson Parish	455,466	432,552	435,204	1,470	296
Orleans Parish	484,674	343,829	382,922	2,266	169
Affected Area Total	966,897	799,423	841,710	3,766	1,245
^a U.S. Census Bureau, 2000 ^b U.S. Census Bureau, 2010 ^c U.S. Census Bureau, 2017a ^d The terminal site and pipeline system are in Census Tract 504. ^e In this assessment, the southern west bank of Plaquemines Parish refers to all of the land for the terminal site on the west bank of the Mississippi River. It comprises partial territory in Census Tract 504 and Census Tracts 505 through 508, depicted in figure B-8, appendix B.					

Plaquemines Parish is a peninsula in the Gulf of Mexico bisected by the Mississippi River. Plaquemines Parish's land area is almost twice as large as Jefferson and Orleans Parishes combined, but its population is less than 25,000 people. Most parish lands are within a designated floodplain, and much of these are coastal wetlands (Plaquemines Parish, 2012). The parish population is largely concentrated in communities along SHs 23 and 39, which follow the west and east banks of the Mississippi River, respectively. Belle Chasse, approximately 20 miles north of the terminal site on the west bank, is the most populous community in Plaquemines Parish, consisting of over half of the parish's residents. All parish communities are unincorporated.

Plaquemines, Jefferson, and Orleans Parishes are part of the Greater New Orleans Region. Many communities in Jefferson Parish are within 50 miles of the Project. The boundary of Orleans Parish is coterminous with the limits of the city of New Orleans, and its closest boundary is about 35 miles north from the terminal site.

The estimated 2016 population levels in all three parishes are lower than in 2000, chiefly because so many people left the region after Hurricane Katrina in 2005. The 2016 population of Belle Chasse, however, is larger than pre-Hurricane Katrina levels (i.e., before 2005), and so is the population in Census Tract 504, the census tract that contains the terminal site. The southern west bank area, stretching from around Port Sulphur to the southern tip of Plaquemines Parish, did not regain its population after Hurricane Katrina. For the purpose of this analysis, the southern west bank is defined as all parish land south of the terminal site on the west bank of the Mississippi River. It comprises partial territory in Census Tract 504 and Census Tracts 505 through 508, depicted in figure B-8 in appendix B.

As shown in table 4.9-2, Venture Global expects that construction of the terminal site would occur in two 35-month phases, with start dates spaced 12 months apart. Thus, construction on the LNG terminal would be continuous for about 4 years. The pipeline system would also be constructed in two phases, each less than a year in duration, overlapping with the LNG terminal construction. Each phase of the LNG terminal's construction would average 1,400 workers and rise to 2,200 workers for a 6-month peak. However, the number of workers on-site would typically be higher during the 23 months of terminal construction phase overlap. During this 23-month period, the total number of workers at the terminal site could range from 1,500 to 3,600, and would average approximately 3,000 workers during the overlapping period.

Table 4.9-2 LNG Terminal and Pipeline System Workforce and Duration						
Phase/Facility	Workforce			Duration ^a		
	Phase I	Phase II	Terminal Site Phase Overlap	Phase I	Phase II	Terminal Site Phase Overlap
Construction						
Terminal Site						
Average	1,400	1,400	3,000	35 months	35 months	23 months
Peak	2,200	2,200	1,500–3,600	6 months	6 months	
Pipeline System						
Average	250	100	ND	9 months	7 months	ND
Peak	350	150	4,100	1 month	1 month	1 month
Operation						
Terminal Site		250		30 years (minimum)		
Pipeline System ^b		NA		50 years (minimum)		
a Phase II of the terminal site construction would overlap with Phase I for about 23 months, and the start-to-end construction period would be 4 years.						
b Pipeline system facilities would be maintained by staff who are based at the terminal site.						
Key:						
ND = Not determined						
NA = Not applicable						

The pipeline system construction workforce would be much smaller, ranging from 100 to 500 workers. Venture Global has not determined the specific timing of the pipeline system phases.

Thus, to be conservative, they assume that peak construction of both pipeline laterals could overlap, resulting in 500 workers on-site for 1 month. Moreover, they assume that LNG terminal peak construction could overlap peak construction of both pipeline system laterals, requiring a total workforce of 4,100 workers at the terminal and pipeline system sites for 1 month.

Given the existing oil and gas and port industries in the affected area, Venture Global expects at least 50 percent of the construction workforce would be hired from people already residing within the affected area. These local workers would not affect the population. The remaining workers, once hired, would increase the population temporarily for the duration of their employment. Because the LNG terminal has a multi-year construction period, some non-local workers may bring householders, e.g., spouses, partners, and/or children, to the area. For this evaluation, we assumed the average number of non-local workers associated with LNG terminal construction would bring householders, each with 2.6 persons per household based on the state average, to the area (U.S. Census Bureau, 2017b). Further, we assumed non-local pipeline system construction workers would not bring householders to the area because of the short construction periods, nor would additional LNG terminal employees hired during peak periods.

From these assumptions, we estimated that 1,820 non-local workers and householders could relocate to the affected area to support each phase of LNG terminal construction. During the period when the LNG terminal's Phases I and II overlap, that number could rise to an average of 3,900 non-local workers and householders, and 4,680 when the overlap construction workforce is highest. If peak construction periods of the LNG terminal and pipeline system overlap, up to 5,330 non-local workers and householders could temporarily reside in the affected area at one time during 1 month.

The affected area population is more than 840,000, so the non-local worker households would increase the population by less than 1.0 percent, including during peak construction. Of course, non-local workers would not evenly distribute through the affected area, and we expect many non-local workers would seek residence in communities with rental housing within a 1-hour commute or less. Belle Chasse, the largest community in Plaquemines Parish, is about a 30-minute commute away. Several other communities in Jefferson Parish (e.g., Timberlane, Terrytown, Gretna, Harvey, and Marrero) are within a 45-minute commute of the terminal site, as are several neighborhoods in New Orleans, and we assume any could appeal to non-local workers.

Based on the comparison of workers and householders with the existing population, we conclude that construction of the Project would have a minor, short-term effect on population levels in communities in the affected area. In forming this conclusion, we also considered the effect of non-local worker households' on housing and public services, which are evaluated in sections that follow. We acknowledge that the population increase would be more apparent in communities closest to the Project site with rental housing and amenities, especially in Belle Chasse, which currently has a low estimated rental vacancy rate of less than 3 percent, though this estimate has a wide margin of error (U.S. Census Bureau, 2017c). In the short term, the population increase could increase demands for services and housing, but may also create economic benefits in the affected area, which still has a smaller population than in 2000, pre-Hurricane Katrina.

During operation, the Project would require 250 full-time workers. Given the existing oil and gas and industrial port economies in the region, we expect at least 50 percent of operations

workers would be hired from within the affected area. The remaining 125 workers, with assumed household sizes of 2.6 persons, would effectively translate into 325 new residents in the region. We conclude that the non-local workers hired during operation, along with their householders, would have a minor, permanent impact on the affected area's population.

4.9.2 Economy and Employment

The Greater New Orleans Region's economy is deeply invested in the oil and gas industry, and Plaquemines Parish has been on record as contributing 25 percent of annual state severance revenues from local oil and gas production (Scott and Richardson, 2015; Greater New Orleans, Inc., n.d.). The Plaquemines Port, Harbor, and Terminal District is one of the top ports by annual cargo tonnage in the country and was ranked 11th largest in 2016 (USACE, 2018). The port district occupies the southernmost 70 miles of the Mississippi River, and its primary cargoes are oil- and gas-related products, chemicals, coal, and grains. Another major employer is Naval Air Station Joint Reserve Base New Orleans in Belle Chasse, which employs over 5,000 people and provides \$340 million to the local economy (Purpura, 2013; Plaquemines Port, Harbor, and Terminal District, 2018). Commercial fishing is another defining industry in Plaquemines Parish, and is evaluated separately in section 4.9.3.

An estimated 88,000 jobs were lost in the aftermath of Hurricane Katrina in 2005. However, southeast Louisiana had high job growth in the ensuing years, such that the New-Orleans-Metairie-Kenner metropolitan statistical area had the highest employment growth rate among the 100 largest metropolitan statistical areas in the country between 2005 and 2011 (Rho et al., 2012). Unemployment rates at the state and local levels are currently low at around 5 percent, reflecting the national trend of shrinking unemployment among workers actively seeking jobs.

Table 4.9-3 provides selected economic and employment information about the affected area.

Table 4.9-3 Existing Economic Conditions in the Affected Area				
Geographic Area	Per Capita Income ^a	Civilian Labor Force ^b	Top Industry Sectors by Employment^a	2016 Unemployment Rate^b (%)
Louisiana	\$25,515	2,112,320	• Ed, Health, Social • Retail trade • Arts, Accom, Food • Pro, Mngmt, Admin • Construction	5.1
Plaquemines Parish	\$25,359	10,149	• Ed, Health, Social • Ag, Fish, Hunt, Mine • Arts, Accom, Food • Construction • Manufacturing	4.6
Jefferson Parish	\$28,067	215,779	• Ed, Health, Social • Arts, Accom, Food • Pro. Mngmt, Admin • Retail Trade • Construction	4.5

Table 4.9-3 Existing Economic Conditions in the Affected Area				
Geographic Area	Per Capita Income ^a	Civilian Labor Force ^b	Top Industry Sectors by Employment^a	2016 Unemployment Rate^b (%)
Orleans Parish	\$28,444	179,465	• Ed, Health, Social • Arts, Accom, Food • Pro, Mngmt, Admin • Retail Trade • Construction	5.1
a U.S. Census Bureau, 2017d b Bureau of Labor Statistics, 2018 Key: Ed, Health, Social: Educational services, and health care and social assistance Arts, Accom, Food: Arts, entertainment, and recreation, and accommodation and food services Pro, Mngmt, Admin: Professional, scientific, and management, and administrative and waste management services Ag, Fish, Hunt, Mine: Agriculture, forestry, fishing and hunting, and mining				

Per capita income in Plaquemines Parish and the state are roughly equivalent, while it is higher in somewhat more affluent Jefferson and Orleans Parishes. The majority of the civilian labor force in the affected area resides outside of Plaquemines Parish.

The combined industry sector of educational services and health care and social assistance is the largest sector by employment in the U.S., and it is also the largest in the affected area (U.S. Census Bureau, 2017d). Of the three parishes, Plaquemines Parish has the lowest concentration in that sector, and it is also distinguished by having the second largest concentration of employment in the agriculture, forestry, fishing and hunting, and mining sector. The mining category includes oil and natural gas extraction, and both it and fishing are important industries in Plaquemines Parish. Construction is the fourth largest employment sector in Plaquemines Parish and the fifth largest in Jefferson and Orleans Parishes. This indicates some residents in the affected area have construction experience and could potentially benefit from the job opportunities associated with Project construction.

Venture Global estimates the Project's total construction cost would be \$8.5 billion, including workforce salaries and material and equipment costs. Venture Global estimates 10 percent of Project costs would be spent locally or regionally, based on their analysis of industrial projects recently constructed in the Gulf Coast region and the local and regional contractors they plan to hire. Venture Global would purchase permanent equipment locally and also lease construction machinery like cranes, lifts, pump trucks, flatbed trucks, dump trucks, excavators, and front end loaders. Locally procured services would include limited design and engineering services, waste disposal, sanitary services, food services, and security. In addition, local distributors would supply fuel to operate the dredging equipment, pumps, earth-moving equipment, trucks, and diesel generators for the Project.

The Project's workforce needs are laid out in table 4.9-3, and at its peak, the workforce could number up to 4,100, but only for a 1-month period. More typically, the workforce would range from 1,400 to 3,000 on the terminal site, and an additional 100 to 250 persons would work on the pipeline system, depending on the construction phase. Project construction salaries are estimated to be \$70,000 per year, excluding benefits, though the duration of any one employee's

employment would vary widely from a few months or less to several years. The construction and related activities required would create short-term business opportunities for local suppliers and service providers and likely boost revenues along their supply chain, supporting job growth in related industries. The Project may increase competition for local supplies, which would increase costs for some market participants and increase revenues for others.

Overall, we conclude that construction of the Project would generate minor, short-term economic benefits in the affected area, which consists of three parishes in the Greater New Orleans Region. This benefit would accrue during the 4 years of construction and a year or two after while Project-related dollars moved through the local economy. In Plaquemines Parish, a rural community compared with the other parishes in the affected area, the economic benefit could be significant depending on the number of workers who lived in the parish and the amount of spending that occurred there. At its peak, the construction workforce would represent a 40-percent increase in the number of workers employed in Plaquemines Parish. The peak construction workforce would represent just a 1-percent increase in the number of workers employed in the broader affected area. We assume approximately half of construction workers would be hired from within the affected area, given that construction is among the top five employing industries in the region. This could be a substantial benefit to local workers and their communities.

Once hired, the construction workforce, ranging from 1,400 to 4,100 individuals, would spend money in the local communities and induce economic benefits in other industries like retail, accommodations, and food service. The labor requirements of the Project would increase demand for general and specialized workers during construction, which could increase labor costs generally for construction projects and petrochemical-related developments in the region, creating a mix of benefits and consequences, depending on the market participant.

During operation, 250 workers would be hired permanently to operate the LNG terminal and, as needed, the pipeline system, earning salaries of \$75,000 to \$90,000, excluding benefits. We assume half of these workers would be hired locally, given the mature oil and gas industry in the affected area and local workers with relevant experience. The operations workforce would increase the number of employed workers in the affected area less than once percent, but at the level of Plaquemines Parish, the workforce would increase the employed workforce by three percent. For the duration of the Project, at least 30 years, Venture Global expects to spend approximately \$20 million annually on local materials, land leases, and water, sewer, and waste disposal utilities. We conclude that operation of the Project would have minor, permanent beneficial impacts on local employment and the economy in the affected area. Depending on the number of workers who move to Plaquemines Parish and the vendor contracts established there, the employment and economic benefit to the parish could be greater.

4.9.3 Commercial and Recreational Fishing

4.9.3.1 Commercial Fishing

The commercial fishing fleet in Plaquemines Parish is one of the largest in the lower 48 states and ranked the largest around 2010, per the Plaquemines Parish Comprehensive Master Plan (Plaquemines Parish, 2012). The parish's highest grossing species are shrimp, menhaden, and oysters; combined, their gross farm earnings valued \$117 million in 2014 (Louisiana State

University, 2017). The commercial fishing industry in Plaquemines Parish has experienced substantial setbacks in the last two decades but has been able to rebound to some extent after each event. Setbacks include Hurricane Katrina in 2005, the Deepwater Horizon drilling rig explosion in 2010, and recent freshwater diversion projects that adversely affected the oyster harvests in the short term.

The highest concentration of commercial fishing ports and marinas in Plaquemines Parish is south of the terminal site, especially in the communities of Empire, Buras, Triumph, and Boothville-Venice. Some commercial marinas exist closer to the terminal site (i.e., Myrtle Grove Marina to the north), but the commercial fishing hub is several miles south of the terminal. Likewise, the Mississippi Delta region and the river's tributaries south of the terminal experience the highest concentration of commercial fishing activity compared with river waters near the terminal and further north.

In this assessment, we considered whether construction or operation of the terminal site would restrict access to fishing grounds or impede commercial fishing boat traffic. (Section 4.6 addresses the Project's potential ecological and/or biological impacts on fish species.) As discussed in section 4.9.8.2, vessel traffic during construction would consist of bulk carrier vessels and tugs and barges, and their peak trips combined would not exceed 16 per week. The various origins of the tugs and barges and bulk carriers are not known at this time, but we assume they could voyage from ports north or south along the Mississippi River, from inland bayous and canals west of the west bank, or from the Gulf of Mexico. Nevertheless, the number of trips would be too small to be noticeable to regional commercial fishermen compared with the existing traffic. Moreover, the bulk carriers and tugs and barges are likely to transit established shipping routes such that their transits are not likely to affect commercial fishing grounds differently from existing commercial vessel traffic. Thus, we conclude that the effects from vessel traffic during terminal construction would be negligible and temporary.

The frequency of LNG carrier traffic during operation of the terminal would be much less than the frequency of construction vessel traffic—an estimated one LNG carrier or less per day, or six LNG carriers per week (see Section 4.9.8.2 Marine Transportation). However, these carrier vessels would be much larger than construction vessels. The LNG carriers would originate from the Gulf of Mexico and travel established shipping lanes and routes transited by other commercial cargo traffic. Because of the width of the Mississippi River, the LNG carrier would not prohibit other vessels from traveling abreast or passing in the waterway north of the delta. However, the passes through the delta region into the main body of the river are narrower, and commercial fishing vessels that voyage through the Southwest Pass could be impacted during LNG carriers' transits through the pass. Impacts could potentially include minor delays or minor increases in fuel costs from increased idle time. We do not expect more than negligible effects on fishermen's catch from these minor delays, especially because other passes provide access to the Gulf of Mexico and because Local Notices to Mariners from the USCG would permit fishermen to schedule their voyage plans most efficiently. Moreover, large cargo vessel traffic already regularly occurs in this region (see Section 4.9.8.2 Marine Transportation). We conclude that effects on commercial fishing from near-daily LNG carrier transits would be permanent but minor.

In Louisiana, oysters are harvested from public oyster grounds and privately leased areas. The pipeline system would cross private lease areas in Barataria Basin, as described in section

4.6.3.1. LDWF and LDNR require water bottom assessments of lease areas within prescribed distances of installation activities, not more than 2 years before the start of construction. Venture Global has performed the necessary surveys (see section 4.6.3 for further discussion). Furthermore, Venture Global intends to conduct financial impact evaluations on individual leases and work with leaseholders and the state to determine compensation for leaseholders. With consideration of Venture Global's commitments, we conclude that the pipeline system construction would have short-term direct impacts on commercial fishing. However, to ensure the successful implementation of these consultations, **we recommend that:**

- **Prior to construction of the pipelines, Gator Express Pipeline should file with the Secretary documentation that consultation with the LDNR Oyster Lease Damage Evaluation Board and/or the affected lease holder(s) has been completed.**

4.9.3.2 Recreational Fishing

Recreational fishing is a vital part of Plaquemines Parish's identity and local economy, made possible by the abundant lakes, bayous, marshes, and canals within its boundaries and the lower Mississippi River that flows through the center of the parish landform and into the Gulf of Mexico. The Louisiana Tourism Coastal Coalition promotes recreational fishing in Plaquemines parish as "world-class," and the Plaquemines Parish Tourism Commission's website address is catchingcapital.com (Louisiana Tourism Coastal Coalition 2019; Plaquemines Parish Tourism Commission 2019a). The Plaquemines Parish Tourism Commission provides a map of eight marinas in the parish out of which fishing guides operate; all but three are south of the Project area (Plaquemines Parish Tourism Commission 2019b). The Tourism Commission also provides a comprehensive list of 68 fishing guides and charter outfits in the parish (Plaquemines Parish Tourism Commission 2019c). A private website developed to facilitate booking fishing trips around the world lists 65 fishing charters in Plaquemines Parish that have signed up to the listing service to date (FishingBooker.com 2019). The same website lists 129 fishing charters for the state of Louisiana, indicating that as many as 50 percent of all fishing charters in the state could operate out of Plaquemines Parish (FishingBooker.com 2019).

Known as the LA Creel Program, the LDWF conducts dockside interviews and telephone and email surveys of recreational anglers to estimate saltwater fishing effort and catch. From the LA Creel survey 2016-2017, LDWF estimated that 2.1 million recreational saltwater fishing trips occurred around the state during that season (LDWF, 2018b). Given the fishing access facilities and abundance of waterbodies in and around Plaquemines Parish, some substantial percentage of trips likely originated out of Plaquemines Parish. This indicates that the economic value of recreational fishing in the parish is substantial. The most recent economic benefits report prepared for LDWF contains estimates of \$1.7 billion (2006 dollars) in total economic effects, \$114.1 million (2006 dollars) in state and local tax revenues, and 18,122 jobs generated by freshwater and saltwater recreational fishing in the state (Southwick Associates, Inc. 2008). The percentage of economic effects captured in Plaquemines Parish is unknown, but it is likely that the proportion was substantial given the prevalence of recreational fishing in the parish.

Both freshwater and saltwater recreational fishing occur in the parish. Primary targeted species in freshwater are largemouth bass, perch, catfish, sunfish, alligator gar, and bream (Plaquemines Parish Tourism Commission 2019b). Primary targeted species during inshore

saltwater fishing trips are redfish (a.k.a. red drum) and trout (a.k.a. speckled sea trout), followed by flounder, sheepshead, and black drum. Recreational anglers fishing offshore seek yellowfin tuna, wahoo, marlin, swordfish, amberjack, cobia, grouper, red snapper, tarpon, and triple tail. Offshore fishing sites in the Gulf of Mexico are beyond the Project area, but recreational fishing vessels with offshore destinations could be affected by the Project during transits in and out of parish marinas.

Section 4.6.3 provides a more thorough ecological discussion of fish species that occur in the Project, as well as an assessment of potential ecological impacts, including impacts on abundance. Section 4.6.4 further discusses the ecological conditions and habitats that support fisheries in the Project area and potential short- and long-term impacts. Just as in this section's commercial fishing impact assessment, we focused our recreational fishing impact assessment on how the Project might restrict access to recreational fishing grounds, impede recreational fishing vessel traffic, or otherwise limit the volume of recreational fishing trips or effort that would occur otherwise in the absence of the Project.

Construction and operation of the terminal would not restrict access to significant recreational fishery resources because none occur within or around the terminal's footprint (see section 4.6.3.2). Construction-related vessel traffic, primarily bulk carriers and tugs-and-barges, carrying materials to and from the terminal site during the four years of construction has some potential to affect recreational fishing by increasing vessel traffic levels along the lower Mississippi River and/or in the canals through the west bank of the parish. However, the trips would not exceed 16 trips per week, too low to cause greater than negligible effects on recreational fishing vessels in the area. Construction vessel traffic's primary effects, if any, would be delaying intercepted recreational fishing vessels in transit or disturbing anchored recreational fishing vessels whose passengers are actively fishing. Should instances of these occur, the collective effect would be negligible and temporary.

During operation of the terminal, the LNG carrier traffic would not likely affect recreational anglers or their vessel transits. LNG carrier vessel frequency would be less than one per day through the Southwest Pass and along the lower Mississippi River to the terminal site. The majority of the marinas in Plaquemines Parish from which recreational fishing vessels launch are positioned along canals with direct access to the bayous, marshes, and other inshore waterbodies adjacent to the east and west banks of the parish. The bayous provide access to the open water of the Gulf of Mexico, so most recreational offshore fishers avoid the Mississippi River altogether during their transits in and out minimizing any interaction with large commercial vessel traffic like LNG carriers. For those recreational fishing vessels transiting the Mississippi River, interactions with LNG carrier traffic would be negligible because the lower Mississippi River is wide and permits transits of multiple vessels abreast or passing with negligible delays. As mentioned in the commercial fishing discussion in section 4.9.3.1, the Southwest Pass in the river delta is narrower and may restrict a fishing vessel from traveling abreast of or passing a piloted vessel like an LNG carrier. However, other passes in the delta provide access for non-piloted vessels to the Gulf, and these could be used to avoid an LNG carrier or other piloted vessel transiting Southwest Pass. Local Notices to Mariners from the USCG would permit fishermen to schedule their voyage plans most efficiently. Overall, the permanent addition of LNG carrier traffic on the lower Mississippi River would have a negligible effect on recreational fishing.

During construction of the pipeline system, barge deliveries averaging one every other day during the 5- to 7-month construction period of each lateral would transport pipe directly from a pipe-coating plant to the pipeline system right-of-way. Other construction barge vessels would include rake-haul type barges and lay barges, though these would not make daily trips but rather remain at the Project site for the duration of their use. These rake-haul and lay barges would use Wilkinson Canal and Barataria Bay Waterway to access the pipeline right-of-way and workspaces. Appendix E shows the Project barge access routes, some of which will be dredged to deepen them by approximately 4 to 7 feet to at least 8 feet deep.

The pipeline construction crew would be transported by crew boats from Myrtle Grove Marina along Wilkinson Canal to lay barges along the pipeline construction site. Crew boat frequency would average about 20 trips per day to and from positions along the right-of-way and peak around 28 trips per day for a one-month peak period during construction of each lateral. Recreational fishing vessels are docked in Myrtle Grove Marina as well as in the neighboring Hermitage Marina, and these anglers may notice the barge and crew boat trips during the 5- and 7-month construction periods of the pipeline laterals. However, pipeline system construction traffic would not prevent recreational vessels from using the marinas or accessing the connected canals and waterways in Barataria Basin.

Although recreational fishing would be prohibited in the pipeline right-of-way during the period of construction, this is a minor area compared with the remainder of Barataria Basin and the fishing grounds. During dredging of the barge access channels, recreational fishing would be prohibited in the active dredging locations, but this would only occur for a period of days or weeks.

The pipeline system right-of-way is in Shrimp Area 09, Barataria Inside, and blue crab are known to occur throughout Barataria Basin (see section 4.6.3). No public oyster areas are traversed by the pipeline system right-of-way or barge access channels, so recreational oyster tonging would not be affected (see section 4.6.3). Thus, recreational fishing in this area refers to finfish fishing, shrimping, and crabbing. Shrimping is restricted to spring and fall seasons, whereas crabbing and fishing for finfish is generally permitted most of the year. Construction of either lateral may occur during the limited spring or fall shrimping seasons; the schedule is not yet known.

Venture Global has obtained consent from the LDWF in order to conduct in water construction activities without a seasonal restriction. As such, impacts on aquatic resources associated with construction activities is expected to be temporary and short-term and localized to the immediate vicinity of construction activities. Although the construction of each pipeline and deepening of discrete segments of barge access channels would take place over an extended duration, the construction activity at any single location along the pipeline route or barge access channels is likely to be limited to several days or weeks minimizing potential impacts on aquatic resources and recreational fishing. Access to the construction right-of-way and barge access channels would not be prohibited for fishing/crabbing/shrimping, except in the immediate vicinity of construction activities where necessary for safety reasons.

Although the pipeline system construction traffic could be noticeable to some recreational anglers and the right-of-way would be off-limits to fishing during construction, we conclude that the overall effect would be temporary and minor given the limited periods of construction (12 months total) and the proportionately small area of Barataria Basin that would be affected.

As soon as construction and restoration activities are complete on the pipelines, the pipeline system's associated vessel traffic would cease and any fishing access restrictions to the right-of-way would be lifted. Venture Global may periodically send staff via vessel to inspect the two permanent meter stations associated with the pipeline system, but these visits would have a negligible impact on recreational fishing. The meter stations, themselves, could increase habitat diversity in Barataria Bay and would likely have a net beneficial impact on fish habitat (see section 4.6.4.2). Thus, we conclude that during operation of the pipeline system, recreational fishing access and opportunity would not be adversely affected.

4.9.4 Taxes and Revenues

The Project would generate taxes and other revenues at the local and state levels during construction and operation. During construction, the Project's main contribution to parish governments would be sales tax revenues. The majority of these revenue increases would be indirect effects of Project construction, as it stimulates activity along the supply chain and provides businesses and workers with disposable income to spend locally. Venture Global estimates construction workers would spend 40 to 60 percent of their wages locally, and at least some of those expenditures would be subject to sales tax. In the affected area, the average local sales tax rate is 4.75 percent. As discussed in section 4.9.2, Venture Global estimates 10 percent of Project costs would be paid to local and regional suppliers of materials, equipment, and services, constituting some of the direct economic and tax benefits of the Project. Local procurement of concrete, fuel supplies, permanent equipment, leased equipment, and miscellaneous consumable materials would be taxed at the average local sales tax rate of 4.75 percent and the state sales tax rate of 4.45. In addition to state sales taxes, income taxes generated by the Project would increase government revenues at the state level. The wages of Project workers would be subject to Louisiana state income tax, as would wages of other workers whose jobs or level of activity were supported indirectly by the Project.

Louisiana Economic Development evaluated the potential tax impact from Project construction activities, direct wages, indirect wages, and induced purchases, and estimated \$131.3 million in state tax revenues and \$34.8 million in local tax revenues, for a total of \$166.1 million. This translates into approximately \$7 million in local tax revenues generated annually over the 4 years of construction, some or most of which would be captured in the affected area. In Plaquemines Parish, general fund tax revenues were \$23.7 million in 2017 (Plaquemines Parish, 2018). In Jefferson and Orleans Parishes, general fund tax revenues were \$355.3 million and \$403.0 million, respectively, in 2017 (Jefferson Parish, 2018; Orleans Parish, 2018). We conclude that Project construction would have a minor, beneficial, short-term effect on local government revenues in the affected area and in Plaquemines Parish, given that the parish's current tax revenues are less than \$25 million. Project construction would provide a minor, short-term boost to state revenues.

During operation, the Project would pay sales and ad valorem taxes and generate income taxes on its annual payroll of \$21 million. Venture Global estimates spending several million dollars annually on local materials and public utilities (water and sewer provided by Plaquemines Parish Water Works District, and waste disposal partially facilitated by Plaquemines Parish). The local material purchases would generate sales tax and the utility payments would support Plaquemines Parish service providers. The 250 permanent employees, whose salaries would

generate income tax, would spend money locally on housing and consumer goods and services, increasing ad valorem and sales tax revenues.

Typically, the largest local tax contribution during operation of a development this size is ad valorem taxes. Louisiana's Industrial Tax Exemption Program (ITEP) waives property taxes on approved developments for 5 years, with a possible extension of another 5 years. At the time of publication, the Louisiana Board of Commerce and Industry had approved Venture Global's application for the ITEP exemption for the LNG terminal; the Governor's approval was still pending. The pipeline system is not eligible for ITEP and would generate ad valorem taxes in year one of operation. At least by the eleventh year of operation, Plaquemines Parish would begin collecting ad valorem taxes from both the LNG terminal and the pipeline system, and these could be substantial given the \$8.5 billion estimated value of the Project.

We conclude that once operational, the Project would have a minor, permanent, beneficial impact on local tax revenues in the affected area. If a substantial portion of local tax revenues accrue in Plaquemines Parish because materials and services are purchased there or a large percentage of the workforce resides there, the tax revenue increase in the parish could be substantial relative to the general fund's annual tax collection. Once the full value of ad valorem taxes are assessed on the Project, the local tax revenue increase in Plaquemines Parish would provide additional benefits to the local economy.

4.9.5 Housing

Table 4.9-4 provides information about housing and accommodations in the affected area.

To evaluate the impact of Project construction on housing, we considered two key data points:

- the average number of non-local workers employed during each 35-month phase of LNG terminal construction: 700; and
- the largest possible number of non-local workers employed by the Project at one time, assuming peak construction of the LNG terminal and both pipeline system laterals coincide: 2,050.

During construction, most non-local workers would seek rental housing or other temporary accommodations like hotels and motels or recreational vehicle (RV) campgrounds. The U.S. Census Bureau (2017e) estimates that 14,035 vacant units are currently for rent in the affected area, and 9,341 more are seasonal, recreational, or occasional use units. In similar scenarios, owners of seasonal use units have rented them to temporary workers when demand increases.

At least some construction workers would reside in hotels or RV campgrounds, depending on their length of hire. The affected area has an abundance of hotel rooms because of the relatively close proximity to New Orleans. RV campgrounds are less plentiful but could accommodate some minority percentage of workers, depending on how many spaces are unoccupied.

Table 4.9-4 Housing and Accommodations in the Affected Area										
Parish	Total Units ^a	Home-owner Vacancy Rate(%) ^a	Rental Vacancy Rate(%) ^a	Vacant Housing ^{a, b}			Accommodations ^c			
				Total Vacant	For Rent	Seasonal	Hotels	Hotel Rooms ^d	RV Campgrounds	RV Spaces
Plaquemines	9,866	1.4	2.9	1,222	79	540	15	450	2	133
Jefferson	189,170	2.1	8.4	19,978	6,044	2,529	27	3,400	5	297
Orleans	192,358	2.6	8.6	37,514	7,912	6,272	122	18,300	8	515
Affected Area Total	391,394	NA	NA	58,714	14,035	9,341	164	22,150	15	945
^a U.S. Census Bureau 2017c ^b U.S. Census Bureau 2017e ^c Louisiana Office of Tourism, 2015; Louisiana Travel, 2015; Jefferson Parish Convention and Visitors Bureau, 2015; New Orleans Convention & Visitors Bureau, 2015; Plaquemines Parish Office of Tourism, 2015; Canal Street Beat, 2013; RVParking.com, 2015 ^d For Orleans Parish, an estimate of 150 rooms per hotel was used. Key: Seasonal: Seasonal, Recreational, or Occasional Use Units Hotels: Hotels, Motels, Inns, or Lodges NA: Not applicable										

In total, 23,376 for-rent and seasonal units are vacant in the affected area, and it has a supply of 23,095 hotel rooms and RV campground spaces. Some of the vacant units would be infeasible options, and many of the hotel rooms and campground spaces would be unavailable. However, given the supply compared with the Project workforce maximum, we conclude that the housing and accommodations market would experience minor, short-term impacts. Effects would be more noticeable in some communities than in others, though they would be short term. Non-local workers would increase demand, which would benefit proprietors and rental unit owners and increase competition among tenants in the affected area. The rental vacancy rates in the region do not reflect a remarkably competitive market, so we conclude that construction workers would not create undo hardships for other individuals seeking temporary housing. Thus, any adverse impacts would be temporary and minor.

During operation, the estimated 175 non-local workers hired permanently would not affect housing in the affected area, though their purchase or rental of local housing would benefit some individuals.

4.9.6 Property Values

For purposes of the property value analysis, we evaluated the terminal and pipe bridge as one entity because they are aboveground features that are nearly adjacent and they would be

expected to have a similar effect. The terminal and pipe bridge would be constructed on an undeveloped site owned by the Plaquemines Port, Harbor, and Terminal District, the majority of which was formerly a sugar cane agricultural field. The frontage on the river between SH 23 and the waterfront has not been developed in recent history. The majority of the LNG terminal site is designated as “port terminal complex” and “major industries” according to the Parish’s Master Plan as described in section 4.8.3.1.

The unique economic, fiscal, and environmental conditions in a community, as well as mitigation measures associated with a project, lead to varying effects, including no effect, on neighboring property values (Gabe et al., 2005). To investigate potential effects from the terminal on the values of nearby properties, we identified studies that assessed similar kinds of industrial development. In the case of Cove Point LNG, commissioned in 1978 in Maryland, 323 of 377 homes within 1 mile of the facility were built after commissioning (Maryland Department of Natural Resources, 2014). This indicates that land in proximity to the LNG terminal maintained value sufficient to encourage new development. In the case of Cove Point LNG, the terminal was partially screened from residential properties by forest cover and topography.

In a study of fossil fuel power plants constructed in the 1990s in neighborhoods across the United States, housing units within 2 miles of newly commissioned power plants were found to experience a minor decrease (3 to 5 percent) in rents and mortgages compared with housing 2 to 5 miles away (Davis, 2010). The transferability of this finding to the Plaquemines LNG terminal is limited because power plants may be perceived as more undesirable local land uses than LNG storage facilities and terminals (Gabe et al., 2005).

One peer-reviewed study found that housing values were higher near LNG facilities than elsewhere, all other variables being equal (Clark and Nieves, 1994). In yet another study prepared for residents in the town of Harpswell, Maine, a consulting group interviewed local realtors and concluded that proximity to a LNG terminal would depress residential property values up to 2 miles away from the Project boundary (Yellow Wood Associates, Inc., 2004). Finally, a composite study that examined peer-reviewed studies of different types of industrial developments such as landfills, Superfund sites, nuclear power plants, and large manufacturing facilities did not find a consistent trend characterizing how these industrial uses impacted property values (Regional Economic Studies Institute of Towson University, 2004).

Although studies to date are sometimes contradictory or inconclusive, one consensus seems to be that properties beyond 2 miles are too far away to experience measurable property value impacts from industrial facilities (e.g., Maryland Department of Natural Resources, 2014; Davis, 2010; Gabe et al., 2005; Yellow Wood Associates, 2004). Likewise, proximity is a chief factor influencing whether a facility could impact residential property values (e.g., Davis, 2010, Yellow Wood Associates, 2004). Two communities, the Deer Range neighborhood and Suzie Bayou Campsites, are located off Lake Hermitage Road within one mile of the terminal site. According to the Plaquemines Parish Comprehensive Master Plan maps, these are camp communities, defined as “residential communities built outside levee protection zones in marshland and swamp-like areas with limited infrastructure, characterized by a part-time or seasonal resident population often engaging in commercial fishing or recreational fishing and hunting” (Plaquemines Parish, 2012). However, the Deer Range neighborhood and Suzie Bayou Campsites consist of both part-time or seasonal camps as well as permanent residences. Lots in the neighborhoods range from 750 feet

to 3,000 feet (0.6 mile) from the terminal boundary. Another camp community on Lake Hermitage Road is 2.6 miles southeast of the terminal, and occupants would drive past the terminal on their way to and from SH 23. Like the other communities, the neighborhood consists of permanent residences in addition to part-time or seasonal camp facilities.

Another nearby residential development is a subdivision around a canal approximately 2.3 miles northwest on SH 23. The parish's Comprehensive Master Plan designates the future land use of this subdivision as a marina/harbor complex, which permits a mix of commercial and residential uses centered on the waterfront feature(s) (Plaquemines Parish, 2012). The closest residential property on the east bank is the community of Davant, northeast of the terminal and approximately 0.8 mile away. The future land use is designated as small community mixed use.

No new developments with a residential component are proposed within 0.25 mile of the terminal site. Moreover, the parish's draft, final Comprehensive Master Plan does not designate any future land use with residential components on west bank properties within several miles of the terminal that do not already have residential uses.

Perception factors heavily into the effect new development has on nearby property values, and so we considered the context of the terminal and pipeline system and their aesthetic and health impacts. In Plaquemines Parish, the oil and gas industry is mature, and related developments are prevalent. Thus, local perception of the Plaquemines LNG terminal would be influenced by residents' familiarity with other oil and gas-related infrastructure on the west and east banks. Appearance and noise emitted from an industrial facility also influence perception, and these factors were evaluated in Section 4.10 Cultural Resources and Section 4.11 Air Quality and Noise. We did not find that the terminal's noise output would be significantly adverse, but rather would comply with noise level requirements and avoid impacting noise-sensitive areas. Our evaluation of the terminal's visual change of the landscape is discussed in section 4.8.6, and we acknowledge that no other industrial facilities of similar scale are visible from the nearest residences. The terminal would be surrounded by a 26-foot floodwall, partially screening facilities, but the storage tanks, stacks, and other tall components would be visible above the floodwall. Perceived health risks could also factor into property values of nearby residences. We conducted rigorous investigations of air emissions and safety, reported in sections 4.11 and 4.12, and found that Venture Global has designed a project that meets state and federal air quality and safety standards.

Although we cannot predict the effects on any individual property, we assume effects on the camp community 2.6 miles from the terminal would be minimal, as would effects on the marina/harbor complex community on SH 23 and the Davant community across the river. The Deer Range neighborhood within 2 miles of the terminal is discussed below. In our evaluation, we considered that Plaquemines Parish has a substantial existing oil and gas-related industry. For example, International Marine Terminals' coal terminal and Phillips 66 Alliance Refinery on SH 23 are 1.3 miles and 6.7 miles driving distance, respectively, from the terminal site. We consulted the draft, final Comprehensive Master Plan for Plaquemines Parish and found that it designates a mix of future land use types on the terminal site, i.e., "business park," "port/terminal complex," and "major industries" (Plaquemines Parish, 2012). The plan's future land use map indicates a less intense use "business park" on the portion of the site closest to the Deer Range neighborhood, but large tracts adjacent and southeast of the terminal are designated "major industries."

The Deer Range neighborhood consists of a substantial number of permanent residences. Locally, it is also called “Lake Hermitage” for its main access road. The LNG terminal would not have a public access road to Lake Hermitage Road. Most of the structures in Deer Range are oriented toward the interior canals, but some have views facing the LNG terminal. Some of the structures are very close to the terminal site boundary.

We assume individual properties in the Deer Range neighborhood could experience a property value change if the terminal is constructed; however, it would be similar to a change accompanying any “port terminal complex” and “major industries” that could be constructed according to the Parish’s Master Plan.

The other components of the pipeline system are not expected to have more than negligible effects on property value in the region. The aboveground meter and valve stations would be on the terminal site behind the floodwall or else in Barataria Basin, out of sight of any residential or commercial properties. With the exception of the pipe bridge, all segments of the pipe would be buried, largely under wetlands and open water but also under some undeveloped upland that is designated as agricultural in the parish’s draft, final Comprehensive Master Plan Future Land Use Map. Pipeline easements do not prohibit agricultural activity directly above, so this would not affect certain individual property owners’ agricultural activities.

Finally, several studies have found limited to no effects of natural gas pipelines on the property values of neighboring or nearby property values (e.g., Integra Reality Resources, 2016; FERC, 2014; Diskin et al., 2011; PGP Valuation Inc., 2008; Allen, Williford, and Seal, Inc., 2001). Thus, we conclude that the pipeline system (not including the pipe bridge), would have a negligible, permanent effect on the collective property value of the traversed land.

4.9.7 Public Services

Table 4.9-5 provides an inventory of selected public services in the affected area, including public education, fire protection, law enforcement, and health care.

Table 4.9-5 Public Services in the Affected Area					
Parish	Public Schools ^a	Students ^a	Fire Departments ^b	Police Departments, Sheriff's Offices ^c	Hospitals ^{d,e}
Plaquemines	8	5,036	8	1	1
<i>Southern West Bank</i>	3	1,115	5	1	1
Jefferson	86	47,977	18	7	6
Orleans	87	43,670	9	4 ^f	7
Affected Area Total	181	96,683	35	9	14
^a Plaquemines Parish School Board, 2015; Jefferson Parish School District, 2015; Tulane University, 2014 ^b U.S. Fire Administration, 2016 ^c USACOPS, 2016 ^d Jefferson Parish Medical Society, 2016; Orleans Parish Medical Society, 2014; Plaquemines Parish Government, 2016 ^e Totals do not include long-term extended care, psychiatric care, rehabilitation, or labor delivery and women's services hospitals. ^f New Orleans Police Department is the public safety agency primarily responsible for patrol of the parish; the primary responsibility of Orleans Parish Sheriff's Office's is correction facilities, and Crescent City Connection and Port of New Orleans Harbor Police Departments patrol the facilities for which they are named.					

In general, the parishes have school, public safety, and hospital services that are commensurate with their populations. The reported number of police and sheriff's departments are not directly comparable because areas of responsibility differ—departments responsible for larger areas have more deputies. For example, the New Orleans Police Department is a large police force that patrols all of Orleans Parish, while Jefferson Parish policing is divided among several municipal police departments and the sheriff's office. Plaquemines Parish law enforcement is provided by the Sheriff's Office, with headquarters in Belle Chasse and additional offices on the east and west banks.

Offsite: Given our finding that the population increase by non-local workers and householders associated with the Project would be short term and minor, we conclude that their additional demand for fire, safety, and medical services would also be short term and minor. The services are adequate in the affected area, and we do not find that relocated households associated with construction would place an undue burden on them. Moreover, local revenues and economic stimulus generated by Project construction could indirectly increase funds available to public safety departments and hospitals in the future. During operation, the needs of the 125 non-local workers hired during operation would not affect the current level of service by local fire, safety, and medical service providers.

To estimate the number of school-aged children that could accompany non-local construction workers and increase enrollment at local schools, we assumed the non-local workers associated with each LNG terminal construction phase's average workforce were the workers most likely to relocate children because of their duration of employment. Because the LNG terminal phases overlap, we assumed up to 1,400 non-local workers could bring families (50 percent of each phase's average workforce size of 1,400). The households of 1,400 non-local workers would comprise 3,640 people, based on assumptions discussed in section 4.9.1. In Louisiana, the proportion of 5- to 17-year-olds is 17.4 percent, so assuming this proportion among the non-local worker households, 633 school-aged children could move to the affected area. Given the

comparatively large student body in the affected area, these additional children would have minor, short-term effects on the public school system. During operation, we expect an even smaller number of school-aged children to accompany non-local hires. Therefore, the Project's effect on schools would be minor and permanent during operation.

On-site: During construction and operation, Venture Global would supply at least some security, fire safety, and medical services on-site. According to Venture Global's current plans, the Plaquemines Parish Fire District would provide backup fire protection, to be described in the Project's final version of the Emergency Response Plan. To that effort, Venture Global would provide specialized training to the Myrtle Grove and/or Lake Hermitage Volunteer Fire Stations, located 3.0 miles north and 4.4 miles southwest, respectively. If persons on-site needed medical care beyond that provided on-site, they could visit the Plaquemines Parish Medical Center, 13 miles south in Port Sulphur, or the Ochsner Medical Center, West Bank, 25 miles north in Jefferson Parish. Plaquemines Parish Medical Center provides most medical services except major surgery, while Ochsner Medical Center, West Bank is a 180-bed full-service facility. The nearest law enforcement office is the Plaquemines Parish Sheriff's Office in Port Sulphur, and 20 patrol deputies are assigned to the west bank region that includes the Project site. We conclude that on-site activities during construction and operation of the Project would have a minor effect on public services at the level of the affected area.

Southern west bank: The communities in the southern west bank of Plaquemines Parish could be vulnerable if an emergency or catastrophic event occurred at the LNG terminal and prohibited travel along SH 23. Therefore, we inventoried the public safety and medical services that are present in the southern west bank to determine services locally available in the event of a road closure. We also identified the Plaquemines Parish schools south of the terminal site to establish whether school-aged children in the southern west bank typically commute past the terminal site to attend school.

During localized emergency incidents at the LNG terminal and other events that might close local highways, e.g., flooding, the Sheriff's Office can direct traffic to the levee system of the parish. Alongside the LNG terminal, this is the berm between SH 23 and the Mississippi River with a narrow, gravel track road on top, so that travel would be limited to one-lane, one-way. Also available for transportation is the Point à la Hache ferry at West Pointe à la Hache. The average ferry vessel fits 40 vehicles, and typically runs every 30 minutes between the west and east banks.

Plaquemines Parish law enforcement is the Sheriff's Office, with headquarters in Belle Chasse. The Project facilities are within the Patrol Division's 2nd District, which extends from Myrtle Grove to Venice with approximately 20 deputies and an office in Port Sulphur. The Sheriff's Office Marine Search and Rescue team are also based in Port Sulphur and respond to emergencies on the rivers and bayous, such as lost boaters and disabled vessels. In addition to its 60 patrol deputies and special division officers, the Sheriff's Office has a Reserve Division of around 21 deputized volunteers that assist during special events and emergencies like road races and hurricane evacuations (Plaquemines Parish Sheriff's Office, n.d.).

Lake Hermitage Volunteer Fire Station in Port Sulphur and Boothville Volunteer Fire Station are both in the southern west bank. Typically, volunteer firefighters are "on call," so they may or may not be in the southern west bank at the time of an incident. The firefighters at Lake

Hermitage may receive specialized training sponsored by Venture Global to serve as backup firefighters to aid incidents at the LNG terminal.

Described above, the Plaquemines Parish Medical Center in Port Sulphur serves all of Plaquemines Parish and is located in the southern west bank. It provides emergency care, but not major surgery. Plaquemines Parish has an ambulance service with a post in Port Sulphur, collocated with the volunteer fire department.

The southern west bank has two elementary schools, one combination middle school/high school, and one learning center geared toward high school-aged children. Thus, local schools are available to school-aged residents of the southern west bank. In the event of a LNG terminal emergency that necessitated closure of SH 23, students who commute north of the LNG terminal to attend another school would be most vulnerable to disruptions- either because they could not return home or drive to school. However, this vulnerability is minimized given the availability of schools south of the LNG terminal.

In sum, the southern west bank has a sheriff's office, a marine search and rescue team, two fire stations, a comprehensive medical center, an ambulance service post, and public schools for K-12 students. The presence of these services would reduce local residents' vulnerability should an emergency event occur at the terminal and require temporary closure of SH 23. Although we find that, in general, the Project would not have a significant adverse impact on the availability of public services in the southern west bank, we discuss the potential for a catastrophic event at the terminal blocking access on SH 23 as an issue of environmental justice (see Section 4.9.9 Environmental Justice).

4.9.8 Transportation

The Project would generate traffic on roads and waterways during construction and operation. Within the affected area, major road corridors include Interstate 10 (I-10), Interstate-310 (I-310), Interstate-610 (I-610), U.S. Highway 171 (US 171), and U.S. Highway 90 (US 90), also referred to as the West Bank Expressway. Locally important road corridors in Plaquemines Parish include SH 23, SH 39, and SH 406, but SH 23 is the only road that accesses the LNG terminal and the parking area and workspace associated with the pipeline system. Thus, SH 23 is the pinch point in the roadway network that would be used by Project-related vehicles; therefore, the traffic analysis examines potential build-up on SH 23 to determine whether significant effects would occur. The Project would generate vessel traffic on the Mississippi River through construction and operation of the LNG terminal and would use canals in Barataria Basin to facilitate construction of the pipeline system. Traffic in both waterbodies are evaluated in the marine transportation section that follows.

4.9.8.1 Roadway Transportation

Because of the narrow geography of Plaquemines Parish, only one arterial road, SH 23, directly serves the Project. SH 23 runs parallel to the Mississippi River on the west bank, and SH 39 runs along the east bank. Because the river is wide, river crossings are limited. The closest bridge crossing to the terminal site is the US 90 crossing in New Orleans, approximately 30 miles north. The closest ferry crossings are 22 miles north in Belle Chasse and 6.8 miles south in West Pointe à la Hache. The Point à la Hache ferry runs every thirty minutes on weekdays and about every hour on weekends, from 6:00 a.m. to 10:00 p.m. 7 days a week. The Point à la Hache ferry vessel carries 40 vehicles, though the parish operates another ferry that transports 72 vehicles at a time.

DOTD characterizes SH 23 as a minor urban arterial in Belle Chasse and a minor rural arterial south of Belle Chasse, to its terminus in Boothville-Venice (DOTD, 2014). DOTD traffic counts near the terminal site range from 9,271 vehicle trips daily near Belle Chasse to 7,074 trips near Port Sulphur (DOTD, 2015).

Venture Global prepared a Traffic Management Plan for Terminal Site Construction and an additional plan for pipeline system construction (appendix E). In the Traffic Management Plan for Terminal Site Construction, Venture Global considered the traffic generated by all LNG terminal and pipeline system construction workers because all would utilize SH 23 to access the Project site. The plan assumes a construction workforce of 3,300, which is not as high as the peak workforces presented in section 4.9.1. After the Traffic Management Plan was prepared, Venture Global revised the construction schedule, resulting in a longer overlap period of Phase I and Phase II and a higher peak workforce. Whereas the original schedule indicated the workforce would not exceed 3,200 during the overlap period, the revised schedule indicated a peak combined workforce of 3,600 for several months. In addition, if all peak periods of the terminal and pipelines overlap, the workforce could rise to 4,100 for one month, though the likelihood of this occurring is low. In spite of these differences, we determined that the Traffic Management Plan assumption of 3,300 workers was adequate, primarily because we believe the plan's summary findings and proposed mitigation measures would not change by increasing the workforce assumption to 3,600. We also considered that during the majority of the construction period, the workforce would be less than the assumed 3,300 - the average workforce at the LNG terminal site would be 3,000 during Phase I and II overlap, and outside the overlap, the workforce would average 1,400.

In the Traffic Management Plan for Terminal Site Construction, a traffic simulation study showed that, without mitigation, traffic on SH 23 would become heavily congested during the morning commute hour as vehicles backed up behind two construction entrances at the terminal site. Heavy congestion was predicted during peak construction periods during the workers' morning commute between 6 a.m. and 7 a.m., assuming one vehicle per person.

During the draft EIS comment period a commenter asked about the traffic increases along SH 23, specifically in Belle Chasse. The applicant estimates that during peak construction 2,380 personnel would originate from locations north of the LNG terminal, passing through Belle Chasse. DOTD traffic data at points located in the northern part of Belle Chasse and the southern part of Belle Chasse along SH 23 indicate between 22,520 and 33,146 traffic counts per day, respectively. To estimate the potential increase in traffic as a result of construction activities, the

DOTD recorded data were averaged for each point and used as the average daily traffic for that point. Project-related traffic was then added to those daily counts and a percent increase was calculated. Project-related traffic would result in an increase of 7.2 percent of daily trips at the southern location and 10.5 percent increase at the northern location in Belle Chasse. These numbers represent the potential peak increase in traffic and would not be representative for the entire duration of construction activities.

Through multiple simulation runs, the simulation study identified a combined group of mitigation measures that would eliminate traffic queues near the LNG terminal entrances and elsewhere on SH 23, including Belle Chasse, and maintain an acceptable level of service on SH 23. The mitigation measures captured in the Traffic Management Plan for Terminal Site Construction are as follows:

- position personnel checkpoints at the entrances to construction sites from the on-site parking lot, rather than at SH 23 access points;
- limit the number of available passenger car parking permits on the designated parking lots to maintain carpooling of at least two people per vehicle;
- limit use of the LNG terminal's secondary access point from SH 23 to construction management only;
- construct auxiliary turning lanes along SH 23 at its intersection with the LNG terminal's main access point;
- minimize the use of external trucks by transporting most construction freight by water;
- station a police officer to control traffic at the proposed intersection of SH 23 and the main construction entrance during commuting rush hours; and
- eliminate truck traffic to the Marine Facilities or any other Project site during commuting rush hours.

The plan also calls for providing a continuous on-site bus shuttle service from the terminal parking lot to work locations. The parking lot is on-site and anywhere from 0.2 to 0.7 mile away from various work locations, so this measure is intended to ensure terminal workers arrive at their specific location on a timely basis. It would not affect traffic on SH 23. More information about pipeline employee parking and transport is provided later in this section.

Venture Global proposes to install a temporary bulk material conveyor and cement handling equipment between the Bulk Carrier Mooring Facility on the Mississippi River and the terminal site south of SH 23. The conveyor and piping would be located overhead on a trestle across SH 23. Transporting materials for terminal construction with this system would preclude the need for the same materials to be trucked across SH 23, thereby avoiding associated traffic congestion. Design efforts are currently underway.

Implementation of the mitigation measures described above would limit the terminal site's construction impacts on traffic to minor and short term. This Traffic Management Plan for Terminal Site Construction is predicated on the current Construction Execution Plan, such that if conditions are modified, the Traffic Management Plan may require further evaluation and potential modification. Venture Global intends to implement these measures assuming the current Construction Execution Plan remains substantively the same. If roadways are damaged because of construction-related traffic, Venture Global would repair or reconstruct the damaged roadway to pre-construction condition.

Pipeline construction workers would commute to a designated parking area near Myrtle Grove Marina off of SH 23, or to the selected contractor staging yard with frontage on SH 23 (see appendix E). Based on their traffic management plans, Venture Global intends for some percentage of pipeline workers to carpool, such that during peak construction of a single pipeline, total employee vehicles would not exceed 100 vehicles. Commuter movements would occur primarily between 5:00 a.m. and 6:00 a.m. and at 6:00 p.m., generally 6 days a week and up to 7 days a week. From Myrtle Grove Marina, 25-person capacity crew boats would transport pipeline workers to contractor lay barges stationed along the pipeline right-of-way or to temporary workspaces. Venture Global estimates that collective traffic on SH 23 associated with pipeline construction would average 175 vehicles daily, including employee vehicles and heavy truck deliveries.

Pipeline construction activities and semi-truck deliveries could cause traffic delays or other impacts, but adverse traffic effects are not expected to be severe or of long duration. Pipe segments for both laterals would be transported by barge from a pipe coating plant directly to a lay barge along the pipeline right-of-way or offloaded at a dock at the terminus of Walker Road. Delivering pipe directly to construction lay barges would greatly reduce semi-truck transport on SH 23, and the effects of this barge transport on inland waterways is discussed in Section 4.9.8.2 Marine Transportation. Because of the location of the barge offloading dock, semi-trucks would travel Walker Road frequently through the construction period.

The other local road that would experience noticeable traffic effects is Lake Hermitage Road. Pipeline installation methods include two road bore crossings across Lake Hermitage Road south of the terminal site—one for each lateral. If the road bore installation required a temporary road closure, Venture Global would avoid closing it during peak traffic hours and would coordinate with appropriate officials to minimize impacts.

The Traffic Management Plan for the Pipeline System identified several measures to reduce impacts from construction activities and heavy truck trips on public roads:

- provide road signage alerting drivers to pipeline system construction activities and potential traffic delays;
- utilize flagmen, as needed, when equipment is crossing a road or traveling along a public roadway;
- adhere to state and county vehicle weight limit regulations and removal of excess soil that may be left on the road surface from construction equipment crossings;

- implement dust control measures, as necessary, in dry weather, especially on roads with unpaved surfaces such as Walker Road and Lake Hermitage Road;
- place additional signage on Lake Hermitage Road where a variety of construction activities would occur, including a bored road crossing operation, construction related to the installation of a main line valve, and an aboveground pipe bridge used to cross an existing non-federal levee; and
- should a temporary road closure be required, the contractor should avoid closing Lake Hermitage Road during peak traffic hours and coordinate construction activities with appropriate local and state officials to avoid or minimize potential traffic delays/impacts.

Venture Global intends to implement these mitigation measures assuming the current Construction Execution Plan remains substantively the same. Assuming implementation of the mitigation measures, we expect impacts on public roadways from pipeline system construction activities would be minor and temporary. Construction of each pipeline would last less than 1 year, and the volume of traffic generated by construction would be under 400 trips per day. Finally, installation would involve only two public road crossings.

4.9.8.2 Marine Transportation

The proposed terminal fronts the Lower Mississippi River at river mile marker 55. Roughly defined as the river section from Baton Rouge to the Gulf of Mexico, the Lower Mississippi River is flanked by four of the top 11 U.S. ports by tonnage, including the top port, the Port of South Louisiana, between Baton Rouge and New Orleans (USACE, 2018). As such, the Lower Mississippi is heavily transited by tankers, cargo ships, and tugs and barges, in addition to recreational vessels, fishing vessels, and cruise ships. As discussed in section 4.9.2, the Plaquemines Port, Harbor, and Terminal District is the 11th largest port by tonnage and hosts around 20 terminals, which receive vessels regularly (Plaquemines Port, Harbor, and Terminal District, 2018). In addition to these vessels, ocean-going vessels that call on New Orleans, South Louisiana, or Baton Rouge also transit the river section in the Plaquemines Port, Harbor, and Terminal District. The Crescent River Pilots Association, whose members pilot foreign-flagged, ocean-going vessels that transit between Pilottown near the southern tip of Plaquemines Parish and New Orleans, pilot over 16,000 transits annually, an average of over 44 transits each day (Crescent River Pilots' Association, n.d.). Considering that ocean-going vessels are a minority percentage of total transits along the Lower Mississippi River, vessel transit numbers likely reach up to several hundred daily in the vicinity of the LNG terminal. U.S. flagged cargo ships, Navy vessels, tugs and barges, fishing vessels, recreational boats, and ferries are examples of other vessel types that regularly transit the river. At river marker 55 near the terminal, the river width is nearly 0.5 mile, permitting multiple vessels to travel abreast.

During terminal construction, bulk carriers and tugs and barges would deliver materials, equipment, and modular plant components to three temporary marine delivery facilities constructed along the terminal's river waterfront, described in section 2.1.1.7. Bulk carrier vessels would deliver rock, structural fill, and cement to the bulk carrier mooring facility. The other two facilities, the MOF and barge mooring facility, would receive deliveries by tugs and barges,

primarily. The MOF has been designed to offload LNG modules, power plant components and equipment, and other heavy lift/heavy haul (greater than 50 tons) material and equipment from barges. The barge mooring facility is designed to dock and offload cargo barges carrying materials like pipe piles, concrete piles, sheet piles, steel, and stone. At most, eight vessels per week would call on the marine facilities during terminal construction. This peak estimate includes one bulk carrier and seven tugboats pulling four-to-eight barges each. The terminal's peak number of vessel transits is limited by the utilization rate of each berth (e.g., the time necessary to unload each bulk carrier vessel or set of barges). At most, the bulk carrier mooring facility could accommodate one bulk carrier vessel per week, while the MOF and barge mooring facility could each accommodate one delivery of barges every other day. Based on these berth utilization rates estimated by Venture Global, the peak vessel transits would equal eight round trips, or 16 trips total, per week. Given the daily traffic in the Mississippi River by existing commercial traffic and the width of the river that permits multiple vessels to travel abreast, the few daily trips added by Venture Global supply vessels would constitute a negligible increase.

Venture Global estimates that upon full build-out, the terminal could receive a maximum of six LNG carriers per week transiting in from the Gulf of Mexico. State-commissioned river pilots would board the LNG carriers during their voyage along the Mississippi River, per statutory requirements designed to ensure persons with local knowledge of the waterway are onboard to minimize accidents. The Associated Branch Pilots board and direct navigation on foreign-flagged, deep-draft vessels transiting between Southwest Pass at the mouth of the river and Pilottown, an island in southern Plaquemines Parish. The Crescent River Port Pilots' Association board foreign-flagged, deep-draft vessels between Pilottown and New Orleans. Thus, during each voyage, an LNG carrier calling at the terminal would be boarded by two pilots inbound and two pilots outbound who would direct navigation along the 65-mile-long transits each way.

As part of the required Waterway Suitability Assessment process (33 CFR 127.009), Venture Global met with the USCG from March 1–3, 2016, during a Waterway Suitability Assessment workshop. Their final Waterway Suitability Assessment was submitted in October 2016, and on January 23, 2017, the USCG issued a Letter of Recommendation stating that the Lower Mississippi River is suitable for LNG traffic associated with the Project in accordance with the guidance in USCG's Navigation and Vessel Inspection Circular (NVIC) 01-2011. Before the terminal is commissioned, the USCG would establish the maximum number of LNG carriers allowed per year. To date, the Captain of the Port has not recommended establishing moving safety and security zones around LNG carriers associated with the terminal. This is consistent with current protocols for vessel carriers of liquefied hazardous gas on the Mississippi River near the terminal, which transit without security zone restrictions.

Although the annual maximum number of LNG carrier calls has not been prescribed, we assume an average of six to seven LNG carriers would call on the terminal weekly. The carriers would not restrict the travel of other vessels in the river around them, and each would be under navigation direction of a local, state-commissioned pilot. The vessel carriers would be consistent with other large tankers and cargo ships that transit the river to the southern Louisiana port districts. We assume current traffic in the vicinity of the terminal consists of several hundred transits per day, by vessels of all types and sizes. Given these factors, we conclude that the effect of terminal operation on marine transportation would be permanent but minor.

As mentioned in section 4.9.8.1, Roadway Transportation, Venture Global would use barges to transport pipe directly from a pipe-coating plant, such as the Bayou Coating plant in New Iberia, to lay barges in the pipeline construction workspace or an offloading dock at the terminus of Walker Road (see appendix E). These barge deliveries would average one every other day during the 5- and 7-month construction periods of each lateral. In the event that pipeline construction phases overlap at all, barge deliveries could increase to one per day, still a minimal increase in vessel traffic. Rake-haul type barges and lay barges would use Wilkinson Canal and Barataria Bay Waterway to access the pipeline right-of-way and workspaces. These Project barge access routes are shown in appendix E. Venture Global plans to dredge discrete portions along the Wilkinson Canal and lateral routes connecting it and Barataria Bay Waterway to the pipeline right-of-way, as discussed in section 4.3.2.2.

Crew boats carrying 25 persons each would transport pipeline workers from Myrtle Grove Marina along Wilkinson Canal to lay barges along the pipeline construction site. In Phase I, crew boats would average 10 vessels per day and increase to 14 vessels per day during the 1-month peak construction period. In the event that phase construction overlaps, crew boat traffic could average 14 vessels per day. The crew boats would remain on-site until they delivered workers back to Myrtle Grove Marina at the end of the work period (see “proposed employee transport route” in appendix E).

Venture Global has met with Coastal Protection Restoration Authority (CPRA) to discuss the pipeline construction plan and associated barge traffic, because CPRA is managing the Barataria Bay Rim Marsh Creation and Renourishment Project, a site with an access canal that intersects one of the barge access channels (Allen et al., 2017). During the meeting, the parties concluded that the barge access channel is sufficiently wide such that, even if construction overlapped, the width of the barge access channel and the intermittent vessel movements associated with both projects would preclude direct or indirect impacts on either project (Allen et al., 2017). Given this finding and the low average level barge traffic associated with pipeline construction, we conclude that pipeline construction impacts on marine transportation would be minor and temporary. Crew boat traffic numbers would be higher than barge trips, but we do not find that these would be more than a minor change.

4.9.9 Environmental Justice

Executive Order 12898 (59 Federal Register [FR] 7629) established a federal policy under which federal agencies must identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. Consistent with Executive Order 12898, the CEQ calls on federal agencies to actively scrutinize the following issues with respect to environmental justice (CEQ, 1997):

- racial and economic composition of affected communities;
- health-related issues that may amplify project effects on minority or low-income individuals; and

- public participation strategies, including community or tribal participation in the process.

The CEQ (1997) advises using demographic and poverty-level data published by the U.S. Census Bureau to identify minority and low-income populations in affected areas. According to federal guidance documents, minority populations are present in an affected area where racial and ethnic minority groups exceed 50 percent or are “meaningfully greater” than in the general population of the larger surrounding area, referred to as a reference area (CEQ, 1997; EPA, 1998). A report by the Federal Interagency Working Group on Environmental Justice and NEPA Committee (2016) states, “The meaningfully greater analysis requires the use of a reasonable, subjective threshold (e.g., 10 or 20 percent greater than the reference community).”

In this environmental justice analysis, we defined the affected area as the census block group occupied by the Project facilities. The census block group, a statistical division of the census tract which generally contains 600 and 3,000 residents, was selected based on guidance from the EPA (1998) that each area under investigation should be an “appropriate unit of geographic analysis” that does not “artificially dilute or inflate the affected minority population.” The census block group is also one of the smallest units for which the U.S. Census Bureau provides demographic and economic statistics. We established Plaquemines Parish as the reference area, representing the general population with which minority percentages in the affected area (selected block group) were compared. To determine whether minority percentages were “meaningfully greater” in the affected area compared with the reference area, we assumed a difference of 10 percentage points indicated a meaningful difference.

As with minority populations, low-income populations in an affected area can be identified as potential environmental justice communities by comparing the affected area to a reference community (Federal Interagency Working Group on Environmental Justice and NEPA Committee, 2016). We used poverty status statistics estimated by the U.S. Census Bureau to estimate the percentage of low-income individuals in the affected area. If the percentage of individuals below the poverty level was greater than the percentage in Plaquemines Parish, we identified it as a potential environmental justice community.

We also considered from the perspective of environmental justice the remaining area south of the Project that depends on SH 23 for egress and ingress, because residents could be at risk if access were cut off during a rare, unexpected event. For this subset of the parish, we used census tract-level data, reasoning that the collective region would become vulnerable in the event of a highway closure. The census tracts in this part of the southwest bank of Plaquemines Parish cover all remaining territory south of the terminal. We performed the same demographic analysis on the additional census tracts to evaluate whether their populations met the criteria for potential environmental justice communities.

Table 4.9-6 provides the minority- and poverty-level percentages in the primary affected area, the remainder of the southwest bank, the parish, and the state. Anywhere a census block group or tract jurisdiction’s minority or poverty percentage exceeds the above-established threshold is shaded in grey. Figure B-8 in appendix B depicts the boundaries of the affected census block group and tracts in the southwest bank of Plaquemines Parish.

The primary affected area is a potential environmental justice community based on the criteria above. Of the census tracts that comprise the remainder of the southwest parish south of the terminal, three have minority percentages that are at least 10 percent greater than the parish's overall minority percentage and poverty-level percentages that exceed the parish's overall poverty percentage. One other census tract, the tract at the southernmost tip of Plaquemines Parish, has a poverty-level percentage that exceeds the parish's poverty percentage.

Under general construction and operation conditions, the Project would not have a significant risk of impact to human health or environmental conditions in the southern west bank census tracts below the terminal because of their distance from Project activities—9.6 or more miles away and the mitigation measures proposed or recommended. However, residents in these census tracts would be vulnerable if a catastrophic incident or other more likely emergency occurred on the terminal site that limited or restricted vehicle travel on SH 23.

Table 4.9-6 Minority and Income Statistics in the Affected Area, Census Tracts Below the Terminal, the Parish, and the State, 2012-2016 Estimates ^{a,b,c}											
Non-Hispanic Population											
Geographic Area	Total Population	White Alone(%)	Black Alone (%)	American Indian Alone (%)	Asian Alone (%)	Pacific Islander Alone (%)	Other Race Alone (%)	Two or More Races Alone(%)	Total Hispanic, of any race (%)	Total Minority (%)	Total Below Poverty Level (%)
Louisiana	4,645,670	59.3	31.9	0.5	1.7	0.0	0.2	1.6	4.8	40.7	19.7
Plaquemines Parish	23,584	66.2	20.5	0.8	3.6	0.0	0.1	2.6	6.2	33.8	17.2
Block Group 1, CT 504 ^d	1,095	28.2	69.3	2.5	0.0	0.0	0.0	0.0	0.0	71.8	24.5
CT 505 ^e	1,432	23.9	66.7	2.5	0.6	0.0	0.0	5.7	0.6	76.1	48.8
CT 506 ^f	926	53.7	25.7	0.0	14.4	0.0	0.0	2.3	4.0	46.3	30.0
CT 507 ^g	1,264	83.1	0.0	0.0	13.6	0.0	1.8	1.4	0.0	16.9	16.4
CT 508 ^h	1,206	62.3	15.8	1.9	8.5	0.0	0.0	5.4	6.1	37.7	40.0
^a U.S. Census Bureau, 2017f ^b U.S. Census Bureau, 2017g ^c Data for all geographic areas based on the U.S. Census Bureau 2012-2016 American Community Survey ^d Includes Project LNG facility and pipeline system sites ^e Includes Port Sulphur Census Designated Place (CDP) ^f Includes Empire CDP ^g Includes Buras-Triumph CDP ^h Includes Boothville-Venice CDP Key: CT: census tract Grey highlighted value is a percentage that exceeds threshold defined in text, indicating a potential environmental justice population.											

Because the southwest bank is rural and sparsely populated, Block Group 1, Census Tract 504, where the Project is located, stretches over 10 miles north and south, encompassing several small scattered communities. The closest are the Deer Range neighborhood and the Suzie Bayou Campsites. These neighborhoods are locally referred to as “Lake Hermitage,” because of their main access road of the same name. According to the Plaquemines Parish Comprehensive Master Plan, camp communities are “residential communities built outside levee protection zones in marshland and swamp-liked [*sic*] areas with limited infrastructure, characterized by a part-time or seasonal resident population often engaging in commercial fishing or recreational fishing and hunting” (Plaquemines Parish, 2012). Although these communities began as fishing and hunting campsites, many site owners have constructed homes on permanent foundations and live there year-round. Residential structures in these communities range from 750 feet to 3,000 feet (0.6 mile) from the terminal boundary. A vegetative buffer partially screens them from the terminal site. A 26-foot-high floodwall would be erected around the perimeter, providing additional screening, but the storage tanks, stacks, and other tall features would not be shielded.

Another similar community, consisting of recreational and permanent homes, is located 2.6 miles southeast (3 miles driving distance) on Lake Hermitage Road. Occupants would drive past the terminal site on their way to and from SH 23. One other relatively close development with residential property is 2.3 miles northwest on SH 23, designated as marina/harbor complex in the Parish’s Draft Final Comprehensive Land Use Plan (Plaquemines Parish, 2012). The plan defines this use as land area “around commercial and recreational marina and harbors, including docks, with water-related commercial such as bait shops, seafood markets, small-scale seafood processing, boat services, hotels, condominiums and other residential, restaurants, outdoor recreation, water-related tourist services, and public uses.” A selection of street names in this neighborhood are Pine Lane, Cypress Lane, and Pecan Lane. Myrtle Grove, another marina/harbor complex in the area, is 3.7 miles northwest of the terminal on SH 23.

The residences closest to the pipeline workspace are 1,500 feet, or approximately 0.3 mile, away. Pipeline construction activities would last approximately one-half year for each phase, after which the surface would be immediately restored and ongoing impacts during operation would be negligible. No compressor stations would be built or augmented as part of the Project. Nearby residents with recreational vessels may encounter construction barge vessels in inland waterways, but these Project barges are not expected to impede traffic or have other significant impacts given the estimated low traffic volume (see Section 4.9.8.2 Marine Transportation).

Air emissions from terminal construction and operations must comply with NAAQS, established to protect human health and the health of flora and fauna, as well as the standards of the Louisiana Toxic Air Pollutant Program. Global has prepared an air permit application, with summary results in Section 4.11, Air Quality and Noise, and submitted the application to the LDEQ for review. The LDEQ review process will evaluate all proposed emission rates and control technologies for compliance with applicable regulations. Venture Global is also required to prepare an air quality impact analysis to demonstrate that proposed emission rates on a short-term and annual basis would not result in ambient pollutant concentrations that exceed ambient air quality standards. An air permit to construct and operate the facility will not be issued unless the Venture Global demonstrates the Project’s ability to meet all emission rates, control technology requirements, and ambient air quality standards. During operation, Venture Global would use a site-specific program to detect leaks utilizing a combination of design and

auditory/visual/olfactory leak detection methods. Any detected leak would be immediately recorded and scheduled for repair in accordance with all applicable laws.

Noise produced onsite at the terminal would remain within applicable FERC limits. Flaring would create negligible, intermittent impacts at the closest NSAs because of its low-frequency occurrence and low exit velocity. Venture Global would implement several mitigation measures, described in Section 4.11, Air Quality and Noise, e.g., liquefaction air coolers reduced to sound power level of 88 dBA per fan, heat recovery steam generators equipped with silencers to limit the sound power level to a maximum of 115 dBA during blowdown events. We have recommended that Venture Global submit a full power load noise survey no later than 60 days after commissioning, to ensure controls are sufficient to maintain a noise level below an Ldn of 55 dBA at each NSA.

Siting LNG facilities with regard to ensuring that the proposed site selection and location would not pose an unacceptable level or risk to public safety is required by DOT's regulations in 49 CFR 193, Subpart B. DOT reviews the information and criteria submitted by Plaquemines LNG to demonstrate compliance with the safety standards prescribed in 49 CFR 193, Subpart B and issues an LOD to the Commission on whether the proposed facilities would meet the DOT siting standards. The LOD will serve as one of the considerations for the Commission to deliberate in its decision to authorize, with or without conditions, or deny Venture Global's application. All safety concerns addressed in DOT's review are summarized in Section 4.12.5, Reliability and Safety. In addition, the USCG issued a Letter of Recommendation stating that the Lower Mississippi River is suitable for LNG traffic associated with the Project in accordance with the guidance in USCG's Navigation and Vessel Inspection Circular (NVIC) 01-2011, which considers safety and security mitigation measures based on Zones of Concern from maximum credible releases from accidental and intentional events as discussed in section 4.12.5. Furthermore, FERC staff evaluated the preliminary engineering design to ensure that there were sufficient layers of protection to enhance the reliability and safety of the facility to mitigate the risk of impact on the public. Based on our preliminary evaluations of the engineering design and with the incorporation of mitigation measures and oversight, we conclude that the Plaquemines LNG terminal design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

Because of the mitigation and project design features described above, we do not expect residential communities closest to the Project to experience high and adverse impacts on their human health or environment from normal construction and operation activities. Thus, we conclude that the Project would not disproportionately affect low-income or minority populations in the primary affected area.

If a rare catastrophic event occurred at the terminal that limited or restricted vehicle travel on SH 23, communities in the southern west bank that depend on access to SH 23 south of the terminal could be vulnerable. Certain residential subdivisions in Census Tract 504 access SH 23 south of the terminal, as do all other residences in Census Tracts 505, 506, and 508, which are the other tracts identified as potential environmental justice communities based on their percentages of minority and low-income residents. We find this vulnerability in the southern west bank necessitates targeted outreach, and to some extent, this has occurred. CEQ (1997) environmental justice guidelines emphasize public participation during the permitting and development of a

project. Moreover, the EPA (2011a) environmental justice guidelines recommend enhancing opportunities for residents to participate in the decision-making process.

Venture Global held two community open houses, one in Plaquemines Parish on September 15, 2015, and another in Jefferson Parish on September 16, 2015, with about 75 residents in attendance, combined. Project staff representing multiple disciplines and FERC representatives attended, and thus were available to answer questions and hear comments from the public. In addition, FERC sponsored a Project scoping meeting on October 21, 2015, in Plaquemines Parish, in accordance with NEPA guidance. Beforehand, Project representatives were available to answer questions from the public.

The DOT regulations require LNG operators to coordinate with appropriate local officials in preparation of an emergency evacuation plan for the LNG terminal. In addition, USCG requires the development of an emergency manual with certain information. Furthermore, under section 311 of the Energy Policy Act of 2005, FERC is required to review and approve an emergency response plan and associated cost sharing plan prior to final approval to begin any construction. As recommended in section 4.12.5, Venture Global would be required to work with local, state, and federal agencies to develop its emergency response plan, and this plan will address potential catastrophic events as required by DOT regulations at the terminal and other more likely emergencies that could close SH 23 and/or impact surrounding communities. The emergency response plan must be approved by FERC prior to initial site preparation, and Venture Global states that it will continue its coordination with public agencies to complete the plan.

4.10 CULTURAL RESOURCES

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

Construction and operation of the Project could have the potential to affect historic properties (i.e., cultural resources listed or eligible for listing on the NRHP). Historic properties include pre-contact or historic archaeological sites, districts, buildings, structures, and objects, as well as locations with traditional value to tribes or other groups. Historic properties generally must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet one or more of the criteria specified in 36 CFR 60.4. Based on these criteria, historic properties are those properties:

- a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
- b) that are associated with the lives of persons significant in our past; or
- c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that

represent a significant and distinguishable entity whose components may lack individual distinction; or

- d) that have yielded, or may be likely to yield, information important in pre-contact or history.

Venture Global completed a records review and cultural resources surveys of the terminal site and pipeline system proposed route in Plaquemines Parish, Louisiana. The investigations covered both archaeological and architectural resources.

4.10.1 Terminal Site

The area of potential effects (APE) for these investigations was defined as the 635-acre tract and marine facilities where construction would take place and for which direct effects were evaluated. An additional 100 acres that have been proposed for use as temporary workspace east of the terminal site also were reviewed. The marine facilities, located on the Mississippi River, also are included in the APE. However, although there is dredge for barge access, no dredging would be required for facility construction or for LNG carriers to access the berthing area.

To account for potential off-site viewshed impacts that the terminal facilities may have on aboveground historic resources, the APE also includes areas to be evaluated for indirect effects. This includes a 1.0-mile-wide buffer extending out from the terminal site boundary. No previously recorded individual historic structures were identified within the 1.0-mile-wide buffer area as part of the records review.

No new archaeological sites were identified; however, the records review identified five previously recorded archaeological sites partially or wholly within the APE. These sites are listed below.

- 16PL173: This resource is a historic twentieth-century site consisting of a concrete foundation.
- 16PL189: This archaeological site is a brick platform for a nineteenth-century steam-powered water wheel.
- 16PL191: This resource consists of the remnants of a twentieth-century agricultural bridge.
- 16PL266: This archaeological site is a historic railroad; no remains of it were identified within the terminal site.
- 16PL102: This resource contains surface and subsurface deposits, including buried intact brick features, associated with a nineteenth-century industrial sugar mill located within the Deer Range Plantation.

No cultural materials were encountered at the location of 16PL173. 16PL189 was intact, but the resource consisted of architectural remains that did not meet the NRHP criteria. It was recommended ineligible for the NRHP and that no further work was needed. 16PL191 consists of

the remaining posts from a bridge across an agricultural canal in the floodplain of the Mississippi River. The remaining materials of the bridge had deteriorated. 16PL266 is the New Orleans and Lower Coastal Railroad, which parallels the river and runs through the terminal site. Within the terminal site, all aspects of the railroad were removed, and no associated artifacts or features were identified. These sites were recommended as ineligible for the NRHP, and the investigations indicated that no further work was needed. The remaining components of these archaeological sites have the potential to be physically damaged by ground disturbance and associated activities occurring at the terminal site.

16PL102, also known as the Deer Range Mill site, is an industrial site located on the south bank of the Mississippi River on either side of the levee. It was initially recorded in 1983 as part of an inventory conducted for the National Park Service's comprehensive cultural resource management plan for the USACE, focusing on the lower Mississippi Valley. A portion of the site had been destroyed due to construction of the levee. The site was recommended for additional testing. Venture Global has committed to avoiding the resource and to protecting the site by fencing.

On June 22, 2015, prior to the initiation of fieldwork, a letter was submitted to the SHPO to introduce the Project. A draft report documenting the cultural resource investigations for the terminal site was submitted to the SHPO on December 30, 2015. In a letter dated January 7, 2016, the SHPO concurred that no historic properties would be affected by the facilities, provided 16PL102 would be avoided during construction and operation of the Project. On June 11, 2016, a site avoidance plan for 16PL102 was submitted to the SHPO for review and comment. The SHPO concurred with this plan on August 22, 2016. An additional letter was submitted to the SHPO on February 2, 2017, for the adjacent temporary workspace of about 100 acres. The SHPO responded on February 17, 2017, with its concurrence that 16PL173 is not eligible for the NRHP and that no effects on historic properties would occur at the terminal site and adjacent workspace. We agree.

The February 17, 2017, SHPO response letter indicated the need for the submittal of the final report for No. 22-5141-1 and the site form for 16PL173. The final report for the Terminal Site Addendum and updated site form for 16PL173 was provided to the SHPO on August 2, 2018. The Final Phase I Cultural Resources Survey Report for the Project has been reviewed by the SHPO and accepted on November 28, 2018.

The results of a remote sensing (sonar) survey for the marine facilities was submitted to the SHPO on March 6, 2017. A large, rectangular-shaped anomaly, approximately 200 feet long by 27 feet wide, was encountered. The anomaly has a relief of 15 feet above the surrounding river bottom and may be a sunken barge associated with recent commercial activity. The SHPO concurred with no historic properties being affected on March 28, 2017. We agree.

4.10.2 Pipeline System

For the pipeline system, the direct APE includes three components: the construction workspace for the pipelines, access roads, and appurtenant aboveground facilities; the dredged portions of the barge access routes; and the barge staging area. To account for potential off-site viewshed impacts that the pipeline system facilities may have on historic structures, the APE also includes areas to be evaluated for indirect effects. This includes a 0.5-mile-wide buffer on either

side of the mid-line of the pipelines and a 0.5-mile-wide buffer on either side of the barge access channels.

In order to determine if archaeological resources or historic structures were present within the APE, an approximately 300-foot-wide survey corridor along the pipeline route was investigated by airboat survey in open water and inundated marshland and by pedestrian and/or shovel test surveys in areas that were not inundated. In areas where additional temporary construction workspace would be required, the survey corridor was expanded.

No archaeological resources or historic structures were identified within the pipeline construction rights-of-way, additional temporary workspace, or construction footprints of the temporary and permanent access roads. Additionally, no historic structures were identified within 0.5 mile of the pipeline system or its associated workspaces. No known or previously identified sites are present.

The areas not surveyed are primarily composed of saturated areas unlikely to yield cultural artifacts. Venture Global consulted with the SHPO on January 12, 2017, regarding the proposed route changes requesting clearance to construct without conducting additional archaeological investigations. The SHPO accepted this letter report as final and stated there would be no effects on historic properties on January 27, 2017. We agree. Environmental Condition Number 23 in the draft EIS has been addressed.

4.10.3 Tribal Consultation

As part of this Project, tribal consultation was conducted by Venture Global and FERC with the following tribes:

- Alabama-Coushatta Tribe of Texas;
- Chitimacha Tribe of Louisiana;
- Choctaw Nation of Oklahoma;
- Coushatta Tribe of Louisiana;
- Jena Band of Choctaw Indians;
- Mississippi Band of Choctaw Indians;
- Seminole Nation of Oklahoma;
- Seminole Tribe of Florida; and
- Tunica-Biloxi Indians of Louisiana.

Table 4.10-1 provides a summary of the correspondence, including information sent and received by FERC, the tribes, and Venture Global.

Table 4.10-1 Correspondence with Federally Recognized Tribes		
Date	Document/Topic	Action Taken
June 22, 2015	Introductory Letter	Letter from Venture Global to tribes
July 21, 2015	Request for cultural resources survey reports	Email response from the Jena Band of Choctaw Indians to Venture Global
August 3, 2015	Response noting that the Project is located within their area of historic interest and requesting Project information	Email response from the Choctaw Nation of Oklahoma to Venture Global
September 30, 2015	Information Update	Letter from Venture Global to tribes
November 17, 2015	Request for cultural resources surveys	Email response from the Choctaw Nation of Oklahoma to Venture Global
November 18, 2015	Request for consulting party status under Section 106, a map showing the Project and all archaeological sites within 1.0 mile of the APE, a copy of all survey reports, and a copy of the EIS	Letter response from the Choctaw Nation of Oklahoma to FERC
February 16, 2016	Provision of reports	Letter response from Venture Global to the Choctaw Nation of Oklahoma and the Jena Band of Choctaw Indians
April 13, 2016	Consultation Letter	Letter from FERC to tribes
October 21, 2016	Response to Information Request	Letter response from Venture Global to the Choctaw Nation of Oklahoma and the Jena Band of Choctaw Indians
November 22, 2016	Comments noting need to notify the tribe in case of inadvertent discovery	Email response from the Choctaw Nation of Oklahoma to Venture Global
January 12, 2017	Information Update	Letter from Venture Global to tribes
January 12, 2017	Introduction Letters	Letter from Venture Global to the Seminole Nation of Oklahoma and the Seminole Tribe of Florida
February 8, 2017	Lack of presence of resources; request for list of flora; and deferring to other tribes	Response from the Seminole Nation of Oklahoma to Venture Global
February 13, 2017	Response with report addendum(Phase I Cultural Resources Report LNG Terminal Site: 100 acre land Parcel report) and a revised copy of the unanticipated discoveries plan	Response from Venture Global to the Choctaw Nation of Oklahoma and the Jena Band of Choctaw Indians
March 29, 2017	Comments to unanticipated discoveries plan and concurrence on Phase I Cultural Resources Report LNG Terminal Site: 100 acre land Parcel report	Email response from the Choctaw Nation of Oklahoma to Venture Global

Table 4.10-1 Correspondence with Federally Recognized Tribes		
Date	Document/Topic	Action Taken
April 11, 2017	Concurrence with finding of no effect and request for adherence to unanticipated discoveries procedures	Email response from the Jena Band of Choctaw Indians to Venture Global
June 22, 2017	Provision of flora list	Letter response from Venture Global to the Seminole Nation of Oklahoma
June 23, 2017	Information summarizing remote-sensing data	Email response from Venture Global to the Choctaw Nation of Oklahoma

On June 22, 2015, Venture Global provided Project introduction letters to the following tribes:

- Alabama-Coushatta Tribe of Texas;
- Chitimacha Tribe of Louisiana;
- Choctaw Nation of Oklahoma;
- Coushatta Tribe of Louisiana;
- Jena Band of Choctaw Indians;
- Mississippi Band of Choctaw Indians; and
- Tunica-Biloxi Indians of Louisiana.

Update letters and emails were provided to each of these tribes on September 30, 2015, October 22, 2015, and January 12, 2017, by Venture Global. In addition, FERC sent consultation letters to the tribes on April 13, 2016.

The Choctaw Nation of Oklahoma provided a response on August 3, 2015, noting that the Project is located within their area of historic interest and requested Project information. After receipt of the October 2015 follow-up, the tribe also responded on November 17, 2015, noting the need for a cultural resources survey. In a letter to FERC dated November 18, 2015, the Choctaw Nation of Oklahoma requested the following: consulting party status under Section 106, a map showing the Project and all archaeological sites within 1.0 mile of the APE, a copy of all survey reports, and a copy of the EIS. Venture Global provided cultural survey information to the tribe on February 16, 2016, October 21, 2016, and February 13, 2017 (see Table 4.10-1). The EIS will be made available to the tribes upon publication of the draft.

Additional information was provided to the Choctaw Nation of Oklahoma by Venture Global on October 21, 2016. The tribe provided comments on November 22, 2016. Venture Global then provided a report addendum and a revised unanticipated discoveries plan on February 13, 2017. The tribe responded on March 29, 2017, noting the need for tribal consultation if sites

are found. They concurred with the findings in the Phase I Cultural Resources Report for the terminal site's 100-acre land parcel, and they requested to be notified in the event of an unanticipated discovery. On June 23, 2017, Venture Global sent a letter report to the Nation summarizing the remote-sensing survey data.

The Jena Band of Choctaw Indians responded on July 21, 2015, requesting the cultural resources survey reports. Venture Global provided this information, consisting of the *Phase I Cultural Resource Report LNG Terminal Site, Plaquemines Parish, Louisiana* and the *Phase I Cultural Resource Report Lateral Pipelines, Plaquemines Parish, Louisiana*, on February 16, 2016. Additional information was then provided by Venture Global on October 21, 2016, with the site avoidance plan, the Unanticipated Discovery Plan, and an addendum report. Venture Global then provided a report on the 100-acre land parcel for the terminal site and a revised copy of the Unanticipated Discovery Plan on February 13, 2017. The Jena Band of Choctaw Indians, on April 11, 2017, concurred with the finding of no effect on cultural and historic properties. The tribe further requested that all inadvertent discovery procedures be followed in the event that an unanticipated discovery occurs.

On January 12, 2017, a Project introduction letter also was provided to the Seminole Nation of Oklahoma and the Seminole Tribe of Florida. On February 8, 2017, the Seminole Nation of Oklahoma responded that they were not aware of any historic resources that would be affected by the Project and requested a list of flora within the Project area. The Seminole Nation of Oklahoma deferred to another tribe and the SHPO recommendation. On June 22, 2017, Venture Global provided a list of flora for the area to the Seminole Nation of Oklahoma.

4.10.4 Unanticipated Discovery Plan

Venture Global has prepared an Unanticipated Discovery Plan to be implemented in the event that previously unreported cultural resources or human remains are encountered during construction of the Project. This plan provides for the notification of interested parties, including the SHPO, tribes, and appropriate officials. The plan was submitted to the Louisiana SHPO on January 27, 2016. Comments were received on February 8, 2016. A copy of the final plan would be kept on site during construction, and field management staff would be trained for the procedures contained within it. A letter was sent to the SHPO on February 2, 2017, providing the revised plan. Due to comments received by tribes, an update was provided to the Louisiana SHPO on June 29, 2017. FERC staff has reviewed the Unanticipated Discovery Plan and find it acceptable.

4.10.5 Compliance with the National Historic Preservation Act

Venture Global investigated the Terminal site, 300-foot corridor for the proposed pipeline route, and associated workspaces in Plaquemines Parish, Louisiana for cultural resources. The survey reports and additional documentation were submitted to interested parties for comments. The Louisiana SHPO did not disagree with the APE and stated that the Project would have no effects on historic properties.

No traditional cultural properties or properties of religious or cultural importance to Indian tribes have been identified by Venture Global, its consultants, the SHPO, or tribes. The FERC staff agrees with the SHPO, and the Project would have no effects on historic properties.

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

This section describes the air quality conditions that would directly or indirectly be affected by construction and operation of the Project. The section summarizes federal and state air quality regulations that are applicable to the Project. The section also characterizes and quantifies the existing air quality and describes potential impacts the construction and operation of Project facilities may have on air quality.

The term “air quality” refers to the relative concentrations of pollutants in the ambient air. The subsections below describe well-established air quality concepts that are applied to characterize air quality and to determine the significance of increases in air pollution. This includes metrics for specific air pollutants known as criteria pollutants, in terms of ambient air quality standards, regional designations to manage air quality known as Air Quality Control Regions (AQCR), and the on-going monitoring of ambient air pollutant concentrations under state and federal programs.

Combustion of natural gas would produce criteria air pollutants such as ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), and inhalable particulate matter ($PM_{2.5}$ and PM_{10}). $PM_{2.5}$ includes particles with an aerodynamic diameter less than or equal to 2.5 micrometers, and PM_{10} includes particles with an aerodynamic diameter less than or equal to 10 micrometers. Combustion of fossil fuels also produces volatile organic compounds (VOCs), a large group of organic chemicals that have a high vapor pressure at room temperature; and oxides of nitrogen (NO_x). VOCs react with nitrogen oxides, typically on warm sunny summer days, to form ozone. Other byproducts of combustion are greenhouse gases (GHGs) and hazardous air pollutants (HAPs). HAPs are chemicals known to cause cancer and other serious health impacts.

GHGs produced by fossil-fuel combustion are CO_2 , methane (CH_4), and nitrous oxide (N_2O). The status of GHGs as a pollutant is not related to toxicity. GHGs are non-toxic and non-hazardous at normal ambient concentrations. GHGs are gases that absorb infrared radiation in the atmosphere are the primary cause of warming of the global climate system since the 1950s. Emissions of GHGs are typically quantified, expressed and regulated in units of carbon dioxide equivalents (CO_2e), where the potential of each gas to increase heating in the atmosphere is expressed as a multiple of the heating potential of CO_2 over a specific timeframe, or its global warming potential (GWP). The 100-year GWP of CO_2 is 1, CH_4 is 25 and N_2O is 298. To obtain the CO_2e quantity, the mass of the particular GHG is multiplied by the corresponding GWP. The CO_2e value for each of the GHG compounds is summed to obtain the total CO_2e GHG emissions.

Other pollutants, not produced by combustion, are fugitive dust and fugitive emissions. Fugitive dust is a mix of $PM_{2.5}$, PM_{10} , and larger particles that become airborne by moving vehicles, earth (soil) transport, or wind erosion. Fugitive emissions, in the context of this EIS, would be fugitive emissions of methane from operational pipelines, the LNG terminal, and other aboveground facilities.

4.11.1.1 Regional Climate

Regional Climate

The Project would be located in Plaquemines Parish, Louisiana, where the climate is humid and subtropical with long, hot summers and short, mild winters. The humidity in the Project area is relatively high due to the proximity of the terminal site to the Gulf of Mexico and the Mississippi River (NOAA, 2016). Wind direction in the Project area is primarily from the south from May through December. During January and February, the prevailing winds are from the east-northeast, and in March and April the prevailing winds are from the north. Over the course of the year, mean wind speeds vary from 6 miles per hour (mph) to 10 mph, with peak gust winds ranging from 44 to 66 mph, depending on the month. The highest average wind speed of 10 mph (moderate breeze) occurs in February, March, and April. The lowest average wind speed of 6 mph (gentle breeze) occurs in July and August (National Climatic Data Center, 1997). Historical wind summaries are substantiated by analysis of wind data from the New Orleans International Airport meteorological station for 2010 through 2014. Analysis of this data reveals predominant winds from the south and south-southeast as well as significant contributions from the north. The average wind speed for the period is 3.8 meters per second (m/s) (or 8.6 mph) and calm winds (< 0.5 m/s) (or 0.2 mph) occur 98 percent of the time.

The Project area receives an annual average of 62.5 inches of rain. October is typically the driest month of the year, with a monthly mean of 3.5 inches, whereas June tends to be the wettest month, with a monthly mean of 8.1 inches. Snow events are rare, with an annual mean of 0.2 inch of snow, and are most likely to occur in February or December. Temperatures range from a monthly average of 55.3°F in January to a monthly average of 88.3°F in July and August (Southern Regional Climate Center, 2015).

4.11.1.2 Existing Air Quality

The LNG terminal and pipeline system would be located in the same general geographic area; therefore, this existing air quality discussion pertains to both parts of the Project.

Background Air Quality and Designation Status

The EPA, as required by the CAA, has established National Ambient Air Quality Standards (NAAQS) to protect public health (primary standards) and welfare (secondary standards). Primary standards are designed to protect human health, and secondary standards focus on the protection of plant and animal life, buildings, and other features in the public interest. Louisiana has adopted the federal primary and secondary NAAQS. The NAAQS reflect the relationship between pollutant concentrations and health and welfare effects. The NAAQS are codified in 40 CFR 50. The LDEQ has adopted the NAAQS.

Standards have been set for six principal pollutants that are called “criteria pollutants.” These criteria pollutants are: ground-level ozone, CO, NO₂, SO₂, PM₁₀, PM_{2.5}, and airborne lead. Ozone develops as a result of a chemical reaction between NO_x and VOCs in the presence of sunlight. Accordingly, NO_x and VOCs are often referred to as ozone precursors. PM_{2.5} may be directly emitted and can also be secondarily formed in the atmosphere as a result of SO₂ and NO_x.

emissions. SO₂ and NO_x are also referred to as PM_{2.5} precursors. See the NAAQS standards at <https://www.epa.gov/criteria-air-pollutants/naaqs-table>.

Air Quality Control Regions and Attainment Status

An air quality control region is defined under 42 U.S.C. 7407(c) as “any interstate area or major intrastate area which the Administrator of the EPA deems necessary or appropriate for the attainment and maintenance of ambient air quality standards.” Each AQCR, or portion(s) of an AQCR, is classified as either “attainment,” “nonattainment,” “unclassifiable,” or “maintenance,” with respect to the NAAQS.

Plaquemines Parish is located in the Southern Louisiana-Southeast Texas Interstate AQCR. Plaquemines Parish is designated as unclassifiable (and treated as attainment) for ozone, PM_{2.5}, and NO₂. For all other criteria pollutants, Plaquemines Parish is designated attainment.

Air Quality Monitoring and Existing Air Quality

The EPA, along with state and local agencies, created a network of ambient air quality monitoring stations that collect data on background concentrations of priority pollutants across the United States. To characterize the existing ambient air quality for the Project, available data were gathered from air quality monitoring stations that are nearest to the Project. The most recent validated data from these monitoring sites are presented in table 4.11-1, which compares the highest monitored data with the appropriate NAAQS standard for each criteria pollutant. All monitored data were below the NAAQS.

For ambient air monitoring in Louisiana, the LDEQ’s Air Quality Assessment Division has developed a statewide network of stationary monitoring stations to collect direct measurements of air pollutant concentrations. Ambient air quality concentrations from 2013 through 2015 for areas near the Project are provided in table 4.11-1.

Data from the air monitoring sites are available through the EPA’s Air Data database, which collects monitoring data nationwide. Venture Global has, in consultation with LDEQ, determined that ambient air quality at the following monitoring sites is representative of ambient air quality at the terminal site:

- Kenner station (Site ID 220511001), Jefferson Parish, as appropriate for the NO_x background concentrations;
- Thibodeaux station (Site ID 220570004), Lafourche Parish, as appropriate for the ozone background concentrations;
- Chalmette station (Site ID 220870007), St. Bernard Parish, as appropriate for the PM₁₀ background concentrations;
- Marrero station (Site ID 220512001), Jefferson Parish, as appropriate for the PM_{2.5} background concentrations;

- Meraux station (Site ID 220870004), St. Bernard Parish, as appropriate for the SO₂ background concentration; and
- Baton Rouge-Capitol station (Site ID 220330009), East Baton Rouge Parish, as appropriate for the CO background concentration, since this is the only site where information is available from EPA. Lead concentration is also measured at this station.

Table 4.11-1 Background Ambient Air Quality (2013 to 2015)						
Air Pollutant	Averaging Period	Statistic (units)	Monitor Values			Monitor Station
			2015	2014	2013	
Sulfur Dioxide (SO ₂)	1-hour	99th Percentile of daily 1-hour maximum (ppb)	16	17	24	Meraux, LA
Carbon Monoxide (CO)	1-hour	Not to be exceeded more than once per year (ppm)	2.1	5.0	2.1	Baton Rouge, LA
	8-hour		1.6	1.4	2.0	
Nitrogen Dioxide (NO ₂)	1-hour	98 th percentile (ppb)	45	30	32	Kenner, LA
	Annual	Annual mean	N/A	N/A	N/A	
Ozone (O ₃)	8-hour	Annual fourth-highest daily maximum 8-hour concentration (ppb)	64	67	65	Thibodeaux, LA
Particulate Matter (PM ₁₀)	24-hour	Not to be exceeded more than once per year on average over 3 years (µg/m ³)	75	50	52	Chalmette, LA
Particulate Matter (PM _{2.5})	24-hour	98 th percentile (µg/m ³)	21	17	18	Marrero, LA
	Annual	Annual mean (µg/m ³)	8.0	7.8	7.8	
Lead (Pb)	Rolling 3-month	Not to be exceeded (µg/m ³)	0.012	0.007	0.006	Baton Rouge, LA
Key: µg/m ³ = micrograms per cubic meter LA = Louisiana N/A = not available NAAQS = National Ambient Air Quality Standards ppb = parts per billion ppm = parts per million PM ₁₀ = particulate matter of 10 microns or less in diameter PM _{2.5} = particulate matter of 2.5 microns or less in diameter ppm = parts per million						

4.11.1.3 Regulatory Requirements for Air Quality

Federal

New Source Review/Prevention of Significant Deterioration

New Source Review (NSR) is a pre-construction permitting program to ensure that air quality is not significantly degraded when a new source of air pollution is constructed, or an existing source is modified such that air pollutant emissions increase. NSR permits are legal

documents that authorize a permittee to construct a source of emissions. Federal pre-construction review of certain large projects varies for attainment and nonattainment areas. Federal pre-construction review for major sources in nonattainment areas is referred to as “Nonattainment New Source Review,” while federal pre-construction review for sources in attainment areas is formally referred to as “PSD.” A minor NSR permit is required as a pre-construction authorization for minor sources whose emissions are below the major source thresholds. Major source emission thresholds vary depending on the air quality designation, with lower thresholds applicable in nonattainment areas. The LNG terminal would be permitted under the NSR PSD program.

If a new source or major modification of an existing source is subject to the PSD program requirements and is within 62 miles (100 kilometer) of a Class I area designated as pristine natural areas or areas of natural significance, the facility is required to notify the appropriate federal officials and assess the impacts of the project on the Class I area. The closest designated Class I area to the Project is the Breton National Wildlife Refuge, located about 95 kilometers east of the Project site; therefore, a PSD Class I analysis is required.

The LNG terminal would be a PSD major source, as the projected emissions for NO_x, CO, PM₁₀, PM_{2.5}, GHG, and total HAPs are above the major stationary thresholds as listed in 40 CFR Part 52.21(b)(1)(i)(a and b). Venture Global submitted a major source air permit application to the LDEQ for PSD review in September 2015; a PSD permit application addendum on June 23, 2017; and seven supplemental information packages between June 8, 2018, and October 15, 2018. The air permit application, addendum and supplements are still under review. The permit emissions limits for the permitted pollutants are enforceable, and Venture Global must stay under the potential to emit annual limits.

GHG emissions from sources located at the terminal site would be minimized by application of EPA-approved BACT under the PSD permitting program. Venture Global prepared a BACT analysis for the proposed gas-fired turbines and associated duct burners, simple-cycle aeroderivative gas turbines, hot oil heaters, acid gas thermal oxidizer, fugitive emissions, and flares/purges at the terminal site, which was submitted to the LDEQ and EPA for review. CO₂e emissions from the turbines, hot oil heaters, and acid-gas thermal oxidizers would be minimized by implementing the following BACT measures:

- exclusively combusting low-carbon fuel gas;
- implementing good combustion practices;
- implementing proper operations and maintenance practices; and
- properly implementing insulation for surfaces above 120°F.

Use of gaseous combustion fuels, in preference over other fossil fuels such as fuel oil or coal, results in lower GHG emissions per unit of energy output. The proposed BACT emission limit for each turbine and associated duct burners is 520,455 tpy of CO₂e emissions, based on an annual total; the proposed BACT emission limit for each smaller aeroderivative simple-cycle combustion turbine is 134,901 tpy of CO₂e emissions, based on annual total per turbine; the proposed BACT emission limit for each hot oil heater is 104,114 tpy of CO₂e emissions, based on

an annual total; and the proposed BACT emission limit for each acid-gas thermal oxidizer is 384,350 tpy of CO₂e emissions, based on an annual total (this limit includes emissions from the combustion of fuel gas and acid gas as well as emissions from the high-purity CO₂ inlet stream to the oxidizer from the acid-gas removal unit).

BACT for equipment leaks would be achieved through proper piping design, and the proposed BACT emission limit is 6,500 tpy of CO₂e emissions, based on an annual total.

BACT for the cold, warm, and LP vent flare pilot operations would be achieved through good management practices and proper flare design. The proposed BACT emissions limit for combined flare pilot operations is 3,916 tpy of CO₂e emissions, based on an annual total.

BACT for the cold, warm, and LP vent flare maintenance, startup, and shutdown and purge operations is also achieved through good management practices and proper flare design. The proposed BACT CO₂e emission limits for each flare are as follows: cold flare – 14,441 tpy; warm flare – 14,826 tpy; and LP flare – 13,980 tpy.

BACT was also evaluated for the marine loading flare for vessel gassing-up operations. The BACT selected is good management practices, proper flare design, and marine gas recovery for loading return gas with methane content of 80 percent or greater. The proposed BACT emission limit is 4,045 tpy of CO₂e, based on an annual total.

Venture Global also evaluated BACT for the proposed large essential emergency generator engines, smaller essential emergency generator engines, and firewater pump engines. The proposed BACT for these engines is good combustion practices, good operations and maintenance practices, properly implementing insulation for surfaces above 120°F, and limiting normal operations to 100 hours per year for each generator engine and 52 hours per year for each firewater pump engine. The proposed BACT emission limits are 2,411 tpy of CO₂e for the large essential emergency generator engines, 81 tpy of CO₂e for the smaller essential emergency generator engines, and 28 tpy of CO₂e for the firewater pump engines.

Venture Global provided an assessment of the feasibility of a carbon capture and storage (CCS) system to the LDEQ as part of the permit application BACT analysis for GHG. Venture Global provided information on the technical and economic feasibility of developing and using CCS for the terminal site. This technology involves employing a method to capture carbon from the exhaust stream of the combustion units and then finding a method for permanent storage (injecting the recovered CO₂ underground through various means, including enhanced oil recovery, saline aquifers, and un-minable coal seams). In the GHG BACT analysis, Venture Global indicates that there is no commercially available CCS of the scale that would be required to control CO₂ emissions from turbines, thermal oxidizers, and flares such as those typically located at an LNG terminal. In addition, no long-term CO₂ storage facilities are located near the Project as the region does not have geological formations that support sequestration. Therefore, Venture Global's application determined that due to the costs and environmental impacts associated with additional infrastructure to send the carbon to a region where it could be properly stored or used for enhanced oil recovery, CCS is not a feasible or preferable alternative. Based on the magnitude of the estimated capital and annualized costs, Venture Global demonstrated that CCS is not economically feasible. Even if feasibility could be demonstrated, Venture Global noted

that any CCS system would cause significant adverse energy and environmental impacts due to the additional water and energy needs for system operation, with the associated generation of additional GHGs and other criteria pollutants from natural gas firing in combustion units. CSS can be retrofitted in the future, should a market or other need arise.

New Source Performance Standards

NSPS, codified in 40 CFR 60, regulate emission rates and provide requirements for new or significantly modified sources. NSPS requirements include emission limits, monitoring, reporting, and record keeping. Applicable NSPS for the Project, based on the types of emission units and the expected date of installation, would potentially include, but not be limited to, the following:

- **40 CFR 60 Subpart A – General Provisions.** Subpart A contains the general requirements applicable to all emission units subject to 40 CFR 60.
- **40 CFR 60 Subpart Db – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units.** This subpart applies to the 12 hot oil heaters at the LNG terminal.
- **40 CFR Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels (including Petroleum Liquid Storage Vessels).** This subpart applies to the iso-pentane storage tanks at the LNG terminal.
- **40 CFR 60 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (CI ICE).** This subpart sets emission standards for oxides of nitrogen and nonmethane hydrocarbons, hydrocarbons, NO_x, CO, and PM. This subpart applies to the diesel engine emergency generators and to the diesel engine emergency fire pumps, since the latter would be manufactured as certified National Fire Protection Association firewater pump engines after July 1, 2006.
- **40 CFR 60 Subpart KKKK – Standards of Performance for Stationary Combustion Turbines.** Subpart KKKK regulates emissions of NO_x and SO₂. The ten turbines at the power generating facility would be subject to NSPS Subpart KKKK. The turbines would meet the less than 42 parts per million (ppm) NO_x emission limit specified in 40 CFR 60.4320(a) and 40 CFR 60 Subpart KKKK, table 1, for a new turbine with a heat input at peak load higher heating value in excess of 850 MMBtu/hour firing fuels other than natural gas. The turbines would also be subject to SO₂ emission limitations in Subpart KKKK.

National Emissions Standards for Hazardous Air Pollutants

NESHAPs codified in 40 CFR 61 and 63 regulate the emissions of HAPs from new and existing sources. Part 61, promulgated before the 1990 CAA Amendments, regulates eight hazardous substances: asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride. The 1990 CAA Amendments established a list of 189

HAPs, resulting in the promulgation of 40 CFR 63, which are also known as the Maximum Achievable Control Technology standards. Part 63 regulates HAPs from major sources of HAPs and specific source categories emitting HAPs. Some NESHAPs may apply to non-major sources (area sources) of HAPs. Major source thresholds for NESHAPs are 10 tons per year (tpy) of any single HAP or 25 tpy of total HAPs.

Applicable NESHAPs for the Project, based on the types of emission units and the expected date of installation, include the following:

- **40 CFR 63 Subpart A – General Provisions.** Subpart A contains the general requirements applicable to all emission units subject to 40 CFR 63.
- **40 CFR 63 Subpart YYYY.** The turbines must comply with the initial notification requirements of 40 CFR 63.6145.
- **40 CFR 63 Subpart ZZZZ – NESHAPs for Stationary Reciprocating Internal Combustion Engines (RICE).** Subpart ZZZZ applies to any existing, new, or reconstructed stationary RICE located at a major or area source of HAP emissions. Separate sections of the rule apply to engines rated greater than 500 horsepower and less than 500 horsepower. Engines greater than 500 horsepower used on-site will need to meet the initial notification requirement of 40 CFR 63.6645(f). For engines less than 500 horsepower used on-site, the Project would comply with NSPS Subpart IIII for these emission units. No other requirements of 40 CFR 63 Subpart ZZZZ apply.
- **40 CFR 63 Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters.** The Project must conduct a fuel specification analysis for mercury.

The proposed hot oil heaters would be new process heaters, as defined in 40 CFR 63.7575, and would be subject to requirements for new units from unit startup. These requirements include an initial notification of startup. The heaters are required to have a tune-up every 5 years and an annual compliance report must be submitted.

In addition to the above, Venture Global would follow the record-keeping requirements outlined in 40 CFR 63.7555 and 63.7560.

Title V Operating Permit

The required elements of title V operating permit programs are outlined in 40 CFR 70 and 40 CFR 71. Title V operating permits may be referred to as “part 70” or “part 71” permits, or as title V permits. A title V permit should list all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. Regulations also require that the permittee annually report the compliance status of its source with respect to permit conditions to the corresponding regulatory agency. In this case, the EPA has delegated to the LDEQ the authority to issue title V permits.

The definition of a “major source” under title V varies according to which pollutants are emitted from the source and the attainment designation of the area where the source is located. In general, a source is considered major for title V if it emits or has the potential to emit 100 tpy or more of any regulated pollutant, 10 tpy or more of any single HAP, 25 tpy or more total HAPs, or 100,000 tpy of CO_{2e} and 100 tpy GHGs on a mass basis.

Total emissions from the LNG terminal would exceed title V thresholds for PM₁₀, PM_{2.5}, NO_x, SO₂, VOC, CO and CO_{2e}. The permit application submitted to the LDEQ serves as both an NSR PSD application and a title V application.

General Conformity

The General Conformity Rule is designed to require federal agencies to ensure that federally funded or federally approved projects conform to the applicable State Implementation Plan (SIP). Section 176(c) of the CAA requires that federal actions in nonattainment areas or air quality areas subject to a maintenance plan conform to the SIP for the attainment and maintenance of the NAAQS. General Conformity regulations do not apply to the Project because the Project is located in an attainment area.

Greenhouse Gas Reporting Rule

In September 2009, the EPA issued the final Mandatory Reporting of Greenhouse Gases Rule, requiring reporting of GHG emissions from: suppliers of fossil fuels; and facilities where the aggregated maximum heat input from all combustion sources is greater than 30 MMBtu/hour and that emit greater than or equal to 25,000 metric tpy of GHGs (reported as CO_{2e}).

Venture Global would be required to report emissions in accordance with the reporting rule as emissions are expected to be greater than 25,000 metric tons per year.

Applicable Louisiana Air Quality Requirements

The LDEQ is the lead air permitting authority for the Project. The LDEQ’s air quality regulations are codified in LAC 33:III.1-59. The regulations incorporate the federal program requirements listed in 40 CFR 50-99 and establish permit review procedures for all facilities that can emit pollutants to the ambient air. New facilities are required to obtain an air quality permit prior to initiating construction. LAC 33:III.1-59, set forth the air quality regulations for emission sources in Louisiana. In addition, LAC 33:III.1 delegates authority to the LDEQ to maintain air quality resources in Louisiana and enforce LDEQ air quality regulations. The following regulations may be applicable to the Project:

- Chapter 2 – Rules and Regulations for the Fee System of the Air Quality Control Program;
- Chapter 5 – Permit Procedures;
- Chapter 9 – General Regulations on Control of Emissions and Emission Standards;
- Chapter 11 – Control of Air Pollution from Smoke;

- Chapter 13 – Emission Standards for Particulate Matter;
- Chapter 15 – Emission Standards for Sulfur Dioxide;
- Chapter 21 – Control of Emission of Organic Compounds;
- Chapter 51 – Comprehensive Toxic Air Pollutant Emission Control Program;
- Chapter 56 – Prevention of Air Pollution Emergency Episodes; and
- Chapter 59 – Chemical Accident Prevention and Minimization of Consequences.

4.11.1.4 Construction Air Emissions, Impacts and Mitigation

Venture Global anticipates it would commence a two-phased construction approach for the proposed liquefaction facility in 2019. Phase I is anticipated to last approximately 35 months, with service of the first liquefaction train initiated in 2022. Construction of Phase II would commence approximately 12 months after the construction of Phase I begins and would also take approximately 35 months to complete. The Southwest Lateral TGP pipeline would be installed during the Phase I construction process, beginning in 2020, while the Southwest Lateral TETCO pipeline would be constructed concurrently with Phase II facilities. The Project is anticipated to be fully complete and operational by 2023.

Liquefaction Terminal Construction

Construction of the terminal site and pipelines would result in short-term increases in emissions of air pollutants due to the use of equipment powered by diesel fuel or gasoline engines and the generation of fugitive dust due to the disturbance of soil and other dust-generating activities. The following construction activities would generate emissions:

- terminal site and pipeline route preparation (clearing, grading, trenching foundation preparation, etc.);
- construction of a material unloading facility, a bulk carrier mooring facility, and a barge mooring facility;
- installation of terminal site equipment;
- installation of the pipeline and associated interconnections, meter stations, etc.;
- operation of off-road equipment, vehicles, and trucks during construction;
- operation of a portable concrete batch plant;
- operation of on-road material delivery trucks;
- operation of marine vessels such as tug boat/barges to deliver bulk material; and

- construction workers' commuting vehicles.

The construction phase of the Project also includes construction of three marine facilities to receive materials to be used to construct the LNG terminal and pipeline system. Construction emissions are not subject to air quality permitting but may be subject to certain Louisiana regulations regarding prevention of general nuisance odors and dust. Construction equipment fuel must be compliant with federal regulations for diesel and gasoline fuel.

Estimated construction emissions are shown in table 4.11-2. Although construction-related emissions would cease after construction is completed, the quantity of pollutants emitted each year for over 4 years would be substantial. The majority of the construction emissions would be produced by off-road heavy equipment such as bulldozers, backhoes, trucks, etc., but some emissions would also be produced by on-road vehicles such as delivery trucks and construction worker commuting vehicles. The quantity of emissions from construction equipment was determined based on the duration of use, type of construction activity, and number and type of vehicles and engine-powered equipment in use at any point in time. Earth-moving equipment and other mobile sources may be powered by diesel or gasoline engines, which are sources of combustion-related emissions that include CO, NO_x, PM₁₀, PM_{2.5}, SO₂, VOCs, GHGs, and HAPs.

Table 4.11-2 Construction Emissions (tons per year)								
Construction Activity	NO_x	CO	VOC	PM₁₀	PM_{2.5}	SO₂	HAPs	CO₂e
Year 1								
Terminal^a								
Off-road equipment	679.2	198.5	52.0	31.6	30.6	0.6	6.8	99,161
On-road vehicles	107.3	937.6	19.5	2.4	2.2	0.8	5.3	120,576
Marine vessels	7.5	4.5	0.4	0.4	0.4	0.0	Na	571
Construction activity fugitive dust ^b	N/A	N/A	N/A	17.5	2.6	N/A	N/A	N/A
Concrete batch plants	0.6	5.2	0.3	0.8	0.8	0.3	0.03	1,022
Total year 1	794.6	1,145.8	72.2	52.7	36.6	1.7	12.1	221,330
Year 2								
Terminal								
Off-road equipment	826.5	228.4	61.3	36.0	34.9	0.7	8.1	119,001
On-road vehicles	128.2	1,120.1	23.4	2.9	2.6	1.0	6.4	144,046
Marine vessels	8.0	4.9	0.4	0.4	0.4	0.0	Na	611
Construction activity fugitive dust	N/A	N/A	N/A	20.9	3.1	N/A	N/A	N/A
Concrete batch plants	1.4	12.4	0.7	1.6	1.5	0.8	0.1	2,452
Terminal subtotal	964.1	1,365.8	85.8	61.8	42.5	2.5	14.6	266,110
Pipeline (Southwest Lateral TGP Pipeline)^c								
Off-road equipment	17.2	45.7	3.1	1.2	1.2	0.0	0.4	3,493
On-road vehicles	11.4	90.5	1.9	0.3	0.2	0.1	0.5	11,909
Marine vessels	13.6	6.9	0.7	1.0	1.0	0.0	Na	968

Table 4.11-2 Construction Emissions (tons per year)								
Construction Activity	NO_x	CO	VOC	PM₁₀	PM_{2.5}	SO₂	HAPs	CO_{2e}
Construction activity fugitive dust	N/A	N/A	N/A	16.8	2.2	N/A	N/A	N/A
Roadway fugitive dust	N/A	N/A	N/A	0.2	0.0	N/A	N/A	N/A
Pipeline subtotal	42.2	143.1	5.7	19.5	4.6	0.1	0.9	16,370
Total year 2	1,006.3	1,508.9	91.5	81.3	47.1	2.6	15.5	282,480
Year 3								
Terminal								
Off-road equipment	1,538.4	430.1	114.5	67.6	65.6	1.3	15.1	222,662
On-road vehicles	128.1	1,123.4	23.4	2.9	2.6	1.0	6.4	144,344
Marine vessels	11.1	6.3	0.6	0.7	0.6	0.0	Na	823
Construction activity fugitive dust	N/A	N/A	N/A	20.9	3.2	N/A	N/A	N/A
Concrete batch plants	0.8	7.3	0.4	0.8	0.7	0.5	0.0	1,430
Total year 3	1,678.4	1,567.1	138.9	92.9	72.7	2.8	21.5	369,259
Year 4								
Terminal								
Off-road equipment	865.4	239.8	64.2	37.7	36.5	0.8	8.4	126,268
On-road vehicles	128.6	1,123.7	23.4	2.9	2.6	1.0	6.4	144,507
Marine vessels	1.8	1.2	0.1	0.1	0.1	0.0	Na	142
Construction activity fugitive dust	N/A	N/A	N/A	21.0	3.2	N/A	N/A	N/A
Terminal subtotal	995.8	1,364.7	87.7	61.7	42.4	1.8	14.8	270,917
Pipeline (Southwest Lateral TETCO Pipeline)^c								
Off-road equipment	6.7	21.7	1.4	0.5	0.5	0.0	0.2	1,529
On-road vehicles	6.8	59.8	1.2	0.2	0.1	0.1	0.3	7,692
Marine vessels	7.9	4.0	0.4	0.6	0.6	0.0	Na	563
Construction activity fugitive dust	N/A	N/A	N/A	6.0	0.6	N/A	N/A	N/A
Pipeline subtotal	21.4	85.5	3.0	7.3	1.8	0.1	0.5	9,784
Total year 4	1,017.2	1,450.2	90.7	69.0	44.2	1.9	15.3	280,701
Year 5								
Terminal								
Off-road equipment	855.5	230.6	62.2	35.9	34.8	0.7	8.2	122,997
On-road vehicles	124.3	1,118.2	23.1	2.7	2.4	1.0	6.3	142,817
Marine vessels	4.1	2.1	0.2	0.3	0.3	0.0	Na	292
Construction activity fugitive dust	N/A	N/A	N/A	20.9	3.1	N/A	N/A	N/A
Total year 5	983.9	1,350.9	85.5	59.8	40.6	1.7	14.5	266,106
Year 6								
Terminal								
Off-road equipment	69.2	21.4	5.2	3.0	2.9	0.1	0.7	12,078

Table 4.11-2 Construction Emissions (tons per year)								
Construction Activity	NO_x	CO	VOC	PM₁₀	PM_{2.5}	SO₂	HAPs	CO_{2e}
On-road vehicles	10.3	92.9	1.9	0.2	0.2	0.1	0.5	11,860
Construction activity fugitive dust	N/A	N/A	N/A	1.7	0.3	N/A	N/A	N/A
Total year 6	79.5	114.3	7.1	4.9	3.4	0.2	1.2	23,938
a Includes construction of the three marine terminals. b Includes handling of soil stabilization materials. c Includes construction emissions from meter and regulator station construction. Key: CO = carbon monoxide CO _{2e} = carbon dioxide equivalent HAPs = hazardous air pollutants N/A = not applicable na = not available NO _x = nitrogen oxides PM ₁₀ = particulate matter equal to or less than 10 micrometers in aerodynamic diameter PM _{2.5} = particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter SO ₂ = sulfur dioxide VOC = volatile organic compounds								

Fugitive dust emissions are produced by off-road equipment travel on exposed soils, working of soils (grading, trenching, earth moving, etc.) by off-road equipment, transport and handling of bulk materials from dumping, unloading via conveyors, and temporary storage piles. Fugitive dust may also be produced by native soil improvement and stabilization activities. This activity would be required on approximately 520 acres near SH 23—across the eastern workspace—and on the three access roads leading to the temporary marine delivery facilities. Soil improvement and stabilization would be undertaken in situ across all these areas by mixing one or more commonly used stabilizers (e.g., crushed stone, sand, portland cement, and hydrated lime) into the native soil.

Marine vessels consisting of bulk carriers and barges pushed by tug boats would deliver bulk material (fill, soil stabilization materials, etc.), equipment, and other supplies needed for construction.

Pipeline Construction Emissions

As shown in table 4.11-2, pipeline construction emissions for Phase I are expected to occur in year 2 of Project construction, and pipeline construction emissions for Phase II in year 4 of construction. Pipeline site preparation and construction activities would generate fugitive dust from clearing, trenching, backfilling, grading, and traffic on paved and unpaved areas, as well as fuel combustion emissions from the construction equipment. The internal combustion engines powering most of the pipeline construction equipment and vehicles would burn ultra-low-sulfur diesel fuel, and the remaining vehicles would burn gasoline. Equipment used for the pipeline construction activities would include various earthmoving equipment (bulldozers, backhoes, trenchers, graders, and compactors), cranes, forklifts, compressors, pumps, trenchers, stringing trucks, welding rigs, generators, and miscellaneous trucks.

Emissions from pipeline construction equipment are produced in the area of active pipeline construction. These emission sources move as construction proceeds along the pipeline right-of-way and therefore are present only for a short time near any location along the pipeline route.

Mitigation - Construction Emissions

Construction equipment would be operated on an as-needed basis, depending on the construction task. Emissions would be minimized by maintaining the equipment in accordance with the manufacturer's recommendations, minimizing idling time of engines whenever feasible, and using fuels compliant with current regulations.

Fugitive dust emissions during construction would be controlled in accordance with LAC 33:III.13 and with a fugitive dust control plan prepared by Venture Global. The fugitive dust control plan addresses dust emissions and control procedures for the following categories of activities:

- general guidelines for all areas and activities for controlling dust during high winds, applying control measures around the clock as needed, locating temporary facilities to avoid dust impacts on public roads, monitoring dust control activities to determine adequacy, and revising the plan as needed;
- staging areas;
- stockpiles;
- earthmoving operations;
- on-site bulk material handling;
- off-site bulk material handling;
- trackout prevention and cleaning;
- enclosed work areas;
- paved haul roads and public roads;
- unpaved parking lots; and
- crushers and grinder mills.

In general, the control measures specified for each of these activities consist of limiting vehicle speed, applying and maintaining dust suppressant (water, etc.), designing storage piles to minimize wind-blown dust generation, limiting the height of stockpiles and the drop distance of material, preventing spillage and cleaning up spilled material as soon as possible, covering loaded haul trucks and limiting freeboard, and preventing track out.

Conclusion

Project construction would produce substantial emissions over a multi-year period. Venture Global would fuel, operate, and maintain construction equipment and other vehicles used during construction in compliance with current federal fuel requirements and with manufacturers' recommendations. Venture Global would also implement a fugitive dust control plan to reduce production of fugitive dust. Nevertheless, construction would produce quantities of criteria pollutant emissions over a multi-year period that would result in elevated levels of pollutants near the Project area and potential intermittent exceedances of certain NAAQS. However, due to the length of time, and dynamic intermittent nature of construction, we do not expect that these construction emission impacts to result in significant local or regional impacts on air quality.

4.11.1.5 Operational Air Emissions, Impacts and Mitigation

The proposed facilities are described in detail in section 2.0. Relevant portions of the Project description pertaining to potential operational air emission sources at the LNG terminal include the following:

- gas gate station where the gas stream would be split into two streams, one for process feed to the liquefaction plant and the other for fuel gas supply³ to the electric power generation facilities;
- feed gas pretreatment to remove CO₂, H₂S, and water using an acid gas removal unit, H₂S removal unit and a dehydration unit. Emissions would occur from four thermal oxidizers that would be used to treat the CO₂-rich acid gas stream;
- six hot oil heaters serving various heat needs throughout the LNG terminal;
- flares consisting of three separate flare structures: a warm/cold flare structure containing two separate flare headers, a low pressure vent flare structure for low velocity marine loading flaring, and a marine vapor control structure for LNG carrier gas up/cool down operations;
- combined cycle gas turbine (CCGT) driven power plant to be constructed in two equal phases, ultimately reaching a generating capacity of 1,420 megawatts (MW) in combined cycle mode. This facility would provide plant power and power to the electric drive refrigerant compressors. Each phase would consist of five CCGTs with initial operation in each phase consisting of two of the gas turbines operating in simple cycle mode. When in combined cycle mode, duct burners combusting natural gas would produce emissions in addition to the gas turbines. In addition, two simple cycle aeroderivative combustion turbines would be used during facility start up events and to provide supplemental power as needed;
- 14 standby diesel engine electric power generator sets;

³ Natural gas feed for power generation would be supplemented with boil-off gas and other fuel gas streams generated in the liquefaction plant.

- two diesel-engine-driven firewater pumps; and
- equipment and piping fugitive emissions and storage tank emissions.

The LNG terminal would utilize electric-motor-driven compressors to boost incoming gas pressure and electric motor refrigeration compressors. No air pollutant emissions are directly associated with this equipment.

The pipeline system would not require installation of compressors for natural gas transport. Minor quantities of emissions would occur from pig launchers and receivers, meter stations, block valves, and fugitive emissions from pipeline components.

The Project would be operated in two modes: interim and final. The interim mode would consist of partial operation of the full capacity of the power generation facility and liquefaction plant; as construction of the power plant and liquefaction blocks is completed, they would be brought into operation. During the interim mode, operation and construction emissions would occur simultaneously. The final operating mode would consist of full facility operation (Phases I and II) after Phase II construction is completed.

During the interim operating mode, in each phase, up to two of the heavy-duty frame combustion turbines would be operated in simple-cycle mode for up to 2 years. In addition, one simple-cycle aeroderivative combustion turbine would be installed and operated. In the first 2 years during construction, a concrete batch plant would be operated. The batch plant would produce emissions from diesel engine-powered electrical generators and fugitive particulate from cement bin vents and other material-handling operations.

Operation of the Project in final operating mode would result in long-term air emissions from the following stationary and mobile sources.

Terminal Site (Phases I and II combined)

Power Plant Facility:

Two power islands with a total generating capacity of 1,420 MW. Each island would consist of:

- five (80 MW each) combined-cycle heavy-duty frame combustion turbines with low NO_x combustion design;
- two aeroderivative combustion simple-cycle turbine (30 MW each) for black start events and to provide supplemental power when needed, equipped with NO_x reduction measures consisting of dry low-NO_x combustors and selective catalytic reduction (SCR);
- ten natural-gas-duct fired heat recovery steam generators (HRSGs) with low NO_x burner design;
- SCR utilized on the combined combustion turbine and duct burner system; and

- fugitive emissions from pipe flanges, valves, and other components.

Liquefaction Facility:

- 18 liquefaction blocks;
- four 200,000 m³ LNG storage tanks;
- six gas pretreatment systems, each containing equipment for hydrogen sulfide removal, acid gas removal with an amine unit to remove CO₂, and a dehydration unit;
- four acid gas thermal oxidizers;
- fourteen diesel-fired engines driving emergency electrical generators;
- six natural-gas-fired hot oil heaters;
- four total flares consisting of a cold flare, a warm flare, a low-pressure flare, and a marine loading flare;
- two diesel-engine-driven firewater pumps;
- two diesel fuel storage tanks (66,577 gallons each) for the power island emergency generators. Other generators would utilize day tanks for diesel storage;
- refrigerant storage tanks, solvent surge tanks, and amine flash drums; and
- fugitive emissions from piping components;

Pipeline

- pig launcher/receivers;
- small diesel-engine-driven emergency generator;
- meter stations;
- block valves; and
- fugitive emissions from piping components such as flanges and smaller valves.

Marine Vessels

- LNG carriers maneuvering in the safety zone and at berth (hoteling emissions);
- escort tug boats; and
- security vessels.

Emissions Common to All Facilities

- vehicle travel emissions from fuel combustion and fugitive dust generation.

Interim Operating Period Emissions

As described more fully above, Venture Global proposes to develop the facility in two phases over a 6-year period, which includes construction and interim operating scenarios. In year 1, only construction is expected to occur. During years 2 through 6 of construction, heavy-duty frame turbines in simple-cycle mode and liquefaction blocks would be commissioned and brought online as they are completed. Thus, there would be concurrent construction and operational emissions during this period. The interim period construction and operational emissions are shown in table 4.11-3.

Table 4.11-3 Combined Construction and Operation Emissions Years 1 through 6									
Year	Facility Scenario	NO_x	CO	VOC	SO₂	PM₁₀	PM_{2.5}	Total HAPs	CO₂e
1	Const Phase I	794.6	1,145.8	72.2	1.7	52.7	36.5	12.2	221,330
2	Const Phase I	1,006.1	1,508.9	91.4	2.6	81.4	47.1	15.4	282,480
	Operating Scenario 1	527.3	961.2	48.6	49.2	94.0	93.7	7.8	2,444,841
	Total	1,533.4	2,470.1	140.0	51.8	175.4	140.8	23.2	2,948,651
3	Const Phase I	1,678.4	1,567.1	138.9	2.8	92.9	72.7	21.5	369,260
	Operating Scenario 1	527.3	961.2	48.6	49.2	94.0	93.7	7.8	2,444,841
	Total	2,205.7	2,528.3	187.5	52.0	186.9	166.4	29.3	2,814,101
4	Const Phase II	1,017.2	1,450.2	90.8	1.8	68.8	44.2	15.3	280,701
	Operating Scenario 2	462.1	739.9	71.5	57.5	187.1	187.1	15.3	4,093,901
	Total	1,479.3	2,190.1	162.3	59.3	255.9	231.3	30.6	4,374,602
5	Const Phase II	984.0	1,350.9	85.5	1.7	59.8	40.6	14.5	266,105
	Operating Scenario 3	966.0	1,590.0	110.3	105.6	276.1	276.1	22.2	6,492,951
	Total	1,950.0	2,940.9	195.8	107.3	335.9	316.7	36.7	6,759,056
6	Const Phase II	79.6	114.3	7.1	0.2	5.0	3.4	1.2	23,938
	Operating Scenario 3	966.0	1,590.0	110.3	105.6	276.1	276.1	22.2	6,492,951
	Total	1,045.6	1,704.3	117.4	105.8	281.1	279.5	23.4	6,516,889
7	Operating Scenario 4	902.3	1,381.0	133.9	114.7	371.8	371.8	29.9	8,144,463
Scenario 1: Phase I turbine interim operating mode plus concrete batch plant operations Scenario 2: Phase I turbine final operating mode Scenario 3: Phase I turbine final operating mode plus Phase II turbine interim operating model Scenario 4: Phases I and II turbine final operating mode (full facility operational). Key: CO = carbon monoxide									

Table 4.11-3 Combined Construction and Operation Emissions Years 1 through 6									
Year	Facility Scenario	NO _x	CO	VOC	SO ₂	PM ₁₀	PM _{2.5}	Total HAPs	CO _{2e}
CO _{2e} = carbon dioxide equivalent HAPs = hazardous air pollutants NO _x = nitrogen oxides PM ₁₀ = particulate matter equal to or less than 10 micrometers in aerodynamic diameter PM _{2.5} = particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter SO ₂ = sulfur dioxide VOC = volatile organic compounds									

Final Operational Emissions

Final (full facility) operational emissions are presented in table 4.11-4. Stationary combustion sources primarily include emergency use engines, gas turbines, hot oil heaters, thermal oxidizers, and flares. Mobile source emissions would be produced by LNG carriers and tug/escort vessels, worker commuting, and routine deliveries to the terminal by truck. Non-combustion sources include storage tanks, LNG loading and transfer operations, and fugitive emissions from pipeline and equipment leaks. Non-combustion emissions would occur from the LNG terminal facilities, pipeline, and meter stations, as well as from up to six pipeline pigging events per year.

Table 4.11-4 Final Operational Emissions ^a									
Tons Per Year									
Source	NO _x	CO	VOC	PM ₁₀	PM _{2.5}	SO ₂	HAPs	Louisiana TAPs	CO _{2e}
Terminal	902	1,381	134	372	372	115	30	354	8,144,463
Pipeline ^b	0.02	0.04	0.01	0.00	0.00	0.00	0.00		3.1
Fugitive ^c			2.3				0.1		6,525
Marine Vessels	140	72	22	7.4	6.7	12.6			31,942
Mobile Sources ^d	15.3	147.6	3.0	0.3	0.3	0.1	0.8		18,541
Total	1,057	1,601	161.3	379.7	379.0	127.7	30.9	354	8,201,474
a Emissions shown for the terminal represent Scenario 4, final operating mode of Phases I and II. b Emissions shown for the pipeline include emissions for the TGP and Tetco laterals and associated meter and regulator stations. c Fugitive emissions include the terminal, TGP lateral, Tetco later, and associated meter and regulator stations combined. d Mobile source emissions represent tail pipe exhaust emissions. Key: CO = carbon monoxide CO _{2e} = carbon dioxide equivalent HAPs = hazardous air pollutants NO _x = nitrogen oxides PM ₁₀ = particulate matter equal to or less than 10 micrometers in aerodynamic diameter PM _{2.5} = particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter SO ₂ = sulfur dioxide TAPs = toxic air pollutants per Louisiana Code 33:III Chapter 51 VOC = volatile organic compounds									

Mitigation Measures

Venture Global has prepared an air permit application and submitted the application to the LDEQ for review. The application review process will evaluate all proposed emission rates and control technologies for compliance with applicable regulations. Venture Global is also required to prepare an air quality impact analysis to demonstrate that proposed emission rates on a short-term and annual basis would not result in ambient pollutant concentrations that exceed ambient air quality standards. An air permit to construct and operate the facility will not be issued unless the applicant demonstrates the Project's ability to meet all emission rates, control technology requirements, and ambient air quality standards.

Venture Global has prepared a Best Available Control Technology (BACT) analysis for the stationary emission sources at the terminal. A BACT analysis is used to identify the maximum degree of emission reduction for air pollutants, taking into account technical feasibility, energy, other environmental, and economic impacts. A summary of the Project's proposed BACT as submitted in the air permit application to LDEQ is provided in appendix F.

In general, most of the Project's combustion sources other than emergency equipment would utilize natural gas fuel. Use of natural gas as fuel results in lower emissions of particulate matter and SO₂ from combustion sources. Additional BACT measures to be used on all combustion devices include good combustion practices, proper operation and maintenance, and proper equipment design. Diesel-fueled emergency equipment would use ultra-low sulfur diesel with a fuel sulfur content equal to or less than 15 ppm in compliance with regulatory requirements.

In the power generation portion of the terminal during the interim operating mode, the simple-cycle, heavy-duty frame combustion turbines would use dry low NO_x combustor design; in the final operating mode, the combined-cycle, heavy-duty frame combustion turbines and duct burners would use low NO_x burner designs, and the combined exhaust would be treated by SCR to reduce NO_x emissions. The two aeroderivative turbines would utilize dry low NO_x and SCR to reduce emissions of oxides of nitrogen. However, normal use of SCR results in some of the ammonia used in the SCR process to pass unreacted through the SCR and emitted to the atmosphere. According to the BACT analysis, catalytic oxidation would be used on the combined-cycle gas turbines/duct burner exhaust to reduce emissions of carbon monoxide and volatile organic compounds.

Thermal oxidizers would be used to treat the sour gas from the acid gas removal units to convert hydrogen sulfide to SO₂. These units would use low NO_x burners to lower emissions of NO_x.

In order to identify leaking equipment such as valves, flanges, and seals, Venture Global would use a site-specific program utilizing a combination of design and auditory/visual/olfactory leak detection methods. Auditory/visual/olfactory leak detection would involve control system monitoring and routine visual inspections and observations (such as fluids dripping, spraying, misting, or clouding from or around components), sound (such as hissing), and smell. Leaks detected in this manner would be immediately recorded and scheduled for repair in accordance with all applicable laws.

4.11.1.6 Air Quality Impact Analysis

Breton NWR Class I Area Air Quality Modeling

Venture Global followed the Federal Land Managers' Air Quality Related Values Work Group's Phase I Report – Revised (NPS, 2010) to determine the Project's air quality impacts on Class I areas to support the air permit application for the Project.

If a new source or major modification of an existing source is subject to PSD review and is (1) within 62 miles (100 kilometers) of a Class I area; or (2) farther than 31 miles (50 kilometers) from a Class I area, and the emission to distance (Q/D) ratio is greater than 10, the facility is required to notify the appropriate federal officials and assess the impacts of the proposed Project on the Class I area. The emission value used in the Q/D ratio prescribed by the NPS 2010 guidance is the sum of emissions of SO₂, PM₁₀, NO_x, and sulfuric acid mist in tons, and where D is distance in kilometers between the source and the Class I area. Venture Global's emission estimates included SO₂, PM₁₀, and NO_x for the Q/D analysis.

The Breton National Wildlife Refuge (NWR) Class I area is approximately 95 kilometers from the Project; the Q/D value is 19.6; therefore, a Class I air quality impact analysis is required. The next closest Class I area is the Sipsey Wilderness Area in Alabama, which is 567 kilometers to the northeast of the Project site. The Q/D value for the Sipsey Wilderness area is 3.3, which is less than the threshold value of 10; therefore, a refined Class I area air quality analysis is not required for the Sipsey Wilderness area.

The Federal Land Manager (FLM) for the Breton NWR is the FWS. Class I air quality modeling was performed to evaluate compliance with the Class I area Significant Impact Levels (SILs) and Class I area Air Quality Related Values (AQRVs) for Breton NWR. The AQRVs evaluated for Breton NWR are nitrogen and sulfur deposition and visibility degradation. The FLM reviewed the procedures and protocol used to conduct the modeling, reviewed the modeling results, and concluded that, based on the report reviewed, the Project would not have significant additional impact on air quality-related values at the Breton NWR and did not request additional analyses.

Models Used

The AERMOD model and the CALPUFF model were used for the analysis. AERMOD was used to evaluate impacts compared to the Class I area PSD SIL; CALPUFF was used to evaluate AQRVs (deposition and visibility).

AERMOD is EPA's preferred regulatory air quality dispersion model for source to receptor distance of up to 50 kilometers. Five years (2011 through 2015) of hourly meteorological data from New Orleans and upper air data from Slidell, Louisiana, were used. Receptor locations (points where the model calculated concentration values) were located along an arc 50 kilometers from the Project in the direction of the Breton NWR. This analysis was used to determine whether further air quality standard (NAAQS) analyses and PSD air quality concentration increment analysis with a long-range transport model at receptors at the Class I area boundary were necessary.

CALPUFF Version 5.8.5, the current model version approved by the EPA, is a long-range (beyond 50 kilometers) air pollutant transport, deposition, and chemical transformation model. CALPUFF uses a sophisticated meteorological data set that consists of a gridded network of meteorological data points spaced 4 kilometers apart over a regional area of the southeast United States. The meteorological data set was obtained from previous modeling studies conducted in the region and covered a 3-year period from 2001 to 2003. Receptor locations for the Breton NWR were obtained from the National Park Service Air Resource Division.

Emission Rates

Venture Global performed the Class I area modeling using the stationary source emission rates and source parameters used in the Class II area modeling study. The following separate emission scenarios, reflecting the phased development of the Project and their corresponding emission rates, were modeled:

- interim operating emission scenario 1, consisting of the Phase I turbine interim operating mode and Phase I concrete batch plant operations;
- interim operating emission scenario 3, consisting of full operation of Phase I and Phase II turbine interim operating mode; and
- final operating scenario 4, consisting of full operation of the Project.

For the Class I area SIL analysis using AERMOD, maximum hourly emission rates were input to the model for the 1-hour, 3-hour, and 24-hour averaging periods. Annual average emission rates were used for the annual SIL analysis.

Mobile source emissions were not included in any of the scenario analyses. Also, concurrent construction emissions occurring during interim emission scenario 1 and interim emission scenario 3 were not included in the modeling. These mobile source emissions and construction emissions are not required to be included in Class I modeling for air permitting purposes. However, they can be considered for NEPA evaluation purposes.

Significant Impact Level (SIL) Modeling Results

Table 4.11-5 summarizes the Class I SIL modeling results. All modeled concentrations at a 50-kilometer distance from the Project in the direction of Breton NWR were found to be less than the SIL value. Based on these results, no further analysis for Class I area increments is required.

However, scenario 1 and scenario 3 results do not include emissions associated with construction, and none of the scenarios include emissions from mobile sources associated with the Project. These emissions (primarily construction emissions) add significantly to the emission rate from the Project during the 5 years of concurrent construction and operation. Addition of these emissions to the model input would increase the maximum modeled results to values that may approach the SIL.

Table 4.11-5 Class I Area SIL Model Results			
Pollutant	Averaging Period	Maximum Result over Five Years ($\mu\text{g}/\text{m}^3$)	SIL ($\mu\text{g}/\text{m}^3$)
Scenario 1			
NO ₂	Annual	0.01	0.1
PM ₁₀	24-hour	0.08	0.3
	Annual	<0.005	0.2
PM _{2.5}	24-hour	0.08	0.27
	Annual	<0.005	0.05
SO ₂	3-hour	0.42	1.0
	24-hour	0.08	0.2
	Annual	<0.005	0.1
Scenario 3			
NO ₂	Annual	0.02	0.1
PM ₁₀	24-hour	0.16	0.3
	Annual	0.01	0.2
PM _{2.5}	24-hour	0.16	0.27
	Annual	0.01	0.05
SO ₂	3-hour	0.83	1.0
	24-hour	0.16	0.2
	Annual	<0.005	0.1
Scenario 4			
NO ₂	Annual	0.02	0.1
PM ₁₀	24-hour	0.23	0.3
	Annual	0.01	0.2
PM _{2.5}	24-hour	0.23	0.27
	Annual	0.01	0.05
SO ₂	3-hour	0.85	1.0
	24-hour	0.16	0.2
	Annual	<0.005	0.1
Key: $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter NO ₂ = nitrogen dioxide PM ₁₀ = particulate matter equal to or less than 10 micrometers in aerodynamic diameter PM _{2.5} = particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter SIL = Significant Impact Level SO ₂ = sulfur dioxide			

Deposition Model Results

Deposition analyses for sulfur and nitrogen in the Breton NWR were performed using the CALPUFF model. Deposition results were compared to deposition analysis thresholds (DATs) established by the FLM's guidance report for Nitrogen and Sulfur Deposition Analyses. The DAT values for eastern U.S. Class I areas are 0.01 kilograms per hectare per year for sulfates and nitrates.

The sulfate deposition analysis included wet and dry fluxes of SO₂ and sulfate to surface receptors to determine total sulfur loading at receptor locations in the Breton NWR. The nitrate deposition analysis included wet and dry fluxes of nitrates and nitric acid and dry flux of oxides of nitrogen to determine total nitrogen loading at the receptor location in the Breton NWR. Results of the modeling are shown in table 4.11-6. All results are below the DAT values for eastern U.S. Class I areas; therefore, Project emissions as modeled are not expected to affect sulfur and nitrogen deposition at the Breton NWR. However, scenario 1 and scenario 3 results do not include emissions associated with construction, and none of the scenarios include emissions from mobile sources associated with the Project. Although these emissions add significantly to the emission rate from the Project during construction, addition of these emissions to the model input is not likely to increase deposition rates that would exceed the DAT values shown in table 4.11-6.

Table 4.11-6 Sulfur and Nitrogen Deposition Modeling Results					
Meteorological Data Year	Deposition Species	Scenario 1 (kg/ha/yr)	Scenario 3 (kg/ha/yr)	Scenario 4 (kg/ha/yr)	Deposition Analysis Threshold (kg/ha/yr)
2001	Nitrates	0.0011	0.0020	0.0020	0.01
	Sulfates	0.0012	0.0024	0.0025	0.01
2002	Nitrates	0.0009	0.0016	0.0016	0.01
	Sulfates	0.0008	0.0017	0.0018	0.01
2003	Nitrates	0.0011	0.0020	0.0019	0.01
	Sulfates	0.0011	0.0023	0.0024	0.01
Key: kg/ha/yr = kilograms per hectare per year					

Visibility Analysis Results

Visibility at the Breton NWR could be affected by a plume from the Project or the Project's contribution to regional haze. Typically, the direct effect of a plume on a Class I area causes a color or contrast difference with the background sky or terrain such that the plume is visible and detracts from viewing the background sky or terrain. This visibility impairment is typically of concern when an emission source is within 50 kilometers of a Class I area. Beyond this distance, the plume has dispersed such that its effect is not discernible as a plume against a background view. However, beyond 50 kilometers, the particulates in the plume may contribute to regional haze. The separation distance between the Project and the Breton NWR is greater than 50 kilometers; therefore, the Project analysis only considered impacts on regional haze.

The amount of visibility reduction is determined by the increase in light extinction. An increase in light extinction describes the increase in the amount of ambient light that is scattered by an increase in particles and gases in the atmosphere. As more light is scattered, visibility of a distant object is reduced. The FLM generally accepts a 5 percent increase in light extinction on a 24-hour average period basis as a visibility reduction threshold. If the increase in light extinction is less than 5 percent, no further analysis is needed. The EPA recommends using the 98th percentile value of the modeled 24-hour visibility values to account for the CALPUFF model's tendency to conservatively estimate actual visibility effects.

The visibility analysis used a background light extinction value calculated according to procedures contained in the 2010 FLAG report (NPS, 2010). This value is used in conjunction with the predicted visibility impacts from Project emission to determine whether the Project would contribute to a greater than 5 percent increase in light extinction and hence a reduction in visibility. The visibility analysis results are shown in table 4.11-7.

Similar to the other Class I area analyses, scenario 1 and scenario 3 results do not include the effects of emissions associated with construction, and none of the scenarios include emissions from mobile sources associated with the Project. These emissions (primarily construction emissions) add significantly to the emission rate from the Project during the 4.5 years of concurrent construction and operation. Addition of these emissions to the visibility model input would increase the percentage change in visibility to values that approach the 5 percent daily threshold change value. Additional modeling would be required to determine whether visibility thresholds would be exceeded.

Table 4.11-7 Visibility Analysis Results				
Year	Scenario 1 (% change)	Scenario 3 (% change)	Scenario 4 (% change)	Visibility % Change Daily Value Threshold
2001	0.65	1.66	2.30	5
2002	0.65	1.47	1.85	5
2003	0.80	1.86	2.38	5

Class II Area Modeling – Stationary and Mobile (Vessel) Sources

Impacts on Ambient Criteria Pollutant Concentrations

Venture Global conducted an air quality dispersion modeling analysis for stationary sources to estimate ambient criteria pollutant concentrations in the vicinity of the Project for pollutants subject to PSD. The analysis followed EPA PSD modeling procedures. A preliminary impact analysis, known as a SIL analysis, was performed, followed by a full impact analysis and PSD increment analysis. The analysis used the EPA's AERMOD, version 15181, to predict maximum short-term and annual concentrations within a 50-kilometer radius of the Project. The 50-kilometer radius is the distance approved for modeling compliance demonstrations for regulatory purposes.

The preliminary impact, full NAAQS, and PSD increment analyses used 5 years of hourly meteorological data, and land use and terrain height data. Existing ambient background pollutant concentration data were used in the full NAAQS analysis. Locations (receptors) where pollutant concentrations were calculated by AERMOD were distributed throughout the analysis area using either a grid of points or specific locations known as discrete receptors. The number and distribution of receptors varied depending on the requirements of the analysis being conducted.

Meteorological Data

The stations selected to represent the Project site conditions were New Orleans International Airport for surface meteorological conditions and Slidell, Louisiana, for upper air conditions. These stations are the closest to the Project site. The meteorological data covered the January 1, 2011, to December 31, 2015, time period. The meteorological data were processed for use in the model according to PSD modeling guideline procedures. The meteorological data were used in the SIL analysis, the full NAAQS analysis, and the PSD increment analysis.

Land Use and Terrain

The Project site is mainly rural with a relatively small amount of industrial development. Terrain elevations do not vary much throughout the Project area. Terrain elevation data from the USGS's National Elevation Dataset were processed using the AERMAP version 11103 terrain processor so that the data could be used by AERMOD. These data were used to assign elevations to each receptor.

Modeling Scenarios

Venture Global developed four emission scenarios to describe the emissions from successive phases of development and operation of the Project. These scenarios are as follows:

- Scenario 1: simple-cycle turbine interim operations plus Phase I concrete batch plant operations;
- Scenario 2: final turbine operating model (combined-cycle operation) for Phase I of development;
- Scenario 3: scenario 2 plus simple-cycle turbine interim operations in Phase II; and
- Scenario 4: full facility operation.

Scenario 3 and 4 are the scenarios with the highest potential to emit air pollutants. Due to the differences between scenarios in terms of equipment that would be operated and the operating mode of the gas turbines (simple cycle versus combined cycle), the maximum potential to emit for NO_x and CO occurs under Scenario 3, whereas Scenario 4 results in the highest potential to emit for PM₁₀, PM_{2.5}, and SO₂. These scenarios were modeled in the SIL, full NAAQS, and PSD increment analyses.

Secondary Formation of PM_{2.5}

Particulate matter PM_{2.5} can be directly emitted from an emission source and modeled as is done for gaseous pollutants. PM_{2.5} may also form from gaseous pollutants emitted from the emission source. EPA guidance calls for PSD permit applications to address the potential for secondary formation of PM_{2.5} in the atmosphere due to emissions of NO_x (which forms nitrate particulate matter) and SO₂ (which forms sulfate particulate matter). Venture Global performed an assessment of the potential formation of secondary PM_{2.5} from the Project in accordance with the hybrid qualitative/quantitative assessment Case 3 from EPA guidance.

The maximum modeled direct PM_{2.5} concentrations typically do not occur where maximum secondary PM_{2.5} impacts occur because the emissions of NO_x and SO₂ from the Project would require time in the atmosphere to form particulate nitrates and sulfates. Typically, secondary PM_{2.5} maximum occurs further downwind due to transport of NO_x and SO₂ and time required for the transformation to PM_{2.5}. Consequently, the maximum secondary PM_{2.5} impacts would not occur close to the Project site where the maximum direct PM_{2.5} impacts are expected to occur.

The Case 3 secondary PM_{2.5} analysis procedure consists of several steps:

- establishing the role that nitrates and sulfates have in the total formation of PM_{2.5} in the region;
- comparing the relationship of regional emissions of NO_x and SO₂ to locally monitored values of PM_{2.5} that have data showing the composition of total PM_{2.5} (e.g., sulfate, nitrate);
- comparing the Project's NO_x and SO₂ emissions to regional NO_x and SO₂ emissions; and
- developing an estimate of the expected secondary PM_{2.5} that could form due to Project emissions.

Monitoring data were used from the closest site with PM_{2.5} data showing sulfate and nitrate composition to establish the role each has in total PM_{2.5}. The monitor is located in Baton Rouge, Louisiana (monitor ID 22-033-0009). This monitor is located in an urban area and reflects a higher degree of development, hence higher sulfate and nitrate values, than the Project site. The composition data are used to determine whether one of these materials (sulfate and nitrate) is more prevalent in total PM_{2.5}. The data for 2013 and 2015 indicated that sulfate is approximately 20 percent of the PM_{2.5} and nitrate is approximately 6 percent. Thus, sulfate is more prevalent in total PM_{2.5} than nitrate. Venture Global also used data from 2013 and 2015 to determine the change in nitrate and sulfate concentration.

The Project's analysis also compiled NO_x and SO₂ regional emissions within 50 kilometers of the Project site for the same 2 years used in the monitoring data analysis. The Project's NO_x emissions would be 6 percent of the total regional NO_x emissions, and the Project's emissions of SO_x would be 3 percent of the total regional SO_x emissions. The change in total NO_x and SO₂ emissions from 2013 to 2015 was also compared to the Project's estimated emissions and to the

change in annual PM_{2.5} concentration at the closest PM_{2.5} monitor to the site. This monitor is in Marrero, Louisiana; note that this monitor does not collect data on which chemical species make up the total PM_{2.5} concentration.

Using this analysis procedure, the applicant estimated a combined contribution to nitrate and sulfate concentrations of less than 0.01 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for interim emission scenario 3 and for operating emission scenario 4. This is less than the annual PM_{2.5} SIL of 0.3 $\mu\text{g}/\text{m}^3$. Consequently, the emissions of NO_x and SO₂ associated with the Project would not be expected to cause significant formation of secondary PM_{2.5} in the region.

SIL Analysis – Stationary Sources

The SIL analysis is a preliminary analysis used to determine whether a project would have significant impacts that require further analysis using more detailed procedures. Venture Global conducted the SIL analysis for pollutants emitted above thresholds that subject them to PSD. In this analysis, the Project's potential to emit PSD pollutants is evaluated to determine whether it may have significant impacts on air quality in the area surrounding the facility. The pollutants evaluated are CO, NO₂, PM₁₀, PM_{2.5}, and SO₂.

Modeled concentrations are compared to the respective EPA SILs. If the maximum modeled concentration at all receptor locations is less than the SIL, then the impact is considered to be less than significant with respect to the NAAQS and PSD increment for that pollutant and averaging period combination, and further analysis is not required. If the maximum modeled concentration is greater than the SIL, or if the SIL plus a relevant background concentration exceeds the corresponding NAAQS, then an NAAQS full impact analysis and a PSD increment analysis are required.

Pursuant to EPA guidance specific to modeling PM_{2.5}, an analysis was performed to determine whether the PM_{2.5} SIL is applicable for use in comparison with preliminary model results. The test consists of determining the difference between the NAAQS and PM_{2.5} monitored background and comparing it to the SIL. If the result is greater than the SIL, there is sufficient evidence to conclude that model results below the SIL would not cause or contribute to a violation of the NAAQS, and no cumulative analysis is needed. Venture Global used data from the Marrero monitoring station, located in an urban part of New Orleans, to conservatively represent background PM_{2.5} at the more rural Project site. The result of the analysis show that the difference is significantly greater than the SIL, and therefore provides sufficient evidence that model results below the SIL would not cause or contribute to an NAAQS violation and do not require a cumulative modeling analysis.

The modeled impact also is compared to the significant monitoring concentration (SMC). Impacts greater than the SMC indicate that Project-specific air quality measurements may be needed to characterize existing background air quality within the Project's impact area. A project that has an impact greater than the SMC may require preconstruction monitoring via the installation of on-site air quality monitors.

A fence-line grid and set of four additional receptor grids were used to locate receptors throughout the 50-kilometer modeling radius surrounding the Project site. The receptor grids are defined as follows:

- fence-line grid consisting of receptors spaced at 100-meter intervals along the property line;
- a finely spaced grid consisting of receptors spaced 100 meters apart extending 1 kilometer in all directions from the property line;
- a first coarse grid with 500-meter receptor spacing extending from 1 to 5 kilometers in all directions from the property line;
- a second coarse grid with 1,000-meter receptor spacing extending from 5 to 10 kilometers in all directions from the property line; and
- a third coarse grid with 5,000-meter receptor spacing extending from 10 to 50 kilometers in all directions from the property line.

Table 4.11-8 lists the SIL and SMC concentration values, the preliminary modeling results, and radius of influence distance for pollutant/averaging period results that are above the respective SILs. This comparison determines the additional analyses that were required to demonstrate the Project's impact on the surrounding air quality and compliance with standards. The preliminary modeling results demonstrated that the Project would exceed the corresponding SILs for 1-hour NO₂, annual NO₂, 24-hour PM_{2.5}, 1-hour SO₂, and 3-hour SO₂. Therefore, Venture Global conducted a full impact analysis for these pollutant/averaging period combinations.

Based on prior LDEQ guidance and precedent on other similar projects in Louisiana, Venture Global determined that on-site preconstruction air quality monitoring would likely not be required because preliminary assessment modeling demonstrated that maximum modeling results are below the respective SMCs. For use in cumulative modeling, Venture Global proposed to the LDEQ use of an appropriate data set of background data collected at existing monitors in the region. These data were subsequently approved by the LDEQ.

Table 4.11-8 Preliminary Model Results – Stationary Sources							
Pollutant	Averaging Period	SIL ($\mu\text{g}/\text{m}^3$)	SMC ($\mu\text{g}/\text{m}^3$)	Preliminary Maximum Modeled Concentration ($\mu\text{g}/\text{m}^3$)		Radius of Influence for SIL Analysis (km)	
				Scenario 3	Scenario 4	Scenario 3	Scenario 4
CO	1-hour	2,000	n/a	1,709.2	1,709.2	Below SIL	Below SIL
	8-hour	500	575	156.2	156.2	Below SIL	Below SIL
NO ₂	1-hour	7.5	n/a	17.8	21.2	17.92	17.92
	Annual	1	14	1.4	1.5	1.21	1.25
PM ₁₀	24-hour	5	n/a	2.8	3.3	Below SIL	Below SIL
	Annual	1.0	10	0.3	0.4	Below SIL	Below SIL
PM _{2.5}	24-hour	1.2	4	2.4	2.7	3.47	6.10
	Annual	0.3	n/a	0.2	0.3	Below SIL	Equal to SIL
SO ₂	1-hour	7.8	n/a	8.8	8.9	1.50	1.50
	3-hour	25	n/a	75.4	75.4	0.76	0.76
	24-hour	5	13	5.0	5.0	Below SIL	Below SIL
	Annual	1	n/a	0.1	0.1	Below SIL	Below SIL
Key: $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter CO = carbon monoxide km = kilometers NO ₂ = nitrogen dioxide PM ₁₀ = particulate matter equal to or less than 10 micrometers in aerodynamic diameter PM _{2.5} = particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter SIL = Significant Impact Level SMC = Significant Monitoring Concentration SO ₂ = sulfur dioxide							

Full NAAQS (Cumulative) Modeling Analysis – Stationary Sources

Emission sources included in the full NAAQS modeling included the Project emission sources plus non-project off-site emission sources. The radius of influence (ROI) shown in table 4.11-8 defines the circular area around the Project known as the area of influence (AOI). Based on LDEQ guidance, the Project AOI radius, plus a 20-kilometer distance beyond the AOI radius, was evaluated for the presence of major emission sources (i.e., greater than 250 tpy) for the cumulative analysis. Venture Global queried a publicly available LDEQ database (the Emissions Reporting and Inventory Center [ERIC]) to extract the non-project emission source inventory data. Additional LDEQ data sources such as the Electronic Document Management System (EDMS), emission source data at similar facilities, and LDEQ guidance on default values were used to fill in missing data in the off-site emission source inventory.

In addition to the contribution of facility emissions and off-site emissions sources, background monitor data were added to modeled results. The background monitor data represents all other emission sources in the modeling area such as minor stationary sources, area sources, and mobile sources.

In the SIL analysis, all NO_x emitted from the Project is conservatively assumed to convert to NO₂. In the full NAAQS analysis, guidance allows the use of a refined conversion ratio that reflects a more realistic conversion process. The Project followed appropriate EPA guidance regarding selection and use of conversion ratios for determining the amount of total NO_x emitted converted to NO₂. The analysis used the Tier 2 Ambient Ratio Method, which prescribes that 80 percent of emitted NO_x converts to NO₂ for the 1-hour averaging period, and 75 percent of the NO_x emitted converts to NO₂ for the annual average period.

Emission scenarios 3 and 4, described above, were modeled in conjunction with off-site emission sources to evaluate NAAQS compliance. For short-term averaging periods (1-hour, 3-hour, 8-hour, and 24-hour), emissions were based on hourly maximum emission rates for continuously or near continuously operating emission sources. Long-term (annual) averaging period emission rates were based on an average annual emission rate that takes into account periods of the source not operating.

Intermittent sources—that is, equipment that operates only a few hours per year or on an emergency basis—were included in the modeling, where appropriate, with emission rates derived based on EPA guidance (EPA, 2011b).

Stack and building locations and dimensions were input to AERMOD to assess potential downwash effects. This data were used with EPA’s currently approved version of the Building Profile Input Program – Plume Rise Model Enhancements software (version 04274) to develop wind direction-specific building profiles.

Table 4.11-9 shows the modeling results for the NAAQS assessment. The table shows that all predicted concentrations were less than the NAAQS except for 1-hour NO₂. To address the 1-hour NO₂ exceedance, a “culpability analysis” was performed. A culpability analysis looks not only at the maximum values shown in table 4.11-5, but also at the contribution of the Project to each individual exceedance over all receptors and modeled hours. EPA guidance provides that a Project is considered to be in compliance with the NAAQS if its contribution to each individual modeled exceedance is less than the SIL. None of the Project’s contributions to modeled NAAQS exceedances are greater than the SIL for 1-hour NO₂. Therefore, the Project would not significantly contribute to any of the modeled NAAQS exceedances and is shown to be in compliance with the NAAQS.

Table 4.11-9 NAAQS Assessment Results – Project Stationary Sources and Off-Site Cumulative Sources						
Scenario	Pollutant	Averaging Period	Model Predicted Concentration (µg/m³) ^a	Background Concentration (µg/m³)	Total Concentration (µg/m³)	NAAQS (µg/m³)
Scenario 3	NO ₂	1-hour	Note b	Note b	1,883.9	188
		Annual	4.5	35.1	39.6	100
	PM _{2.5}	24-hour	184.1	18.6	202.6	35
	SO ₂	1-hour	424.1	49.5	473.7	196
		3-hour	216.6	62.3	278.8	1,300
Scenario 4	NO ₂	1-hour	Note b	Note b	1,883.9	188
		Annual	4.6	35.1	39.6	100
	PM _{2.5}	24-hour	737.9	18.6	756.5	35
	SO ₂	1-hour	424.1	49.5	473.7	196
		3-hour	216.6	62.3	278.9	1,300
a Model predicted concentration shown is the value corresponding to the statistical nature of the NAAQS. This value is different than the maximum modeled value used in the SIL analysis. b The analysis for the 1-hour NO₂ concentration involved use of seasonal (e.g., winter, spring, summer, fall) background concentration values added to the model predicted concentration. The total concentration shown for 1-hour NO₂ is the maximum value from this analysis. Key: µg/m³ = micrograms per cubic meter NAAQS = National Ambient Air Quality Standards NO₂ = nitrogen dioxide PM_{2.5} = particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter SO₂ = sulfur dioxide						

Exceedances of the NAAQS are shown for both scenarios for 1-hour NO₂, 1-hour SO₂, and 24-hour PM_{2.5}. However, based solely on this step of the analysis, it is unknown whether the Project is contributing above the SIL at receptor locations that show an exceedance of the NAAQS. Therefore, Venture Global conducted a statistical analysis per EPA modeling guidance and the Project's approved modeling protocol that involves a detailed examination of each cumulative emission source's contribution, including the Project's, to predicted NAAQS exceedances at all receptors. Based on this additional analysis, it was found that the Project did not contribute above the applicable SIL at any of the receptor locations where a modeled NAAQS exceedance was predicted. Therefore, the Project demonstrated compliance with the NAAQS based on the emission scenarios modeled. However, the modeling analysis did not consider the concurrent construction emissions that are projected to occur during Scenario 3.

Modeling Including Mobile (Vessel) Emission Sources

Venture Global prepared an additional modeling analysis that included only Project stationary sources (no off-site cumulative sources were included) with the Project's LNG carriers and support vessels. The analysis consisted of modeling the impact of the emissions, adding in a background value from monitoring stations used in the PSD modeling analysis, and comparing the total concentration to the applicable NAAQS. Vessels were modeled for maneuvering activities within the moored safety (security) zone and hoteling at the terminal, and also within the moored

safety (security) zone. The mobile sources during maneuvering activities included one LNG carrier and four tug boats, while the sources during the hoteling activities included one LNG carrier and one tug boat. Venture Global conducted the modeling analysis for the terminal plus LNG carrier and supporting vessel mobile emissions, with background concentrations, and compared these concentrations to the NAAQS.

The position and emission rates for the vessels included in the modeling varied for short-term (e.g., 1-hour, 3-hour, 8-hour, and 24-hour) periods compared to the annual period. For the short-term modeling periods of 1, 3, and 8 hours, one LNG carrier and three attendant tug boats were assumed in the safety zone performing maneuvering activities, with one LNG carrier and one tug boat docked at the terminal. For the 24-hour short-term modeling period, two LNG carriers were modeled as docked at the terminal with two tug boats standing by. For the annual modeling period, LNG carriers were located at all three loading docks along with their attendant support vessels. For operation of stationary sources in the modeling, scenarios 3 and 4 described earlier were included. Thus, the following combinations of stationary and vessel sources were modeled:

- Scenario 3 – Phase I final operating mode (gas turbines in combined-cycle operation), plus Phase II interim operating mode (Phase II gas turbines in simple-cycle operating mode), plus marine vessels; and
- Scenario 4 – Final operating model for the terminal (Phase I and Phase II) plus marine vessels.

The NAAQS Assessment results in table 4.11-10 show compliance with the NAAQS. The combined stationary/marine vessel modeling analysis was not carried through to include the off-site cumulative emission source inventory as was done for the PSD modeling.

Table 4.11-10 NAAQS Assessment Results – Project Stationary and Vessel Sources						
Scenario	Pollutant	Averaging Period	Model Predicted Concentration (µg/m³) ^a	Background Concentration (µg/m³)	Total Concentration (µg/m³)	NAAQS (µg/m³)
Scenario 3	CO	1-hour	1,675.2	5,713.6	7,388.7	40,000
		8-hour	147.9	2,290.0	2,437.9	10,000
	NO ₂	1-hour	Note b	Note b	84.0	188
		Annual	1.4	35.1	36.5	100
	PM _{2.5}	24-hour	1.8	18.6	20.4	35
		Annual	0.2	7.9	8.1	12
	PM ₁₀	24-hour	2.4	75.0	77.4	150
	SO ₂	1-hour	8.0	49.5	57.5	196
		3-hour	11.4	62.3	73.7	1,300
		24-hour	3.0	21.8	24.8	365
		Annual	0.1	14.1	14.2	80
	Scenario 4	CO	1-hour	1,675.2	5,713.6	7,388.7
8-hour			147.9	2,290.0	2,437.9	10,000
NO ₂		1-hour	Note b	Note b	84.0	188
		Annual	1.5	35.1	36.6	100
PM _{2.5}		24-hour	2.0	18.6	20.6	35
		Annual	0.3	7.9	8.2	12
PM ₁₀		24-hour	2.5	75.0	77.5	150
SO ₂		1-hour	8.1	49.5	57.6	196
		3-hour	11.4	62.3	73.7	1,300
		24-hour	3.0	21.8	24.8	365
		Annual	0.1	14.1	14.2	80
a Model predicted concentration shown is the value corresponding to the statistical nature of the NAAQS. This value is different than the maximum modeled value used in the SIL analysis. b The analysis for the 1-hour NO₂ concentration involved use of seasonal (e.g., winter, spring, summer, fall) background concentration values added to the model predicted concentration. The total concentration shown for 1-hour NO₂ is the highest value from this analysis. Key: µg/m³ = micrograms per cubic meter CO = carbon monoxide NAAQS = National Ambient Air Quality Standards NO₂ = nitrogen dioxide PM₁₀ = particulate matter equal to or less than 10 micrometers in aerodynamic diameter PM_{2.5} = particulate matter equal to or less than 2.5 micrometers in aerodynamic diameter SO₂ = sulfur dioxide						

Additional Impact Analyses

The PSD modeling analysis also requires additional assessments of potential impacts from air emissions on Class I areas; soil, vegetation, and wildlife; and additional or induced growth.

The additional assessments were based on the results of the NAAQS analysis and are summarized below.

The nearest Class I area is the Breton National Wildlife Refuge. Venture Global performed a modeling analysis to evaluate potential air quality and visibility impacts on sulfate and nitrate deposition. This is discussed in section 4.11.1.6.

The secondary NAAQS are set at levels designed to protect soil, vegetation, and wildlife. The NAAQS assessment demonstrates that the Project would comply with the primary NAAQS, which are more stringent (set at lower levels) than the secondary NAAQS. Therefore, the Project is not expected to result in significant impacts on soil, vegetation, or wildlife as a result of air pollutant emissions.

Additional Growth

Venture Global conducted a growth analysis to determine whether the Project could induce additional development that could lead to air quality impacts on the surrounding area. The Gulf Coast region historically has been a center for the oil and gas industry, and the Project would be of similar character. Raw materials, other supplies, and services to be used by the Project are currently available to serve existing oil and gas facilities, and it is believed that existing suppliers would be able to support the Project. Therefore, growth of the supply industry in the immediate area is not expected and will not lead to additional growth related air quality impacts.

The area surrounding the Project site contains an established road network and available workforce. Venture Global anticipates that the majority of the permanent workforce at the Project would be local hires already residing in the area. There would not be a large demand for development of new housing in the area. With little induced development, there would not be a large increase in emissions associated with residential growth.

In addition to the Class I visibility analysis discussed in section 4.11.1.6, Venture Global reviewed land uses that may be sensitive to reductions in visibility. The area examined was defined as the 3-kilometer area surrounding the Project, where potential PM₁₀ concentrations could be above the SIL. No airports, state or federal parks, or other land uses sensitive to changes in visibility were identified.

Louisiana Toxic Air Pollutant Modeling – Stationary Sources

As part of the air permit application submitted to the LDEQ, Venture Global was required to conduct a modeling analysis for toxic air pollutants (TAPs) per LAC 33:III Chapter 51. TAPs include chemical compounds that are known, probable or suspected human carcinogens, and acute and chronic non-carcinogenic toxins. TAPs with a potential to emit above minimum emission rates specified in LDEQ's regulation may be subject to dispersion modeling. However, according to LDEQ regulations in LAC 33:III Chapter 51, emissions associated with the combustion of certain fossil fuels such as natural gas and gas streams with a heating value above 7,000 British thermal units (BTU) per pound of fuel are exempt from the modeling requirement. This exemption eliminates consideration of any TAP emissions from equipment burning natural gas.

Ammonia would be released from the selective catalytic reduction control technology units that would be installed on the combined-cycle, heavy-duty frame combustion turbines, and aeroderivative combustion turbines at the power facility. Since this TAP is not produced by combustion of virgin fossil fuels and is not a gas stream with a BTU per pound content greater than 7,000, it is subject to modeling.

The modeling procedures in LDEQ's Air Quality Modeling Guidance consist of three steps: an initial screening analysis, an initial refined analysis, and an additional refined analysis. Modeling followed previously established modeling procedures and receptor grids as used for the SIL analysis. For TAP modeling, the LDEQ requires that only the latest year of meteorological data (2015) in the 5-year data set be used. Ammonia emission rates from the combined cycle gas turbine and aeroderivative gas turbine stacks for emission scenarios 3 and 4 were modeled separately.

Venture Global conducted modeling in the initial screening analysis step. The maximum modeled concentration of ammonia is compared to 7.5 percent of the LDEQ ambient air standard for ammonia shown in LAC 33:III.51, Table 51.2. The results of the modeling are shown in table 4.11-11. Because the results are less than 7.5 percent of the ambient air standard, the modeling demonstration is complete and no further analysis is required.

Table 4.11-11 Ammonia Model Results – LDEQ Toxic Air Pollutant Analysis			
Scenario	Averaging Period	Model Result (µg/m³)	LDEQ AAS (µg/m³)
3	8 hour	4.1	640
4	8 hour	5.0	640
Key: µg/m ³ = micrograms per cubic meter AAS = ambient air standard LDEQ = Louisiana Department of Environmental Quality			

4.11.1.7 Impacts on Ambient Ozone Concentrations

Venture Global prepared an ozone impact analysis in accordance with LDEQ Air Quality Modeling Procedures. An ozone impact analysis is required because a Project's potential to emit NO_x and VOC is above the 100-ton per year emission threshold prescribed by LDEQ.

The Project would be located in Plaquemines Parish, which is currently designated as an attainment area for the 2008 ozone NAAQS. In November 2017, the EPA published an initial round of final designations for the 2015 ozone NAAQS that included designating Plaquemines Parish as unclassifiable or in attainment for the 2015 ozone NAAQS.

Although the Project area is in attainment or unclassifiable for the Ozone NAAQS, there is one nearby area and two more distant areas of potential air quality concern in the larger region beyond Plaquemines Parish:

- parishes in the Baton Rouge Metropolitan Statistical Area that were only recently designated as in attainment for the 2008 ozone NAAQS (about 90 miles northwest of the Project site). These parishes were also very recently designated as attainment/unclassifiable for the 2015 ozone NAAQS after the LDEQ requested and EPA agreed with exclusion of certain exception event data from Ascension Parish and a submittal of certified 2017 monitoring data indicating attainment with the standard;
- the Beaumont/Port Arthur 2008 ozone NAAQS attainment area, a former nonattainment area in which ozone remains a concern and which is about 250 miles west of the Project site; and
- the Houston/Galveston/Brazoria 2008 ozone NAAQS nonattainment area, about 320 miles west of the Project site.

Due to the quantity of ozone precursor emissions (VOC and NO_x) from the Project and the proximity of the Project to these three areas, Venture Global performed an ozone modeling analysis to quantify the potential impact of the Project on ozone concentrations in the surrounding area. The analysis was performed in accordance with current EPA and LDEQ air quality modeling guidelines. The analysis evaluated interim operating scenario 3 and final operating scenario 4. Both scenarios were evaluated because scenario 3 has the highest NO_x emissions of the two scenarios, while scenario 4 has higher VOC emissions. However, interim operating scenario 3 only included stationary emissions sources and did not include concurrent construction emissions. As noted earlier, during construction, NO_x and VOC emissions would be significantly higher than in the final operating model. As a result, ambient ozone concentration may be higher than shown for the final operating mode.

Photochemical Grid Model

The potential 8-hour ozone impact of Project emissions was quantified using a state-of-the-science regional photochemical grid model, the Comprehensive Air Quality Model with Extensions (CAMx) in conjunction with data for an ozone episode that occurred in the Baton Rouge region from August 17 through October 31, 2010. The LDEQ had prepared the ozone episode data as part of its submittal to EPA requesting redesignation of the Baton Rouge ozone nonattainment area to attainment for the 1997 8-hour ozone standard. These data and this study are fully described in the *Photochemical Modeling for the Louisiana 8-Hour Ozone State Implementation Plan Technical Support Document* (LDEQ, 2013). This modeling was conducted on a nested grid configuration of 22-mile (36-kilometer), 7.5-mile (12-kilometer), and 2.5-mile (4-kilometer) grid cells. In a photochemical grid modeling analysis, grid cells correspond to receptors. Consistent with the analysis by the LDEQ, the modeling for the Project was restricted to the 2.5-mile (4-kilometer) domain.

The modeling approach used in this analysis follows the EPA (2016) guidance for a “Refined or Second Tier” modeling study. The guidance specifies a step-wise approach for the analyses, beginning with a significant impact analysis followed by, if necessary, a cumulative analysis (second tier). Consistent with the guidance, the Project impact was assessed using the episode maximum daily 8-hour average concentration at receptors (as grid cells) on days where the ozone is estimated to be over 60 parts per billion (ppb) on more than five episode days (known

as “high modeled days”). The emission sources and rates, land use and terrain, and other inputs were consistent with those used in the Class II PSD modeling analysis conducted for the Project and submitted to the LDEQ.

Venture Global conducted a preliminary modeling analysis for ozone in which the peak increases in ozone concentrations from the Project, as modeled with CAMx, were evaluated to determine whether they have the potential to have a significant impact on ozone in the area surrounding the facility. Modeled concentrations are compared to the EPA SIL for ozone; a draft SIL value of 1.0 ppb was established by the EPA in August 2016. If the modeled level is less than the SIL, then the impact is considered to be less than significant with respect to the NAAQS and no further analysis is required.

The modeled peak ozone impact from the Project is 2.45 ppb for scenario 3 and 2.47 ppb for scenario 4. Both exceed the draft ozone SIL of 1.0 ppb. Because the Project’s impact from the preliminary analysis exceeds the SIL, a cumulative modeling analysis for ozone impacts was performed.

The cumulative ozone modeling analysis was performed using CAMx as described above, but with the addition of background concentrations in the region. In accordance with the EPA guidance, a monitored design concentration value was used for the background values. The background monitor design value was obtained from the Houma-Thibodaux air quality monitor (AIRS ID: 220570004).

The 2016 Modeling Guidance specifies that the highest daily 8-hour maximum ozone contribution from the Project source on high modeled days at each receptor should be added to the monitored design value at that receptor. For this analysis, the maximum monitored design value in the Houma-Thibodaux area for 2013–2015 was used to conservatively represent the monitored design value at all receptors. The design value used in the analysis was 65 ppb.

The addition of the modeled Project impact of 2.45 ppb for scenario 3 and 2.47 ppb for scenario 4 to the monitored design concentration value of 65 ppb would not exceed either the 75 ppb 2008 ozone NAAQS or the 70 ppb 2015 ozone NAAQS for each scenario. Therefore, the Project would not cause or contribute to a violation of the ozone NAAQS. However, Project impacts during the interim operating mode including construction emissions would result in higher ozone impacts.

4.11.1.8 Summary Conclusion – Overall Air Quality

During the construction period (currently estimated 2019 - 2023), residents in the vicinity of the Project would experience local impacts on air quality. During the period of combined construction and operation, nearby locations would experience larger air quality impacts due to the high level of emissions during certain years, and may exceed the NAAQS. These exceedances would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities within a day, week, or month. During operation, extensive modeling has indicated that the Project would not have significant impacts on the local and regional air quality and Class I areas.

4.11.2 Noise

The noise environment can be affected during both construction and operation of the Project. The magnitude and frequency of environmental noise may vary considerably over the course of the day, throughout the week, and across seasons, in part due to changing weather conditions and the effects of seasonal vegetative cover. This section identifies the potential sources of noise, the magnitude of noise, and discusses the change in noise attributable to construction and operation of the Project.

Noise is defined as any unwanted sound. Sound is defined as any pressure variation that the human ear can detect. Humans can detect a wide range of sound pressures, but only the pressure variations occurring within a particular set of frequencies are experienced as sound. However, the acuity of human hearing is not the same at all frequencies. Humans are less sensitive to low frequencies than to mid-frequencies; therefore, noise measurements are often adjusted (or weighted) to account for human perception and sensitivities.

The ambient sound level of a region is defined by the total noise generated within the specific environment and usually comprises natural and man-made sounds.

Two measures used by some federal agencies to relate the time-varying quality of environmental noise with its known effect on people are the equivalent continuous sound level (L_{eq}) and the day-night average sound level (L_{dn}). The preferred single value figure to describe sound levels that vary over time is L_{eq} , which is defined as the sound pressure level of a noise fluctuating over a period of time, expressed as the amount of average energy. L_{dn} is defined as the 24-hour average of the equivalent average of the sound levels during the daytime (L_d – from 7:00 a.m. to 10:00 p.m.) and the equivalent average of the sound levels during the nighttime (L_n – 10:00 p.m. to 7:00 a.m.). Specifically, in the calculation of the L_{dn} , late night and early morning (10:00 p.m. to 7:00 a.m.) noise exposures are increased by 10 dB to account for people's greater sensitivity to sound during nighttime hours. In general, if the sound energy does not vary over the given time period, the L_{dn} level will be equal to the L_{eq} level plus 6.4 dB. The 6.4 dB difference between the L_{dn} and the L_{eq} is a result of the 10 dB nighttime addition for the L_{dn} calculation.

Decibels are the units of measurement used to quantify the intensity of noise. To account for the human ear's sensitivity to low level noises the decibel values are corrected to weighted values known as decibels on the A-weighted scale (dBA). The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than mid-range frequencies.

Decibels are relative units that compare two pressures: the sound pressure and a reference pressure. The reference pressures typically used for air and water are not the same, and a direct comparison of values between in-air and underwater noises is not appropriate. Underwater sounds use a reference pressure of 1 μ Pa while in air sounds have a reference pressure of 20 μ Pa. For in-air sound levels, the reference pressure is often not explicitly stated, as is the case in this text. The reference pressure of underwater sounds is typically stated, and is presented in this text. This is done to remind readers of the different reference pressures between underwater and in air sound levels, and avoid direct comparison. Therefore, in this text, in air sound levels are presented in decibels while underwater sound levels are presented as “dB referenced to (re) 1 μ Pa.” Underwater sound levels may also include a distance to indicate setback from the sound source. For example,

a setback distance of 1 meter would be expressed as “dB (re 1 μ Pa) at 1 meter.” Propagation distances in water are farther than in air because water is denser; however, loudness underwater diminishes quickly with distance from the sound source.

Table 4.11-12 lists relative dBA noise levels of common sounds measured in the environment and industry. A 3 dB change of sound level is considered to be barely perceivable by the human ear, a 5 or 6 dB change of sound level is considered noticeable, and a 10 dB increase is perceived as if the sound intensity has doubled.

Table 4.11-12 Sound Levels and Relative Loudness			
Noise Source or Activity	Sound Level (dBA)	Subjective Impression ^a	Relative Loudness (perception of change)
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain	64 times as loud
Loud rock concert near stage	120	Uncomfortably loud	16 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Garbage disposal / food blender (2 feet)	80	Loud	Reference loudness
Vacuum cleaner (10 feet)	70	Moderate	1/2 as loud
Light auto traffic (100 feet)	50	Quiet	1/8 as loud
Quiet library, soft whisper (15 feet)	30	Very quiet	1/32 a loud
Wilderness with no wind or animal activity	25	Extremely quiet	No perceptible change
a Barnes et al., 1977; EPA, 1971			

4.11.2.1 Noise Regulations

Federal 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 document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that, to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. We have adopted this criterion and have used it to evaluate the potential noise impacts from the Project at noise sensitive areas (NSA). NSAs can be residences, hospitals, places of worship, temporary residences, and other areas that may have a greater sensitivity to noise than other locations. Due to the 10 dBA nighttime penalty added prior to calculation of the L_{dn} , for a facility to meet the L_{dn} 55 dBA limit, it must be designed such that actual constant noise levels on a 24-hour basis do not exceed 48.6 dBA L_{eq} at any NSA.

State and Local Regulations

The State of Louisiana has not adopted noise regulations applicable to construction and operation of the Project. Plaquemines Parish does maintain noise regulations within its Code of

Ordinances, Part 1 – Chapter for Local Self Government for Plaquemines Parish, Louisiana, Chapter 17 – Offenses – Miscellaneous, Article IX – Noise (Plaquemines Parish, Louisiana Municipal Code, 2015). The FERC noise limits are more stringent than Plaquemines Parish limits; therefore, the FERC noise limits represent the governing limits for the Project.

Section 17-133 of the noise article for Plaquemines Parish states the following:

For any source of sound, the sound level shall not exceed the maximum permissible sound level limit set forth in table 1 by fifteen dB (A) for all land use categories. Sound level measurement shall be made with a sound level meter using the A-weighting scale in accordance with the standards promulgated by the American National Standards Institute.

See table 4.11-13 for the maximum permissible sound level limit, referenced as “table 1” in the Plaquemines Parish noise article.

Table 4.11-13 Maximum Permissible Sound Levels by Receiving Land Use Category (Table 1)		
Land Use Category	Time	Sound Level Limited dB(A)
Residential, noise sensitive area, public space	7:00 a.m.–10:00 p.m.	60
	10:01 p.m.–6:59 a.m.	55
Multifamily dwelling	7:00 a.m.–10:00 p.m.	50
	10:01 p.m.– 6:59 a.m.	45
Commercial, convention	7:00 a.m.–10:00 p.m.	65
	10:01 p.m.– 6:59 a.m.	60
Industrial	At all times	75

4.11.2.2 Existing Sound Levels and Noise-sensitive Areas

The terminal site is located in a mixed industrial and rural area, with two small groups of residences over 0.5 mile from the center (0.2 mile from the nearest corner) of the terminal site. The primary noise sources currently in the area include wind, birds, insects, industrial facilities, marine traffic, and vehicular traffic on local roads. The pipeline system is located in a remote area of open water and wetlands, where noise levels are influenced by occasional recreational marine traffic and rural background sources. Additional noise from road traffic may be associated with the Lake Hermitage Road crossing the pipeline system. There are residences within 0.5 mile of the pipeline system, which could contribute to ambient noise levels at these residences during construction.

Residences, along with schools, recreational areas, and hospitals, are considered NSAs. Venture Global conducted an ambient noise survey at nine measurement locations. Venture Global identified several residences that would be considered NSAs. These residences were grouped into four NSA clusters containing multiple residences. Five other areas, identified as potential noise receptors (PNRs), were also included in Venture Global’s baseline ambient noise

survey. Table 4.11-14 provides the distance and direction of each NSA and PNR cluster, and figure B-9 in appendix B identifies their location.

Table 4.11-14 Ambient Noise Level Survey Locations			
NSA/PNR	Direction	Distance to Terminal Site (miles)^a	Distance to Pipeline System (miles)^b
NSA 1	NW	0.90	0.69
NSA 2	W	0.56	0.29
PNR 3	NNW	0.71	0.92
PNR 4	ENE	0.97	1.29
PNR 5	ENE	1.70	1.96
NSA 6	E	1.80	2.09
PNR 7	SSW	0.81	0.13
PNR 8	SW	0.97	0.95
NSA 9	NE	1.80	2.08
a Measured from the center of the terminal site. b Measured from the nearest workspace. Key: NSA = noise-sensitive area PNR = potential noise receptor			

The ambient noise survey was conducted at each of the nine measurement locations over a 24-hour period using a calibrated sound level meter and analyzer and a field microphone equipped with a windscreen to minimize wind turbulence. The noise survey results for the four locations subsequently identified as NSAs are presented in table 4.11-15.

Table 4.11-15 Ambient Noise Level Survey Results			
NSA	Daytime Ambient Noise Level (dBA)	Nighttime Ambient Noise Level (dBA)	24-Hour Ambient Noise Level (dBA)
NSA 1	46.5	44.5	51.3
NSA 2	46.9	45.9	52.5
NSA 6	52.4	47.9	55.3
NSA 9	46.5	43.2	50.3
Key: dBA = A-weighted decibels NSA = noise-sensitive area			

The most common noise producing activities were noted as vessel traffic along the Mississippi River, construction activities, vehicle traffic along SH 23 and Lake Hermitage Road, and wildlife and birds. At NSA 6, the predominant noise during the day was related to nearby construction. As shown in the table above, the nighttime levels at NSA 6 are more in line with the other NSAs at night than during the day.

4.11.2.3 Construction Noise Impacts and Mitigation

LNG Terminal

Construction activities at the Project site would involve clearing and grading, placement of fill, installation of foundations for the planned Project facilities, other equipment settings, ancillary equipment, piping, and structures. Construction of the Project would cause temporary increases in ambient noise levels in the immediate vicinity of the construction sites. Construction operating hours would be from 7:00 a.m. to 7:00 p.m., Monday through Saturday. Land-based and marine-side pile driving, which is the loudest construction activity, is expected to also occur 6 days per week starting at 7:00 a.m., as well, but would end at 5:00 p.m. It is anticipated that the Project would require nighttime construction at the terminal site during the initial 6 to 12 months. The level of construction-related noise would also vary over the course of the construction period, depending on the construction phase in progress. In water and marine pile driving and the anticipated sound pressure levels effect on marine wildlife is discussed in section 4.6.3.2.

Noise levels resulting from construction equipment are dependent on several factors including the number and type of equipment operating, the level of operation, and the distance between sources and receptors. The loudest equipment during construction would contribute to a composite average or equivalent site noise level. Pile-driving activities are expected to produce the highest level of noise during construction of approximately 110 dBA at 50 feet. The composite noise level of all other heavy equipment that would be used during construction is expected to be approximately 90 dBA. For this EIS, the impacts on NSAs from land-based and marine-side pile driving are being evaluated, since they are the predominant noise-producing activity.

The evaluation of land-based and marine-side pile driving assumed that 12 pile drivers would be operating simultaneously for 16-months, which would be the worst-case scenario, according to Venture Global. Table 4.11-16 reports the predicted noise levels at each of the four NSAs, based on this worst-case scenario in Phase I of construction. Phase II would have the benefit of a constructed floodwall, and thus pile-driving noise levels would be greatly reduced (as compared to Phase I) due to the floodwall's indirect suppression of pressure waves. Venture Global based the predictive modeling on noise emanating from the center of the terminal site because that location would contain the most noise-making construction equipment.

Table 4.11-16 Predicted Noise Levels at NSAs During Pile Driving – Phase I		
NSA	Distance from Center of Terminal Site (miles)	Predicted Noise Level L_{MAX} (dBA)
NSA 1	0.90	65.3
NSA 2	0.56	69.9
NSA 6	1.80	58.1
NSA 9	1.80	56.5
Key: dBA = A-weighted decibels L _{MAX} = Maximum sound level during a measurement period or noise event. NSA = noise-sensitive area		

Impact pile driving is an intermittent noise source (i.e., non-constant), so a usage factor was applied to the calculated maximum noise level (L_{max}). In accordance with the Federal Highway Administration Roadway Construction Noise Model (Federal Highway Administration, 2006), Venture Global applied a usage factor of 20 percent to the predicted L_{max} levels from pile driving as shown in table 4.11-17. Calculating pile-driving noise without a usage factor would not be an appropriate way of estimating noise impacts from an intermittent noise source for comparison to ambient background noise levels because ambient noise is also applied a usage factor.

Table 4.11-17 Predicted Noise Levels at NSAs During Pile Driving and Applying 20 Percent Usage Factor				
NSA	Baseline L_d (dBA)	Predicted Noise Level L_{MAX} (dBA)	Predicted Noise Level L_{MAX} (dBA) with Usage Factor	Increase on Baseline (dBA)
NSA 1	46.5	65.3	58.3	11.8
NSA 2	46.9	69.9	62.9	16.0
NSA 6	52.4	58.1	51.1	-1.3
NSA 9	46.5	56.5	49.5	3.0
Key: L _{MAX} = Maximum sound level during a measurement period or noise event. dBA = A-weighted decibels L _d = daytime equivalent sound level (dBA) NSA = noise-sensitive area L _{max} = highest sound measured by the sound level meter over a given period of time L _{max} with Usage Factor = highest sound measured by the sound level meter over a given period of time with consideration to Usage Factor for intermittent noise sources.				

Noise impacts on NSAs during construction would be temporary and moderate, considering the predicted noise levels from land-based and marine-side pile driving range from 11.8 to 16.0 dBA greater than existing ambient noise levels during daytime hours at the two closest NSAs.

Venture Global has committed to implement mitigation measures to reduce land-based and marine-side pile-driving noise impact on NSAs. Venture Global would construct 5-meter-high noise protection walls around piling rigs for mitigation. As modeled, these noise barriers would reduce the increase of ambient noise levels to 0.4 dBA and 2.2 dBA at the two nearest NSAs. Without this mitigation, the increase above ambient noise levels would range from 11.8 dBA to 16.0 dBA.

Pipeline System

During construction of the pipeline system, noise would be primarily generated by construction equipment, including HDD equipment, and pile installation activities. Noise associated with HDD and pile installation activities are further described below.

HDD construction involves various equipment and activities, including power generation, mobile equipment, and mixing pumps. Different equipment is used on the entry and exit side of the HDD section. Typical equipment used at the HDD entry side includes:

- drilling rig and engine-driven hydraulic power unit;
- engine-driven mud pump(s) and engine-driven generator set(s);
- mud mixing/cleaning equipment and associated fluid systems' shale-shakers;
- mobile equipment, including a crane, forklift, and/or truck(s);
- drill mud and make up tanks; and
- engine-driven lights.

Predicted noise levels at the closest NSA (NSA 2) associated with the HDD at Lake Hermitage Road are presented in table 4.11-18.

Table 4.11-18 Predicted Noise Level from Lake Hermitage Road HDD at NSA 2					
HDD Site	Distance to NSA 2	Ambient Noise Level	Predicted L_{dn} of HDD (dBA)	Predicted L_{dn} HDD + Ambient L_{dn} (dBA)	Potential Change in Noise Level (dBA)
HDD Entry Site	1,610 feet	46.4	59.5	59.7	13.3
HDD Exit Site	1,925 feet	46.4	46.0	49.2	2.8
Key: dBA = A-weighted decibels HDD = horizontal directional drill L _{dn} = day-night average sound level NSA = noise-sensitive area					

To minimize impacts on NSAs from HDD operations, Venture Global proposes to implement a sound curtain enclosure or acoustic barrier as necessary. Sound curtain enclosures would be used around the drilling rig and other stationary equipment during the HDD process. Sound curtain enclosures have been shown to provide 10 to 14 dBA of mitigation. To obtain a conservative estimate of the noise levels, it is assumed that 10 dBA of mitigation would be provided due to the sound curtain enclosure. Sound enclosures or acoustic barriers could also be used during dredging activities if nearby structures are occupied during barge access channel dredging.

Impacts associated with pipeline HDD and dredging activities would be temporary and minor at NSAs and PNRs. Further implementation of sound curtains, as necessary, would further minimize this temporary impact.

To insure that potential noise impacts on nearby NSAs are minimized to the extent practical, **we recommend that:**

- **Prior to beginning the HDD at Lake Hermitage Road, Gator Express Pipeline should file with the Secretary, for the review and written approval by the Director of OEP, an HDD noise mitigation plan for the crossing to reduce the projected noise level attributable to the proposed drilling operations at the nearby**

NSA. During drilling operations, Gator Express Pipeline should implement the approved plan, monitor noise levels, and make all reasonable efforts to restrict the noise attributable to the drilling operations to no more than an L_{dn} of 55 dBA at the NSA.

The pipe bridge that would be constructed north of Lake Hermitage Road would be used to traverse an existing non-federal levee. Two NSAs are located within 1 mile of pile installation activities associated with the pipe bridge at respective distances of approximately 3,900 and 1,600 feet. Construction activities at the pipe bridge would generally occur during the daytime and would occur over a period of 20 days involving 18 piles. Pile installation would involve an auger type drill rig instead of an impact rig as discussed in LNG terminal construction. An auger drill rig has an L_{max} of 85 dBA at a distance of 50 feet. Use of an auger drill for pipe bridge pile installation would be estimated to produce a noise level of 54.3 dBA at NSA 2, located approximately 1,713 feet to the west. This would be a 7.9 dBA increase during daytime ambient noise levels. Venture Global has committed to keep noise impacts at the NSAs under 10 dBA above the ambient noise levels for all Project activities.

Additional noise produced during pipeline construction would come from installation of piles for the metering stations and dredging along the barge access routes. Although no NSAs are within 0.5 mile of a proposed metering station, pile installation would create greater noise levels for possible boaters nearby. However, Venture Global anticipates that piles would be installed via a vibratory process for metering stations that produces less noise than impact pile driving.

Venture Global anticipates no dredging within the Mississippi River is needed and, therefore, NSAs near the terminal site would not be affected by dredging activities. However, during construction of the pipeline system, Venture Global would require water access to the construction site for barges and other vessels involved in dredging, pipe laying, equipment and materials deliveries, and spoil storage. Barge access to the work area would follow existing waterways, and the majority of the system is sufficiently deep (at least 8 feet) to allow free passage; however, some dredging would be required in four areas, totaling 8.9 miles, to facilitate access.

The nearest PNR to the areas to be dredged is a structure within a coastal marshland located approximately 265 feet south of Barge Access Channel No. 2. Approximately 24 additional structures are located near this structure but farther away along the Wilkinson Canal. These structures are vacation/seasonal homes accessible only by water and are considered NSAs. However, as a conservative measure, dredging noise levels at the nearest structure were evaluated for this EIS.

Dredging activities are anticipated to occur only during the daytime and are estimated to last for 1 month (17 days for excavation and 11 days for backfill). Dredging of the channel is expected to be required to support construction of both pipeline laterals, resulting in two separate dredging events. It is estimated that the dredging noise level (24-hour L_{eq}) would be 84 dBA at a distance of 50 feet for this type of activity (FERC, 2002). This corresponds to a daytime sound level of 65.7 dBA at the nearest structure. The distance at which the noise related to dredging activities decreases to 55.0 dBA is approximately 900 feet. There are ten structures within a 900-foot radius of dredging activities.

Pipeline construction and dredge barge operation would be audibly noticeable at the nearest NSAs (in relation to the specific construction activity). Venture Global has committed to mitigation measures, such as sound curtains around drillings rigs, which would reduce noise from construction equipment to within acceptable thresholds. Furthermore, the recommendation made in this section regarding the HDD ensure noise impacts would not be significant during the pipeline system construction.

4.11.2.4 Operational Noise Impacts and Mitigation

LNG Terminal

Operation of the LNG terminal would produce noise on a continuous basis, but is expected to remain within applicable FERC limits. The primary noise-generating sources would be:

- steam power generation;
- fan-driven air-cooled heat exchangers;
- LNG refrigerant compressor electric motor drive units;
- mixed refrigerant and boil-off gas (BOG) compressor units;
- power plant electric generation units;
- inlet and discharge piping;
- expander units;
- packaged items; and
- LNG carriers.

Additionally, during the scoping period and draft EIS comment period, comments were received to address noise generated from flaring activities during normal LNG terminal operation. Venture Global does not consider the flares to be significant contributors to the noise generated by the facility due to their infrequent use and low exit velocity. After initial facility start-up, during which flaring would occur during the daytime, the LNG terminal is designed to limit flaring events only to LNG carrier gas up/cool down operations, which may occur up to 40 times a year. Due to the nature of the operations, the vapor routed to the marine loading flare (a low pressure flare) would be discharged at a low exit velocity. Consequently, Venture Global does not anticipate such flaring events would have noise impacts on NSAs during facility operation. Thus, flaring would create negligible, intermittent impacts at the closest NSAs. We agree.

We require that the noise attributable to the operation of a newly constructed facility must not exceed an Ldn of 55 dBA at any pre-existing NSA. The predicted noise levels due to LNG terminal operation at NSAs are listed in table 4.11-19. The predicted contribution from LNG terminal operation (Ldn 55.0 dBA) meets FERC's contribution threshold (Ldn 55.0 dBA) with implementation of mitigation measures, as discussed below.

Table 4.11-19 Predicted Noise Levels at NSAs from Terminal Operation				
NSA	Ambient Noise Level L_{dn} (dBA)	Predicted L_{dn} of Terminal Operation (dBA)	Predicted L_{dn} Relative to FERC Threshold L_{dn} 55 (dBA)	Ambient L_{dn} + Predicted L_{dn} of Terminal (dBA)
NSA 1	51.3	51.6	-3.4	54.6
NSA 2	52.5	55.0	0.0	57.0
NSA 6	55.3	43.1	-0.9	55.5
NSA 9	50.4	50.8	-4.6	53.8
Key: dBA = A-weighted decibels FERC = Federal Energy Regulatory Commission HDD = horizontal directional drill L _{dn} = day-night average sound level NSA = noise-sensitive area				

Specifically, blowdowns associated with steam generation in the power island would have the greatest potential to affect NSAs during normal operation of the LNG terminal. Venture Global anticipates 5 to 25 blowdown events per year as a result of routine maintenance and/or planned shutdowns and restarts of the heat recovery steam generators. Other potential blowdown events associated with forced outages (equipment- or weather-based) are expected to be infrequent, with less potential impact on NSAs.

Each vent outlet associated with the heat recovery steam generators would be equipped with a silencer in order to limit the sound power level to a maximum of 115 dBA during blowdown events. The blowdown stack is closest to NSA 2 at approximately 2,300 feet. The sound level produced by this vent would be approximately 50 dBA at NSA 2, which is the closest NSA. Noise impacts on NSAs located farther away from blowdown stack would be less.

Venture Global plans to implement the following mitigation measures to reduce noise levels emanating from the LNG terminal during normal operations:

- liquefaction air coolers reduced to sound power level of 88 dBA per fan;
- elastomeric foam Class D mixed refrigerant compressor piping insulation;
- mixed refrigerant compressor blankets;
- steam turbine duct insulation D; and
- heat recovery steam generators would be equipped with silencers to limit the sound power level to a maximum of 115 dBA during blowdown events.

To ensure the above proposed and implemented mitigation measures reduce noise levels from LNG Terminal operations, including flaring events, to an acceptable level, **we recommend that:**

- **No later than 60 days after placing Phase I into service, Plaquemines LNG should file a full power load noise survey with the Secretary for the LNG terminal. If the noise attributable to operation of the equipment at the LNG terminal exceeds an L_{dn} of 55 dBA at the nearest NSA, within 60 days Plaquemines LNG should modify operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the NSA is achieved. Plaquemines LNG should confirm compliance with the above requirement by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.**

We also recommend that:

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

With implementation of these noise reducing mitigation efforts, we have determined that operation of the LNG terminal would not exceed an L_{dn} 55.0 dBA at all NSAs. Nearby residents would hear operational activities, especially flaring/venting events, but the overall impacts would not be significant.

Pipeline System

The pipeline system would include new meter stations. There are no known NSAs or other PNRs within 0.5 mile of the proposed meter station locations. Because noise related to the metering station would be limited to construction, it is unlikely that the existence of the new facilities would markedly alter existing noise levels. Currently, Venture Global has not proposed mitigation measures to reduce the potential of elevated noise levels resulting from new meter station operation. Based on all available data, we do not anticipate an impact from elevated noise levels from pipeline system operation on any NSAs.

4.12 RELIABILITY AND SAFETY

4.12.1 LNG Terminal Reliability, Safety and Security Regulatory Oversight

LNG facilities handle flammable and sometimes toxic materials that can pose a risk to the public if not properly managed. These risks are managed by the companies owning the facilities, through selecting the site location and plant layout, as well as through suitable design, engineering, construction, and operation of the LNG facilities. Multiple federal agencies share regulatory authority over LNG facilities and the operator's approach to risk management. The safety, security, and reliability of Plaquemines LNG's Project would be regulated by the DOT, USCG, and FERC.

In February 2004, the DOT, the USCG, and FERC entered into an Interagency Agreement to ensure greater coordination among these three agencies in addressing the full range of safety and security issues at LNG terminals and LNG carrier vessel operations, and maximizing the exchange of information related to the safety and security aspects of LNG facilities and related marine operations. Under the Interagency Agreement, FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with terminal construction and operation. The DOT and the USCG participate as cooperating agencies but remain responsible for enforcing their regulations covering LNG facility siting, design, construction, and operation. All three agencies have some oversight and responsibility for the inspection and compliance during the LNG facility's operation.

The DOT establishes and has the authority to enforce the federal safety standards for the location, design, installation, construction, inspection, testing, operation, and maintenance of onshore LNG facilities under the Federal Pipeline Safety Laws (49 U.S.C. 60101 et seq.). The DOT's LNG safety regulations are codified in 49 CFR 193, which prescribes safety standards for LNG facilities used in the transportation of gas by pipeline that are subject to federal pipeline safety laws (49 U.S.C. 60101 et seq.), and 49 CFR 192. On August 31, 2018, DOT and FERC signed a Memorandum of Understanding (MOU) regarding methods to improve coordination throughout the LNG permit application process for FERC jurisdictional LNG facilities. In the MOU, DOT agreed to issue an LOD stating whether a proposed LNG facility would be capable of complying with location criteria and design standards contained in Subpart B of Part 193. The Commission committed to rely upon the DOT determination in conducting its review of whether the facilities would be consistent with the public interest. The issuance of the LOD does not abrogate DOT's continuing authority and responsibility over a project's compliance with Part 193 during construction and future operation of the facility. The DOT's conclusion on the siting and hazard analysis required by Part 193 would be based on preliminary design information, which may be revised as the engineering design progresses to final design. DOT regulations also contain requirements for the design, construction, installation, inspection, testing, operation, maintenance, qualifications and training of personnel, fire protection, and security for LNG facilities, as defined by 49 CFR 193, which would be completed during later stages of the Project. If the Project is authorized, constructed, and operated, the LNG facilities, as defined by 49 CFR 193, would be subject to the DOT's inspection and enforcement programs to ensure compliance with the requirements of 49 CFR 193.

The USCG has authority over the safety of an LNG terminal's marine transfer area and LNG marine traffic, as well as over security plans for the waterfront facilities handling LNG and LNG marine traffic. The USCG regulations for water front facilities handling LNG are codified in 33 CFR 105 and 33 CFR 127. As a cooperating agency, the USCG assists FERC staff in evaluating whether an applicant's proposed waterway would be suitable for LNG marine traffic and whether the waterfront facilities handling LNG would be in accordance with 33 CFR 105 and 33 CFR 127. If the facilities are constructed and become operational, the waterfront facilities handling LNG would be subject to the USCG inspection program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

FERC authorizes the siting and construction of LNG terminals under the NGA and delegated authority from the DOE. FERC requires standard information to be submitted to perform safety and reliability engineering reviews. FERC's filing regulations are codified in 18 CFR 380.12(m) and (o), and requires each applicant to identify how its proposed design would comply with the DOT's siting requirements of 49 CFR 193 Subpart B. The level of detail necessary for this submittal requires the applicant to perform substantial front-end engineering of the complete project. The design information is required to be site-specific and developed to the extent that further detailed design would not result in significant changes to the siting considerations, basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs. As part of the review required for a FERC order, we use this information from the applicant to assess whether the proposed facilities would have a public safety impact and to suggest additional mitigations for the Commission to consider in the order. If the facilities are approved and the mitigations are incorporated into the order as conditions, FERC staff would review material filed to satisfy the conditions of the order and conduct periodic inspections throughout construction and operation.

In addition, the Energy Policy Act of 2005 requires FERC to coordinate and consult with the DoD on the siting, construction, expansion, and operation of LNG terminals that would affect the military. On November 21, 2007, FERC and the DoD (<http://www.ferc.gov/legal/mou/mou-dod.pdf>) entered into a MOU formalizing this process. In accordance with the MOU, FERC sent a letter to the DoD on April 1, 2015, requesting their comments on whether the planned Project could potentially have an impact on the test, training, or operational activities of any active military installation. On June 4, 2018, FERC received a response letter from the DoD Siting Clearinghouse stating that the Plaquemines LNG facility would have a minimal impact on military training and operations conducted in the area.

4.12.2 DOT Safety Regulatory Requirements and 49 CFR 193 Subpart B Determination

Siting LNG facilities as defined in 49 CFR 193, with regard to ensuring that the proposed site selection and location would not pose an unacceptable level or risk to public safety is required by DOT's regulations in 49 CFR 193, Subpart B. The Commission's regulations under 18 CFR 380.12(o)(14) require Plaquemines LNG to identify how the proposed design complies with the siting requirements in DOT's regulations under 49 CFR 193, Subpart B. The scope of

DOT's siting authority under 49 CFR 193 applies to LNG facilities used in the transportation of gas by pipeline subject to the federal pipeline safety laws and 49 CFR 192.⁴

The regulations in 49 CFR 193, Subpart B require the establishment of an exclusion zone surrounding an LNG facility in which an operator or government agency must exercise legal control over the activities where specified levels of thermal radiation and flammable vapors may occur in the event of a release for as long as the facility is in operation. Approved mathematical models must be used to calculate the dimensions of these exclusion zones. The siting requirements specified in NFPA 59A (2001), an industry consensus standard for LNG facilities, are incorporated into 49 CFR 193, Subpart B by reference, with regulatory preemption in the event of conflict. The following sections of 49 CFR 193 Subpart B specifically address siting requirements:

- Section 193.2051, Scope, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements in accordance with Subpart B and NFPA 59A (2001). In the event of a conflict with NFPA 59A (2001), the regulatory requirements in Part 193 prevail.
- Section 193.2057, Thermal radiation protection, requires that each LNG container and LNG transfer system have thermal exclusion zones in accordance with section 2.2.3.2 of NFPA 59A (2001).
- Section 193.2059, Flammable vapor-gas dispersion protection, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA 59A (2001).
- Section 193.2067, Wind forces, requires that shop fabricated containers of LNG or other hazardous fluids less than 70,000 gallons must be designed to withstand wind forces based on the applicable wind load data in American Society of Civil Engineers (ASCE) 7 (2005). All other LNG facilities must be designed for a sustained wind velocity of not less than 150 mph unless the DOT Administrator finds a lesser wind speed is justified or the most critical combination of wind velocity and duration for a 10,000-year mean return interval.

As stated in 49 CFR 193.2051, under Subpart B, LNG facilities must meet the siting requirements of NFPA 59A (2001), Chapter 2, and include but may not be limited to:

- NFPA 59A (2001) section 2.1.1(c) requires consideration of protection against forces of nature.
- NFPA 59A (2001) section 2.1.1(d) requires that other factors applicable to the specific site that have a bearing on the safety of plant personnel and surrounding public be considered, including an evaluation of potential incidents and safety measures incorporated in the design or operation of the facility.

⁴ 49 CFR 193.2001(b)(3), Scope of part, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the LNG carrier and the last manifold or valve immediately before a storage tank.

- NFPA 59A (2001) section 2.2.3.2 requires provisions to minimize the damaging effects of fire from reaching beyond a property line, and requires provisions to prevent a radiant heat flux level of 1,600 British thermal units per square foot per hour (Btu/ft²-hr) from reaching beyond a property line that can be built upon. The distance to this flux level is to be calculated with LNGFIRE3 or with models that have been validated by experimental test data appropriate for the hazard to be evaluated and that have been approved by DOT.
- NFPA 59A (2001) 2.2.3.4 requires provisions to minimize the possibility of any flammable mixture of vapors from a design spill from reaching a property line that can be built upon and that would result in a distinct hazard. Determination of the distance that the flammable vapors extend is to be determined with DEGADIS or approved alternative models that take into account physical factors influencing LNG vapor dispersion.⁵

Taken together, 49 CFR 193 Subpart B and NFPA 59A (2001) require that flammable LNG vapors either from an LNG tank withdrawal impoundment or from a design spill do not extend beyond areas in which the operator or a government agency legally controls all activities. Furthermore, consideration of other hazards which may affect the public or plant personnel must be evaluated as prescribed in NFPA 59A (2001) section 2.1.1(d).

Title 49 CFR 193 Subpart B and NFPA 59A (2001) also specify three radiant heat flux levels which must be considered for LNG storage tank spills for as long as the facility is in operation:

- 1,600 Btu/ft²-hr - This level can extend beyond the plant property line that can be built upon but cannot include areas that are used for outdoor assembly by groups of 50 or more persons;⁶
- 3,000 Btu/ft²-hr - This level can extend beyond the plant property line that can be built upon but cannot include areas that contain assembly, educational, health care, detention or residential buildings or structures;⁷ and

⁵ The DOT has approved two additional models for the determination of vapor dispersion exclusion zones in accordance with 49 CFR 193.2059: FLACS 9.1 Release 2 (Oct. 7, 2011) and PHAST-UDM Version 6.6 and 6.7 (Oct. 7, 2011).

⁶ The 1,600 Btu/ft²-hr flux level is associated with producing pain in less than 15 seconds, first degree burns in 20 seconds, second degree burns in approximately 30-40 seconds, 1 percent mortality in approximately 120 seconds, and 100 percent mortality in approximately 400 seconds, assuming no shielding from the heat, and is typically the maximum allowable intensity for emergency operations with appropriate clothing based on average 10-minute exposure.

⁷ The 3,000 Btu/ft²-hr flux level is associated with producing pain in less than 5 seconds, first degree burns in 5 seconds, second degree burns in approximately 10-15 seconds, 1 percent mortality in approximately 50 seconds, and 100 percent mortality in approximately 180 seconds, assuming no shielding from the heat, and is typically the critical heat flux for piloted ignition of common building materials (e.g., wood, PVC, fiberglass, etc.) with prolonged exposures.

- 10,000 Btu/ft²-hr - This level cannot extend beyond the plant property line that can be built upon.⁸

The requirements for design spills from process or transfer areas are more stringent. For LNG spills, the 1,600 Btu/ft²-hr flux level cannot extend beyond the plant property line onto a property that can be built upon.

In addition, NFPA 59A (2001) section 2.1.1 requires that factors applicable to the specific site with a bearing on the safety of plant personnel and surrounding public must be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility. DOT has indicated that potential incidents, such as vapor cloud explosions and toxic releases should be considered to comply with part 193 Subpart B.⁹

In accordance with the August 31, 2018, MOU, DOT issued a LOD to FERC on the 49 CFR 193 Subpart B regulatory requirements.¹⁰ The LOD provides PHMSA's analysis and conclusions regarding 49 CFR 193, Subpart B regulatory compliance. Pursuant to the 2018 MOU, the LOD is a consideration in the Commission's decision to authorize, with or without modification or conditions, or deny an application.

4.12.3 USCG Regulatory Requirements and Letter of Recommendation

4.12.3.1 LNG Carrier Historical Record

Since 1959, LNG carriers have transported LNG without a major release of cargo or a major accident involving an LNG carrier. There are more than 370 LNG carriers in operation routinely transporting LNG between more than 100 import/export terminals currently in operation worldwide. Since U.S. LNG terminals first began operating under FERC jurisdiction in the 1970s, there have been thousands of individual LNG carrier arrivals at terminals in the U.S. For more than 40 years, LNG carrier operations have been safely conducted in U.S. ports and waterways.

A review of the history of LNG maritime transportation indicates that 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 sources, and public websites identify a number of incidents involving LNG carriers, including minor collisions with other vessels of all sizes, groundings, minor LNG releases during cargo unloading operations, and mechanical/equipment failures typical

⁸ The 10,000 Btu/ft²-hr flux level is associated with producing pain in less than 1 seconds, first degree burns in 1 seconds, second degree burns in approximately 3 seconds, 1 percent mortality in approximately 10 seconds, and 100 percent mortality in approximately 35 seconds, assuming no shielding from the heat, and is typically the critical heat flux for unpiloted ignition of common building materials (e.g., wood, PVC, fiberglass) and degradation of unprotected process equipment after approximate 10 minute exposure and to reinforced concrete after prolonged exposure.

⁹ The US DOT PHMSA's "LNG Plant Requirements: Frequently Asked Questions" item H1, <https://www.phmsa.dot.gov/pipeline/liquified-natural-gas/lng-plant-requirements-frequently-asked-questions>, accessed August 2018.

¹⁰ April 3, 2019 letter "Re: Plaquemines LNG Project, Docket No. CP17-66-000, 49 CFR Part 193, Subpart B, Siting – Letter of Determination" from Alan K. Mayberry to Rich McGuire. Filed in Docket Number CP17-66-000 on April 4, 2019. FERC eLibrary accession number 20190404-3002.

of large vessels. Some of the more significant occurrences, representing the range of incidents experienced by the worldwide LNG carrier fleet, are described below:

- **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, no cargo was released because no damage was done to the cargo tanks. The entire cargo of LNG was subsequently transferred to another LNG carrier and delivered to its U.S. destination.
- **Tellier** was blown by severe winds from its docking berth at Skikda, Algeria in February 1989 causing damage to the loading arms and the vessel and shore piping. The cargo loading had been secured just before the wind struck, but the loading arms had not been drained. Consequently, the LNG remaining in the loading arms spilled onto the deck, causing fracture of some plating.
- **Mostefa Ben Boulaid** had an electrical fire in the engine control room during unloading at Everett, Massachusetts on February 5, 1996. The LNG carrier crew extinguished the fire and the LNG carrier completed unloading.
- **Khannur** had a cargo tank overfill into the vessel's vapor handling system on September 10, 2001, during unloading at Everett, Massachusetts. Approximately 100 gallons of LNG were vented and sprayed onto the protective decking over the cargo tank dome, resulting in several cracks. After inspection by the USCG, the Khannur was allowed to discharge its LNG cargo.
- **Mostefa Ben Boulaid** had LNG spill onto its deck during loading operations in Algeria in 2002. The spill, which is believed to have been caused by overflow rather than a mechanical failure, caused significant brittle fracturing of the steelwork. The vessel was required to discharge its cargo, after which it proceeded to dock for repair.
- **Norman Lady** was struck by the USS *Oklahoma City* nuclear submarine while the submarine was rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 m³ LNG carrier, which had just unloaded its cargo at Barcelona, Spain, sustained only minor damage to the outer layer of its double hull but no damage 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 by 80 feet, and internal breaches allowed water to enter the insulation space between the primary and secondary membranes. The vessel 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.

- **Catalunya Spirit** lost propulsion and became adrift 35 miles east of Chatham, Massachusetts on February 11, 2008. Four tugs towed the vessel to a safe anchorage for repairs. The Catalunya Spirit was repaired and taken to port to discharge its cargo.
- **Al Gharrafa** collided with a container ship, Hanjin Italy, in the Malacca Strait off Singapore on December 19, 2013. The bow of the Al Gharrafa and the middle of the starboard side of the Hanjin were damaged. Both marine vessels were safely anchored after the incident. No loss of LNG was reported.
- **Al Oraiq** collided with a freight carrier, Flinterstar, near Zeebrugge, Belgium on October 6, 2015. The freight carrier sank, but the Al Oraiq was reported to have sustained only minor damage to its bow and no damage to the LNG cargo tanks. According to reports, the Al Oraiq took on a little water but was towed to the Zeebrugge LNG terminal where its cargo was unloaded using normal procedures. No loss of LNG was reported.
- **Al Khattiya** suffered damage after a collision with an oil tanker off the Port of Fujairah on February 23, 2017. Al Khattiya had discharged its cargo and was anchored at the time of the incident. A small amount of LNG was retained within the LNG carrier to keep the cargo tanks cool. The collision damaged the hull and two ballast tanks on the Al Khattiya, but did not cause any injury or water pollution. No loss of LNG was reported.
- **Aseem** collided with a very large crude carrier (VLCC) Shinyo Ocean off the Port of Fujairah on March 26, 2019. The VLCC suffered severe portside hull height breach and Aseem had damage to its bow. Both marine vessels were unloaded at the time of the collision and subsequently no LNG or oil was released. Aseem was moved to port for anchorage and Shinyo Ocean was relocated to another point of anchorage.

4.12.3.2 LNG Carrier Regulatory Oversight

The USCG exercises regulatory authority over LNG carriers under 46 CFR 154, which contains the United States safety standards for LNG carriers transporting bulk liquefied gases. The LNG carriers visiting the facility would also be constructed and operated in accordance with the *IMO Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* and the *International Convention for the Safety of Life at Sea*. All LNG carriers entering U.S. waters are required to possess a valid IMO Certificate of Fitness and either a USCG Certificate of Inspection (for U.S. flag marine vessels) or a USCG Certificate of Compliance (for foreign flag marine vessels). These documents certify that the marine vessel is designed and operating in accordance with both international standards and the U.S. regulations for bulk LNG carriers under Title 46 CFR 154.

The LNG carriers that would deliver or receive LNG to or from the facility would also need to comply with various U.S. and international security requirements. The IMO adopted the *International Ship and Port Facility Security Code* in 2002. This code requires both marine vessels and ports to conduct vulnerability assessments and to develop security plans. The purpose of the code is to prevent and suppress terrorism against marine vessels; improve security aboard marine

vessels and ashore; and reduce the risk to passengers, crew, and port personnel on board marine vessels and in port areas. All LNG carriers, as well as other cargo marine vessels 500 gross tons and larger, and ports servicing those regulated marine vessels, must adhere to the IMO standards. Some of the IMO requirements for marine vessels are as follows:

- marine vessels must develop security plans and have a Vessel Security Officer;
- marine vessels must have a ship security alert system. These alarms transmit ship-to-shore security alerts identifying the marine vessel, its location, and indication that the security of the marine vessel is under threat or has been compromised;
- marine vessels must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with marine vessels; and
- marine vessels may have equipment onboard to help maintain or enhance the physical security of the marine vessel.

In 2002, the MTSA was enacted by the U.S. Congress and aligned domestic regulations with the maritime security standards of the *International Ship and Port Facility Security Code* and the *Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* and the *International Convention for the Safety of Life at Sea*. The USCG's regulations in 33 CFR 104, require marine vessels to conduct a vessel security assessment and develop a vessel security plan that addresses each vulnerability identified in the vessel security assessments. All LNG carriers servicing the facility would have to comply with the MTSA requirements and associated regulations while in U.S. waters.

The USCG also 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 U.S.C. Section 191); the Ports and Waterways Safety Act of 1972, as amended (33 U.S.C. Section 1221, et seq.); and the MTSA of 2002 (46 U.S.C. Section 701). The USCG is responsible for matters related to navigation safety, LNG carrier 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 USCG also has authority for LNG facility security plan review, approval, and compliance verification as provided in 33 CFR 105.

The USCG regulations in 33 CFR 127 apply to the marine transfer area of waterfront facilities between the LNG carrier and the last manifold or valve immediately before the receiving tanks. 33 CFR 127 applies to the marine transfer area for LNG of each new waterfront facility handling LNG and to new construction in the marine transfer areas for LNG of each existing waterfront facility handling LNG. The scope of the regulations includes the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, firefighting, and security of the marine transfer area of LNG waterfront facilities. The safety systems, including communications, emergency shutdown, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Plaquemines LNG would be required to submit two copies of its Operations and Emergency Manuals to the USCG Captain of the Port (COTP) for examination.

Both the USCG regulations under 33 CFR 127 and FERC regulations under 18 CFR 157.21, require an applicant who intends to build an LNG terminal facility to submit a Letter of Intent (LOI) to the USCG no later than the date that the owner/operator initiates pre-filing with FERC, but, in all cases, at least 1 year prior to the start of construction. In addition, the applicant must submit a Preliminary WSA to the COTP with the LOI.

The Preliminary WSA provides an initial explanation of the port community and the facility and transit routes. It provides an overview of the expected impacts LNG operations may have on the port and the waterway. Generally, the Preliminary WSA does not contain detailed studies or conclusions. This document is used by the COTP to begin his or her evaluation of the suitability of the waterway for LNG marine traffic. The Preliminary WSA must provide an initial explanation of the following

- port characterization;
- characterization of the LNG facility and the LNG carrier route;
- risk assessment for maritime safety and security;
- risk management strategies; and
- resource needs for maritime safety, security, and response.

A Follow-On WSA must be provided no later than the date the owner/operator files an application with FERC, but in all cases at least 180 days prior to transferring LNG. The Follow-on WSA must provide a detailed and accurate characterization of the waterfront facilities handling LNG, the LNG carrier route, and the port area. The Follow-on WSA provides a complete analysis of the topics outlined in the Preliminary WSA. It should identify credible security threats and navigational safety hazards for the LNG marine traffic, along with appropriate risk management measures and the resources (i.e., federal, state, local, and private sector) needed to carry out those measures. Until a facility begins operation, applicants must also annually review their WSAs and submit a report to the COTP as to whether changes are required. This document is reviewed and validated by the USCG and forms the basis for the agency's LOR to FERC.

In order to provide the USCG COTPs/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, the USCG has published a Navigation and Vessel Inspection Circular – *Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic* (NVIC 01-11).

NVIC 01-11 directs the use of the three concentric Zones of Concern, based on LNG carriers with a cargo carrying capacity up to 265,000 m³, used to assess the maritime safety and security risks of LNG marine traffic. The Zones of Concern are:

- Zone 1 – impacts on structures and organisms are expected to be significant within 500 meters (1,640 feet). The outer perimeter of Zone 1 is approximately the distance to thermal hazards of 37.5 kW/m² (12,000 Btu/ft²-hr) from a pool fire.

- Zone 2 – impacts would be significant but reduced, and damage from radiant heat levels are expected to transition from severe to minimal between 500 and 1,600 meters (1,640 and 5,250 feet). The outer perimeter of Zone 2 is approximately the distance to thermal hazards of 5 kW/m² (1,600 Btu/ft²-hr) from a pool fire.
- Zone 3 – impacts on people and property from a pool fire or an un-ignited LNG spill are expected to be minimal between 1,600 meters (5,250 feet) and a conservative maximum distance of 3,500 meters (11,500 feet or 2.2 miles). The outer perimeter of Zone 3 should be considered the vapor cloud dispersion distance to the lower flammability limit from a worst-case un-ignited release. Impacts on people and property could be significant if the vapor cloud reaches an ignition source and burns back to the source.

Once the applicant submits a complete Follow-On WSA, the USCG reviews the document to determine if it presents a realistic and credible analysis of the public safety and security implications from LNG marine traffic both in the waterway and when in port.

As required by its regulations (33 CFR 127.009), the USCG is responsible for issuing a LOR to FERC regarding the suitability of the waterway for LNG marine traffic with respect to the following items:

- physical location and description of the facility;
- the LNG carrier's characteristics and the frequency of LNG shipments to or from the facility;
- waterway channels and commercial, industrial, environmentally sensitive, and residential areas in and adjacent to the waterway used by LNG carriers en route to the facility, within 25 kilometers (15.5 miles) of the facility;
- density and character of marine traffic in the waterway;
- locks, bridges, or other manmade obstructions in the waterway;
- depth of water;
- tidal range;
- protection from high seas;
- natural hazards, including reefs, rocks, and sandbars;
- underwater pipes and cables; and
- distance of berthed LNG carriers from the channel and the width of the channel.

The USCG may also prepare an LOR Analysis, which serves as a record of review of the LOR and contains detailed information along with the rationale used in assessing the suitability of the waterway for LNG marine traffic.

4.12.3.3 Plaquemines LNG's Waterway Suitability Assessment

On June 17, 2015, Plaquemines LNG submitted a Letter of Intent to the COTP, Sector New Orleans to notify the USCG that it proposed to construct an LNG export terminal. On June 18, 2015, Plaquemines LNG submitted a Preliminary WSA to the COTP, Sector New Orleans. In the development of the Follow-On WSA, Plaquemines LNG consulted with the USCG and port stakeholders. Plaquemines LNG submitted the Follow-On WSA to the USCG on May 12, 2016.

4.12.3.4 LNG Carrier Routes and Hazard Analysis

As described in Plaquemines LNG's WSAs, an LNG carrier's transit to the terminal would begin in the Gulf of Mexico. The LNG carrier would travel approximately 90 miles in the Gulf of Mexico and the Lower Mississippi River to the LNG terminal. LNG carriers would return to sea by reversing their travel. Pilotage is compulsory for foreign marine vessels and U.S. marine vessels under registry in foreign trade when in U.S. waters. All deep draft marine vessels currently entering the waterway would employ a U.S. pilot. The National Vessel Movement Center in the U.S. would require a 96-hour advance notice of arrival for deep draft marine vessels calling on U.S. ports. During transit, LNG carriers would be required to maintain voice contact with controllers and check in on designated frequencies at established way points.

The transit of an LNG carrier from the Gulf of Mexico up the Lower Mississippi River to the LNG terminal would be approximately 90 miles. Pilots would board the LNG carrier and be responsible for the passage of the LNG carrier throughout its entire transit. During the transit, the LNG carrier would pass by the towns and incorporated areas of Pilottown, Venice, Boothville-Venice, Triumph, Buras, Empire, Port Sulphur, Bohemia, Pointe a la Heche, and Davant. The LNG carrier would also pass by several schools during its transit to the LNG terminal: the South Plaquemines High School, the South Plaquemines Elementary School, the McBride School, and the Saint Jude School.

NVIC 01-11 references the "Zones of Concern" for assisting in a risk assessment of the waterway. As LNG carriers proceed along the intended transit route, Hazard Zone 1 would encompass coastal areas along the Mississippi Delta, up through Port Sulphur, Bohemia, and Davant. Hazard Zone 2 would encompass a wider swath of coastal areas along the Mississippi Delta, up through Port Sulphur, Bohemia, and Davant. Hazard Zone 3 would encompass an even larger portions coastal areas along the Mississippi Delta, up through Port Sulphur, Bohemia, and Davant.

The areas impacted by the three different hazard zones are illustrated for both accidental and intentional events in figures 4.12-1 and 4.12-2, respectively.

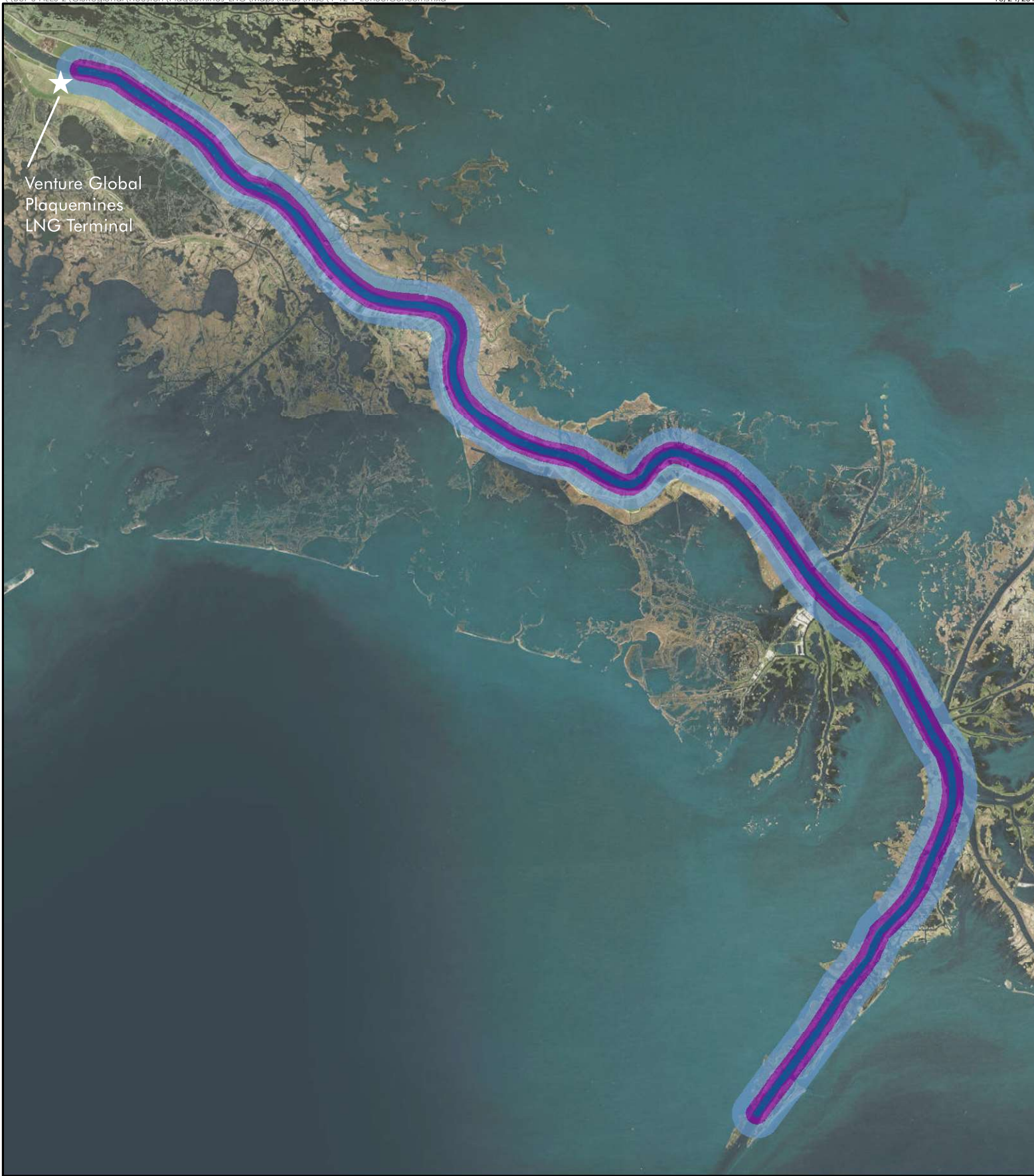
4.12.3.5 Coast Guard Letter of Recommendation and Analysis

In a letter dated January 23, 2017, the USCG issued an LOR to FERC stating that the Lower Mississippi River be considered suitable for accommodating the type and frequency of LNG

marine traffic associated with this Project. The recommendation was based on full implementation of the strategies and risk management measures identified to the USCG by Plaquemines LNG in its WSA.

Although Plaquemines LNG has suggested mitigation measures for responsibly managing the maritime safety and security risks associated with LNG marine traffic, the necessary marine vessel traffic and/or facility control measures may change depending on changes in conditions along the waterway. The USCG regulations in 33 CFR 127 require that applicants annually review WSAs until a facility begins operation. Accordingly, Plaquemines LNG is required to submit a report to the USCG identifying any changes in conditions, such as changes to the port environment, the LNG facility, or the LNG carrier route, that would affect the suitability of the waterway. Accordingly, Plaquemines LNG submitted its annual WSA update on January 23, 2018 and the USCG responded on March 5, 2018, stating the annual review met the requirements of 33 CFR 127.007(h)(1).

The USCG's LOR is a recommendation, regarding the current status of the waterway, to FERC, the lead agency responsible for siting the on-shore LNG facility. Neither the USCG nor FERC has authority to require waterway resources of anyone other than the applicant under any statutory authority or under the Emergency Response Plan (ERP) or the Cost Sharing Plan. As stated in the LOR, the USCG would assess each transit on a case-by-case basis to identify what, if any, safety and security measures are necessary to safeguard the public health and welfare, critical infrastructure and key resources, the port, the marine environment, and the LNG carrier.



- Accidental Sandia "Zone of Concern 1" (0 - 250m)
- Accidental Sandia "Zone of Concern 2" (250 - 750m)
- Accidental Sandia "Zone of Concern 3" (750 - 1700m)

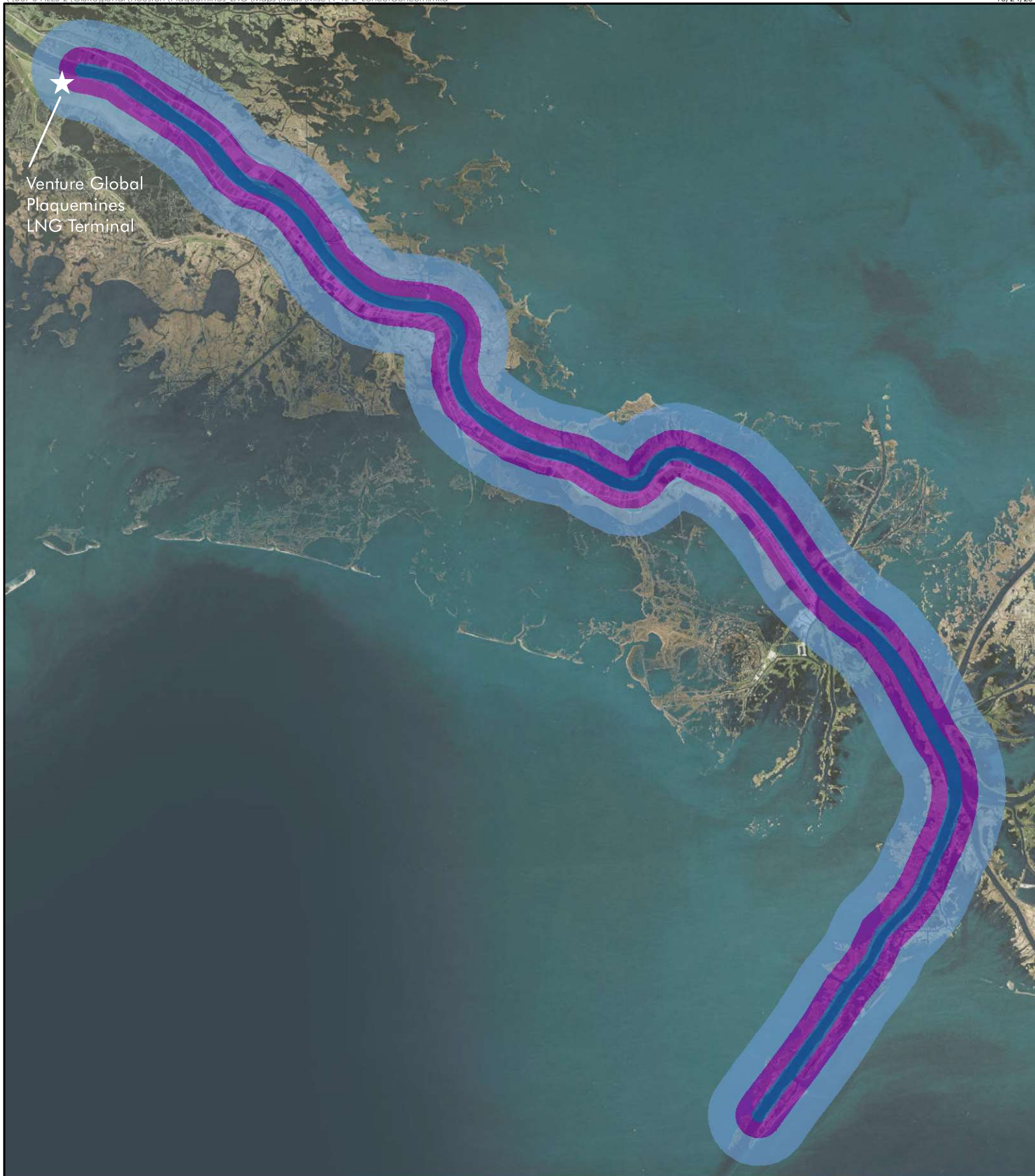


0 2.5 5 10 Miles

Figure 4.12-1
Accidental Sandia
"Zones of Concern"
Along LNG Transit Route
Plaquemines Parish,
Louisiana



Source: DigitalGlobe 2017, USGS 2018



- Intentional Sandia "Zone of Concern 1" (0 - 500m)
- Intentional Sandia "Zone of Concern 2" (500 - 1600m)
- Intentional Sandia "Zone of Concern 3" (1600 - 3500m)



0 2.5 5 10 Miles

Figure 4.12-2
Intentional Sandia
"Zones of Concern"
Along LNG Transit Route
Plaquemines Parish,
Louisiana



Source: DigitalGlobe 2017, USGS 2018

Under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA, and the Security and Accountability for Every Port Act, the COTP has the authority to prohibit LNG transfer or LNG carrier movements within his or her area of responsibility if he or she determines that such action is necessary to protect the waterway, port, or marine environment. If this Project is approved and if appropriate resources are not in place prior to LNG carrier movement along the waterway, then the COTP would consider at that time what, if any, marine vessel traffic and/or facility control measures would be appropriate to adequately address navigational safety and maritime security considerations.

4.12.3.6 LNG Terminal Security Regulatory Requirements

The security requirements for the proposed Project are governed by 33 CFR 105, 33 CFR 127, and 49 CFR 193 Subpart J. Title 33 CFR 105, as authorized by the Marine Transportation Security Act, requires all terminal owners and operators to submit a Facility Security Assessment (FSA) and a Facility Security Plan (FSP) to the USCG for review and approval before commencement of operations of the proposed Project facilities. Plaquemines LNG would also be required to control and restrict access, patrol and monitor the plant, detect unauthorized access, and respond to security threats or breaches under 33 CFR 105. Some of the responsibilities of the applicant include, but are not limited to:

- designating a Facility Security Officer with a general knowledge of current security threats and patterns, security assessment methodology, LNG carrier and facility operations, conditions, security measures, emergency preparedness, response, and contingency plans, who would be responsible for implementing the FSA and FSP and performing an annual audit for the life of the Project;
- conducting a FSA to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures; developing a FSP based on the FSA, with procedures for: responding to transportation security incidents; notification and coordination with federal, state, and local authorities; prevention of unauthorized access; measures to prevent or deter entrance with dangerous substances or devices; training; and evacuation;
- defining the security organizational structure with facility personnel with knowledge or training in current security threats and patterns; recognition and detection of dangerous substances and devices, recognition of characteristics and behavioral patterns of persons who are likely to threaten security; techniques to circumvent security measures; emergency procedures and contingency plans; operation, testing, calibration, and maintenance of security equipment; and inspection, control, monitoring, and screening techniques;
- implementing scalable security measures to provide increasing levels of security at increasing maritime security levels for facility access control, restricted areas, cargo handling, LNG carrier stores and bunkers, and monitoring; ensuring that the TWIC program is properly implemented;

- ensuring coordination of shore leave for LNG carrier personnel or crew change out as well as access through the facility for visitors to the LNG carrier;
- conducting drills and exercises to test the proficiency of security and facility personnel on a quarterly and annual basis; and
- reporting all breaches of security and transportation security incidents to the National Response Center.

Title 33 CFR 127 has requirements for access controls, lighting, security systems, security personnel, protective enclosures, communications, and emergency power. In addition, an LNG facility regulated under 33 CFR 105 and 33 CFR 127 would be subject to the Transportation Worker Identification Credential (TWIC) Reader Requirements Rule issued by the USCG on August 23, 2016. This rule requires owners and operators of certain marine vessels and facilities regulated by the USCG to conduct electronic inspections of TWICs (e.g., readers with biometric fingerprint authentication) as an access control measure. The final rule would also include recordkeeping requirements and security plan amendments that would incorporate these TWIC requirements. The implementation of the rule was first proposed to be in effect August 23, 2018. In a subsequent notice issued on June 22, 2018, USCG indicated delaying the effective date for certain facilities by 3 years, until August 23, 2021. On August 2, 2018, the President of the United States signed into law the Transportation Worker Identification Credential Accountability Act of 2018 (H.R. 5729). This law prohibits the USCG from implementing the rule requiring electronic inspections of TWICs until after the Department of Homeland Security has submitted a report to the Congress. Although the implementation of this rule has been postponed, the company may need to consider the rule when developing access control and security plan provisions for the facility.

Title 49 CFR 193 Subpart J also specifies security requirements for the onshore component of LNG facilities, as defined in 49 CFR 193, including 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.

If the Project is authorized, constructed and operated, compliance with the security requirements of 33 CFR 105, 33 CFR 127, and 49 CFR 193, Subpart J would be subject to the respective USCG and DOT inspection and enforcement programs.

Plaquemines LNG provided preliminary information on these security features and indicated additional details would be completed in the final design. We recommend in section 4.12.5 that Plaquemines LNG provide final details on these security features for review and approval, including: provide drawings and simulations that demonstrate lighting adequately cover the perimeter and interior of the site, in accordance with API 540, including in liquefaction blocks, oily water treatment plant area, exterior of buildings, and along paths/roads of access and egress; provide drawings that demonstrate cameras adequately cover interior of plant, including a camera be provided at the top of each LNG storage tank; provide drawings that demonstrate fencing or equivalent barrier would restrict and deter access at the road crossing and is set back from exterior power lines and trees and from interior hazardous piping and equipment by at least 10 feet; provide drawings and specifications of vehicle barrier at controlled access points; and provide additional

details on these security features and others in final design for review and approval. In accordance with the February 2004 Interagency Agreement among FERC, DOT, and USCG, FERC staff would collaborate with USCG and DOT on the Project's security features.

4.12.4 FERC Engineering and Technical Review of the Preliminary Engineering Designs

4.12.4.1 LNG Facility Historical Record

The operating history of the U.S. LNG industry has been free of safety-related incidents resulting in adverse effects on the public or the environment with the exception of the October 20, 1944, failure at an LNG plant in Cleveland, Ohio. The 1944 incident in Cleveland led to a fire that killed 128 people and injured 200 to 400 more people.¹¹ The failure of the LNG storage tank was due to the use of materials not suited for cryogenic temperatures. LNG migrated through streets and into underground sewers due to inadequate spill impoundments at the site. Current regulatory requirements ensure that proper materials suited for cryogenic temperatures are used in the design and that spill impoundments are designed and constructed properly to contain a spill at the site. To ensure that this potential hazard would be addressed for LNG facilities, we also evaluate the preliminary and final specifications for suitable materials of construction and for the spill containment systems that would properly contain a spill at the site.

Another operational accident occurred in 1979 at the Cove Point LNG plant in Lusby, Maryland. A pump electrical seal located on a submerged electrical motor LNG pump leak causing flammable gas vapors to enter an electrical conduit and settle in a confined space. When a worker switched off a circuit breaker, the flammable gas ignited, causing severe damage to the building and a worker fatality. With the participation of FERC, lessons learned from the 1979 Cove Point accident led to changes in the national fire codes to better ensure that the situation would not occur again. To ensure that this potential hazard would be addressed for facilities that have electrical seal interfaces, we evaluated the preliminary designs and recommend in section 4.12.5 that Plaquemines LNG provide, for review and approval, the final design details of the electrical seal design at the interface between flammable fluids and the electrical conduit or wiring system, details of the electrical seal leak detection system and the details of a downstream physical break (i.e., air gap) in the electrical conduit to prevent the migration of flammable vapors.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria, LNG liquefaction plant that killed 27 and injured 56 workers. No members of the public were injured. Findings of the accident investigation suggested that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced into a high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler firebox, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998 and 1999, Train 40 had been operating with its original equipment since start-up in 1981. To ensure that this potential hazard would be addressed for the LNG terminal, we evaluated the preliminary design for mitigation of flammable vapor dispersion and ignition in buildings and combustion equipment

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

to ensure they would be adequately covered by hazard detection equipment that could isolate and deactivate any combustion equipment whose continued operation could add to or sustain an emergency. We also recommend in section 4.12.5 that Plaquemines LNG provide, for review and approval, the final design details of hazard detection equipment, including the location and elevation of all detection equipment, instrument tag numbers, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

On March 31, 2014, a detonation occurred within a gas heater at Northwest Pipeline Corporation's LNG peak-shaving plant in Plymouth, Washington.¹² This internal detonation subsequently caused the failure of pressurized equipment, resulting in high velocity projectiles. The plant was immediately shut down, and emergency procedures were activated, which included notifying local authorities and evacuating all plant personnel. No members of the public were injured, but one worker was sent to the hospital for injuries. As a result of the incident, the liquefaction trains and a compressor station located onsite were rendered inoperable. Projectiles from the incident also damaged the control building that was located near pre-treatment facilities and penetrated the outer shell of one of the single containment LNG storage tanks. All damaged facilities were ultimately taken out of service for repair. The accident investigation showed that an inadequate purge after maintenance activities resulted in a fuel-air mixture remaining in the system. The fuel-air mixture auto-ignited during startup after it passed through the gas heater at full operating pressure and temperature. To ensure that this potential hazard would be addressed, we recommend in section 4.12.5 that Plaquemines LNG provide a plan for purging, for review and approval, which addresses the requirements of the American Gas Association *Purging Principles and Practice* and to provide justification if not using an inert or non-flammable gas for purging. In evaluating such plans, we would assess whether the purging could be done safely based on review of other plans and lessons learned from this and other past incidents. If a plan proposes the use of flammable mediums for cleaning, dry-out or other activities, we would evaluate the plans against other recommended and generally accepted good engineering practices, such as NFPA 56, *Standard for Fire and Explosion Prevention during Cleaning and Purging of Flammable Gas Piping Systems*. We also recommend in section 4.12.5 that Plaquemines LNG provide, for review and approval, its operating and maintenance plans, including safety procedures, prior to commissioning. In evaluating such plans, we would assess whether the plans cover all standard operations, including purging activities associated with startup and shutdown. Also, in order to prevent other sources of projectiles from affecting occupied buildings and storage tanks, we recommend in section 4.12.5 that Plaquemines LNG incorporate mitigation into their final design with supportive information, for review and approval, that demonstrates it would mitigate the risk of a pressure vessel burst or boiling liquid expanding vapor explosion (BLEVE) from occurring.

4.12.4.2 FERC Preliminary Engineering Review

FERC requires an applicant to provide safety, reliability, and engineering design information as part of its application, including hazard identification studies and front-end-engineering-design (FEED) information for its Project. FERC staff evaluates this information with a focus on potential hazards from within and nearby the site, including external events, which may have the potential to cause damage or failure to the Project facilities, and the engineering design

¹² For a description of the incident and the findings of the investigation, see Root Cause Failure Analysis, Plymouth LNG Plant Incident Investigation under CP14-515.

and safety and reliability concepts of the various protection layers to mitigate the risks of potential hazards.

The primary concerns are those events that could lead to a hazardous release of sufficient magnitude to create an offsite hazard or interruption of service. Furthermore, the potential hazards are dictated by the site location and the engineering details. In general, we consider an acceptable design to include various layers of protection or safeguards to reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public. These layers of protection are generally independent of one another so that any one layer would perform its function regardless of the initiating event or action, or failure of any other protection layer. Such design features and safeguards typically include:

- A facility design that prevents hazardous events, including the use of inherently safer designs; suitable materials of construction; adequate design margins from operating limits for process piping, process vessels, and storage tanks; adequate design for wind, flood, seismic, and other outside hazards;
- Control systems, including monitoring systems and process alarms, remotely-operated control and isolation valves, and operating procedures to ensure that the facility stays within the established operating and design limits;
- Safety instrumented prevention systems, such as safety control valves and emergency shutdown systems, to prevent a release if operating and design limits are exceeded;
- Physical protection systems, such as appropriate electrical area classification, proper equipment and building spacing, pressure relief valves, spill containment, and cryogenic, overpressure, and fire structural protection, to prevent escalation to a more severe event;
- Site security measures for controlling access to the plant, including security inspections and patrols, response procedures to any breach of security, and liaison with local law enforcement officials; and
- Onsite and offsite emergency response, including hazard detection and control equipment, firewater systems, and coordination with local first responders, to mitigate the consequences of a release and prevent it from escalating to an event that could impact the public.

The inclusion of such protection systems or safeguards in a plant design can minimize the potential for an initiating event to develop into an incident that could impact the safety of the offsite public. The review of the engineering design for these layers of protection are initiated in the application process and carried through to the next phase of the Project in final design if authorization is granted by the Commission.

The reliability of these layers of protection are informed by occurrence and likelihood of root causes of past incidents and the potential severity of consequences based on past incidents and validated hazard modeling. As a result of a preliminary engineering review, FERC staff

recommend mitigation measures and continuous oversight to the Commission for consideration to include as requirements in the order. If a facility is authorized and recommendations are adopted as conditions to the order, FERC staff will continue its engineering review through final design, construction, and operation.

4.12.4.3 Process Design

In order to liquefy natural gas, most liquefaction technologies require that the feed gas stream be pre-treated to remove components that could freeze out and clog the liquefaction equipment or would otherwise be incompatible with the liquefaction process or equipment, including H₂S, CO₂, water, and heavy hydrocarbons. Most other designs would also propose a mercury removal system to safeguard their equipment and reduce the likelihood of potential losses of containment because mercury can react with damaging effects with downstream aluminum heat exchangers. While Plaquemines LNG expects the feed gas to be mercury free and mercury concentrations have been generally low in the U.S., mercury concentrations can still exceed typical specified mercury concentration limits for liquefaction facilities and no specific tests for mercury have been carried out to support that mercury does not currently exist in their proposed feed gas sources. Plaquemines LNG proposes to provide space and connections for a future mercury removal unit. To ensure these provisions are provided and feed gas mercury concentrations are monitored, we recommend in section 4.12.5 that Plaquemines LNG provide a means to limit mercury concentrations to less than 0.01 micrograms per normal cubic meter or alternatively provide monitoring for mercury by means of an analyzer, sample connection, or preventative maintenance inspections of the heat exchangers with provisions for a mercury removal package.

The inlet gas would be conditioned to remove solids and water droplets prior to entering feed gas pretreatment processes. Once the inlet gas is conditioned, the feed gas would enter a knockout (KO) drum before flowing to a booster compressor. If the inlet gas pressure is sufficient, the booster compressor would be bypassed and the feed gas would flow through a feed gas heater to ensure the feed gas is at an appropriate temperature prior to entering the non-regenerative H₂S removal beds to remove most of the H₂S. The feed gas would then contact an amine-based solvent solution in the acid gas absorber column to remove acid gas (i.e., CO₂ and trace amounts of H₂S carried over from the H₂S removal beds). Once the acid gas components accumulate in the amine solution, it is routed to an amine regenerator column that utilizes a reboiler to create hot amine vapor. Contact with the hot amine vapor would release the acid gas from the amine solution. The regenerated amine solution would be recycled back to the acid gas absorber column and the removed acid gas would be sent to a thermal oxidizer, where CO₂, trace amounts of H₂S, and trace amounts of hydrocarbons would be incinerated. The treated feed gas exiting the acid gas absorber column then enters the dehydration unit where a dryer inlet separator would recover bulk water and recycle it to the acid gas absorber column. After the dryer inlet separator, any remaining water in the feed gas would be removed in regenerative molecular sieve beds. During the molecular sieve bed regeneration process, heated regeneration gas would remove water from the molecular sieve beds. Water would then be separated from the regeneration gas and would be routed to the acid gas absorber column. The treated gas would then flow to the liquefaction unit.

The Project proposes to install 36 liquefaction trains (2 trains per liquefaction block), each consisting of a brazed aluminum heat exchanger (BAHX). Heavy hydrocarbon removal would be integrated into the liquefaction process. In the initial BAHX pass, the treated feed gas would be

precooled and would flow into a separator to remove the liquids. The vapor portion from the separator would reenter the BAHX and would be desuperheated, condensed, and sub-cooled into LNG. The liquid portion from the separator would flow into the debutanizer to further separate the condensate product (C4+) from the lighter hydrocarbons. The liquid condensate product within the debutanizer would be sent to the condensate system and the lighter hydrocarbons would be returned to the BAHX where it would also be desuperheated, condensed, and sub-cooled into LNG. The condensate product would be sent to the condensate surge drum where the condensate vapors would be directed to the hot oil furnace fuel gas system and the condensate liquids would be vaporized and directed into the hot oil furnace fuel gas system. The LNG exiting the BAHX would flow to the LNG flash vessel before being routed to the LNG storage tanks. In order to achieve the cryogenic temperatures needed to liquefy the natural gas stream in the above process, the gas would be cooled by a thermal exchange process driven by a single mixed refrigerant process comprised of a mixture of nitrogen, methane, ethylene, propane, and i-pentane. Methane would be provided from the BOG system and the other refrigerants required for the liquefaction process would be delivered as a liquid by truck and stored onsite for initial filling and use, as needed, for make-up.

After cooling the natural gas into its liquid form, LNG would be routed to and stored in four full-containment LNG storage tanks. During export operations, LNG stored within the LNG storage tanks would be sent out through multiple in-tank pumps (the pump discharge piping would penetrate through the roof and is an inherently safer design when compared to penetrating the side of an LNG storage tank). The LNG would flow through a marine transfer line and multiple liquid marine transfer arms connected to a LNG carrier. In order to keep the marine transfer line cold between LNG export cargoes, a recirculation line would be provided so that the marine transfer line would not have to be cooled down prior to every LNG carrier loading operation. The LNG transferred to the LNG carriers would displace vapors from the LNG carriers, which would be sent back through a vapor marine transfer arm and vapor return line to the BOG header. Once loaded, the LNG carrier would be disconnected and leave for export.

Low pressure BOG generated from stored LNG (LNG is continuously boiling) as well as vapors returned during LNG carrier filling operations would be compressed and be routed to the fuel gas system. The closed BOG system would prevent the release of BOG to the atmosphere and would be in accordance with NFPA 59A. This would be an inherently safer design when compared to allowing the BOG to vent to the atmosphere.

In addition, the Project would include many utilities and associated auxiliary equipment. The major auxiliary systems required for the operation of the liquefaction facility include fuel gas, hot oil, flares, instrument and utility air, water, demineralized water, steam, nitrogen, and power generation. Hot oil would be used to provide the heat to the inlet feed gas heater, amine regenerator reboilers, regeneration gas heaters, debutanizer reboilers, condensate vaporizers, and fuel gas heaters. There would be three flare systems: warm (wet), cold (dry), and low pressure flares. Each system would be routed to a separate flare stack and would be designed to handle the vent gases from the process areas. Diesel would be stored in a dedicated tank to supply the backup power generators as well as in double walled daytanks for each diesel firewater pump. Gas turbine generators would provide electric power to the site. In addition, aqueous ammonia would be used in the selective catalytic removal process to reduce the NOx emissions created during power

generation. Liquid nitrogen vaporizers would be used to supply gaseous nitrogen for various uses in the plant including pre-commissioning, start-up, and refrigerant make-up.

The failure of process equipment could pose potential harm if not properly safeguarded through the use of appropriate engineering controls and operation. Plaquemines LNG would install process control valves and instrumentation to safely operate and monitor the facilities. Alarms would have visual and audible notification in the control room to warn operators that process conditions may be approaching design limits. We recommend Plaquemines LNG design their control systems and human machine interfaces to the International Society for Automation (ISA) Standards 5.3, 5.5, 60.1, 60.3, 60.4, and 60.6, and other standards and recommended practices. We recommend in section 4.12.5 that Plaquemines LNG develop and implement an alarm management program, for review and approval to ensure the effectiveness of the alarms. FERC staff will evaluate the alarm management program against recommended and generally accepted good engineering practices, such as ISA Standard 18.2.

Operators would have the capability to take action from the control room to mitigate an upset. Plaquemines LNG would develop facility operation procedures after completion of the final design; this timing is fully consistent with accepted industry practice. We recommend in section 4.12.5 that Plaquemines LNG provide more information, for review and approval, on the operating and maintenance procedures, including safety procedures, hot work procedures and permits, abnormal operating conditions procedures, and personnel training prior to commissioning. We will evaluate these procedures to ensure that an operator can operate and maintain all systems safely, based on benchmarking against other operating and maintenance plans and comparing against recommended and generally accepted good engineering practices, such as American Institute of Chemical Engineers (AIChE) Center for Chemical Process Safety (CCPS), *Guidelines for Writing Effective Operating and Maintenance Procedures*, AIChE CCPS *Guidelines for Management of Change for Process Safety*, AIChE CCPS, *Guidelines for Effective Pre-Startup Safety Reviews*, AGA, *Purging Principles and Practices*, and NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*. In addition, we recommend in section 4.12.5 that Plaquemines LNG tag and label instrumentation and valves, piping, and equipment and providing car-seals/locks to address human factor considerations and improve facility safety and prevent incidents.

In the event of a process deviation, ESD valves and instrumentation would be installed to monitor, alarm, shutdown, and isolate equipment and piping during process upsets or emergency conditions. The Project would have a plant-wide ESD system to initiate closure of valves and shutdown of the process during emergency situations. Furthermore, each Liquefaction block would have the individual shutdown capability to address local emergency conditions. Safety-instrumented systems would comply with ISA Standard 84.00.01 and other recommended and generally accepted good engineering practices. We recommend in section 4.12.5 that Plaquemines LNG file information, for review and approval, on the final design, installation, and commissioning of instrumentation and emergency shutdown equipment to ensure appropriate cause-and-effect alarm or shutdown logic and enhanced representation of the emergency shutdown system in the plant control room and throughout the plant.

In developing the FEED, Plaquemines LNG conducted a hazard identification review to identify potential hazards (both safety and environmental) associated with the facility location, site

layout, process design, marine operations, simultaneous operations, and construction. In the application, Plaquemines LNG stated that a preliminary process hazard review was under development and would be submitted at a later date. Therefore, we recommended in the draft EIS for Plaquemines LNG to provide a preliminary process hazard review for review prior to the end of the draft EIS comment period. As comments to the draft EIS, Plaquemines LNG indicated that they previously filed the process hazard review. Plaquemines LNG conducted a HAZID based on the PFDs, HMBs, and plot plan of the facility using a risk matrix based on severity of consequences and likelihood. There were some inconsistencies in severity of consequences and frequency of likelihoods, but, more importantly, resolution or recommendations were not fully demonstrated. For example, in some high risk scenarios, Plaquemines LNG indicated that safeguards were provided, but did not indicate what the safeguards were (e.g., 2.20), Plaquemines LNG did not provide supportive documentation for some of the resolutions (e.g., 1.73), and Plaquemines LNG indicated some of the resolutions would be completed in final design (e.g., 6.03/6.04). Therefore, we recommend in section 4.12.5 that Plaquemines LNG demonstrate the recommendations to the HAZID have all been resolved and reflected in the final design and include any supportive documentation on the safeguards added.

A more detailed hazard and operability review (HAZOP) analysis would be performed by Plaquemines LNG during the final design to identify the major process hazards that may occur during the operation of the facilities. The HAZOP study would be intended to address hazards of the process, engineering and administrative controls and would provide a qualitative evaluation of a range of possible safety, health, and environmental consequences that may result from the process hazard, and identify whether there are adequate safeguards (e.g., engineering and administrative controls) to prevent or mitigate the risk from such events. Where insufficient engineering or administrative controls were identified, recommendations to prevent or minimize these hazards would be generated from the results of the HAZOP review. We recommend in section 4.12.5 that Plaquemines LNG file the HAZOP study on the completed final design for review and approval. We will evaluate the HAZOP to ensure all systems and process deviations are addressed appropriately based on likelihood, severity and risk values with commensurate layers of protection in accordance with recommended and generally accepted good engineering practices, such as American Institute of Chemical Engineers, *Guidelines for Hazard Evaluation Procedures*. We also recommend in section 4.12.5 that Plaquemines LNG file the resolutions of the recommendations generated by the HAZOP review so that FERC staff can monitor these resolutions. Once the design has been subjected to a HAZOP review, the design development team would track, manage, and keep records of changes in the facility design, construction, operations, documentation, and personnel. Plaquemines LNG would evaluate these changes to ensure that the safety, health, and environmental risks arising from these changes are addressed and controlled based on its management of change procedures. We also recommend in section 4.12.5 that Plaquemines LNG file all changes to their FEED for our review and approval. However, major modifications could require an amendment or new proceeding.

If the Project is authorized and constructed, Plaquemines LNG would install equipment in accordance with its design. We recommend in section 4.12.5 that the Project facilities be subject to construction inspections and that Plaquemines LNG provide, for review and approval, commissioning plans, procedures and commissioning demonstration tests that would verify the performance of equipment. In addition, we recommend in section 4.12.5 that Plaquemines LNG provide semi-annual reports that include abnormal operating conditions and facility modifications.

Furthermore, we recommend in section 4.12.5 that the Project facilities be subject to regular inspections throughout the life of the facilities to verify that equipment is being properly maintained and to verify basis of design conditions, such as feed gas and sendout conditions, do not exceed the original basis of design.

4.12.4.4 Mechanical Design

Plaquemines LNG provided codes and standards for the design, fabrication, construction and installation of piping and equipment and specifications for the facility. The design specifies materials of construction and ratings suitable for the pressure and temperature conditions of the process design. Piping would be designed, fabricated, assembled, erected, inspected, examined, and tested in accordance with the ASME Standards B31.1, B31.3, B31.8, B36.10, and B36.19M. Valves and fittings would be designed to standards and recommended practices such as API Standards 594, 598, 600, 602, 607, and 609; ASME Standards B16.5, B16.9, B16.10, B16.11, B16.20, B16.21, B16.25, B16.34, B16.47, B16.48; and ISA Standard 75.08.01. Portions of the facility regulated under 33 CFR 127 for the marine transfer system, including piping, hoses, and loading arms should also be tested in accordance with 33 CFR 127.407.

Pressure vessels must be designed, fabricated, inspected, examined, and tested in accordance with ASME Boiler and Pressure Vessel Code (BPVC) Section VIII and must be code-stamped per NFPA 59A (2001 edition), as incorporated by 49 CFR 193, Subparts C, D, and E. LNG storage tanks must be designed, fabricated, tested, and inspected in accordance with 49 CFR 193, Subpart D, NFPA 59A (2001 and 2006), and API 620. In addition, Plaquemines LNG would design, fabricate, test, and inspect the full containment LNG storage tanks in accordance with API 625 and ACI 376. Other low-pressure storage tanks such as the amine, and condensate storage tanks, would be designed, inspected, and maintained in accordance with the API Standards 650 and 653. All LNG storage tanks would also include boil-off gas compression to prevent the release of boil-off to the atmosphere in accordance with NFPA 59A (2001) for an inherently safer design. Heat exchangers would be designed to ASME BPVC Section VIII standards; API Standards 530, 660, and 661; and the Tubular Exchanger Manufacturers Association standards. Rotating equipment would be designed to standards and recommended practices, such as API Standards 610, 611, 612, 613, 614, 616, 617, 618, 619, 670, 671, 672, 675, and 682; and ASME Standards B73.1 and B73.2. Fired heaters would be specified and designed to standards and recommended practices, such as API Standards 556 and 560.

Pressure and vacuum safety relief valves and flares would be installed to protect the storage containers, pressure vessels, process equipment, and piping in the event of an unexpected vapor release or uncontrolled pressure excursion. The safety relief valves would be designed to handle process upsets and thermal expansion, per NFPA 59A (2001), ASME Standard B31.3, and ASME BPVC Section VIII; and would be designed in accordance with API Standards 520, 521, 526, 527, and 2000; and other recommended and generally accepted good engineering practices. In addition, the operator should verify the set pressure of the pressure relief valves meet the requirements in 33 CFR 127.407. We recommend in section 4.12.5 Plaquemines LNG provide final design information on pressure and vacuum relief devices and flares, for review and approval, to ensure that the final sizing, design, and installation of these components are adequate and in accordance with the standards reference and other recommended and generally accepted good engineering practices.

Although many of the codes and standards were listed as ones the Project would meet, Plaquemines LNG did not make reference to all codes and standards required by regulations (e.g., NFPA 51B) or are recommended and generally accepted good engineering practices. In addition, they were not consistently reflected in any specifications or data sheets reviewed. Therefore, we recommend in section 4.12.5 that Plaquemines LNG provide the final specifications for all equipment and a cross referenced list of all codes and standards for review and approval. If the Project is authorized and constructed, Plaquemines LNG would install equipment in accordance with its design and FERC staff would verify equipment nameplates to ensure equipment is installed based on approved design and conduct construction inspections including reviewing quality assurance and quality control plans to ensure construction work is performed according to Project specifications, procedures, codes and standards. We recommend in section 4.12.5 Plaquemines LNG provide semi-annual reports that include equipment malfunctions and abnormal maintenance activities. In addition, we recommend in section 4.12.5 that the Project facilities be subject to inspections throughout the life of the facility to verify that the plant equipment is properly maintained.

4.12.4.5 Hazard Mitigation Design

If operational control of the facilities were lost and operational controls and emergency shutdown systems failed to maintain the Project within the design limits of the piping, containers, and safety relief valves, a release could potentially occur. FERC regulations under 18 CFR 380.12 (o) (1) through (4) require applicants to provide information on spill containment, spacing and plant layout, hazard detection, hazard control, and firewater systems. In addition, 18 CFR 380.12 (o) (7) require applicants to provide engineering studies on the design approach and 18 CFR 380.12 (o) (14) requires applicants to demonstrate how they comply with 49 CFR 193 and NFPA 59A (2001). As required by 49 CFR 193 Subpart I and by incorporation section 9.1.2 of NFPA 59A (2001), fire protection must be provided for all DOT regulated LNG plant facilities based on an evaluation of sound fire protection engineering principles, analysis of local conditions, hazards within the facility, and exposure to or from other property. NFPA 59A (2001) also requires a fire protection evaluation to determine the type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, and emergency response equipment, training, and qualifications.

If authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193, Subpart I and would be subject to DOT's inspection and enforcement programs. However, NFPA 59A (2001) also indicates the wide range in size, design, and location of LNG facilities precludes the inclusion of detailed fire protection provisions that apply to all facilities comprehensively and includes subjective performance-based language on where ESD systems and hazard control are required and does not provide any additional guidance on placement or selection of hazard detection equipment and provides minimal requirements on firewater. Also, the marine facilities would be subject to 33 CFR 127, which incorporates sections of NFPA 59A (1994), which have similar performance-based guidance. Therefore, we evaluated the proposed spill containment and spacing, hazard detection, emergency shutdown and depressurization systems, hazard control, firewater coverage, structural protection, and onsite and offsite emergency response to determine whether they would provide adequate protection of the LNG facilities as described more fully below.

Plaquemines LNG performed a preliminary fire protection evaluation to ensure that adequate mitigation would be in place, including spill containment and spacing, hazard detection, emergency shutdown and depressurization systems, hazard control, firewater coverage, structural protection, and onsite and offsite emergency response. We evaluated the fire protection evaluation and recommend in section 4.12.5 that Plaquemines LNG provide a final fire protection evaluation for review and approval, and to provide more information on the final design, installation, and commissioning of spill containment, hazard detection, hazard control, firewater systems, structural fire protection, and onsite and offsite emergency response procedures for review and approval.

Spill Containment

In the event of a release, sloped areas at the base of storage and process facilities would direct a spill away from equipment and into the impoundment system. This arrangement would minimize the dispersion of flammable vapors into confined, occupied, or public areas and minimize the potential for heat from a fire to impact adjacent equipment, occupied buildings, or public areas if ignition were to occur.

Title 49 CFR 193.2181, under Subpart C specifies that each impounding system serving an LNG storage tank must have a minimum volumetric liquid capacity of 110 percent of the LNG tank's maximum design liquid capacity for an impoundment serving a single tank, unless surge is accounted for in the impoundment design. If authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193, Subpart C and would be subject to DOT's inspection and enforcement programs. For full containment LNG tanks, we also consider it prudent to provide a barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property). The purpose of the barrier is to prevent liquid from flowing off the plant property and does not define containment or an impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements already met by sumps and impoundments throughout the site. Plaquemines LNG proposes four (two constructed during phase 1, two constructed during phase 2) full-containment LNG storage tanks for which the outer tank wall would serve as the impoundment system. We verified that the LNG storage tank's outer concrete wall would have a liquid capacity of at least 110 percent of the inner LNG tank's maximum liquid capacity. In addition, Plaquemines LNG would also install a berm (i.e., 26-foot storm surge barrier) around the facility, which would prevent liquid in the storage tank area from flowing off-site in the event of an outer tank impoundment failure. We recommend in section 4.12.5 that Plaquemines LNG should provide an evaluation prior to construction of final design that demonstrates the storm surge barrier, including any gated areas and water discharge through the storm surge barrier, would prevent LNG from extending offsite in the event of a release of the full contents of a LNG storage tank. The evaluation should also demonstrate whether and how high the sheet piles would need to be protected from embrittlement.

Plaquemines LNG proposes to install an LNG Transfer Area Spill Impoundment Basin located between the LNG storage tanks that would collect a spill from the LNG transfer lines in the storage tank area. Plaquemines LNG proposes to install an LNG Spill Impoundment Basins located in each of the marine berth areas that would collect a potential spill from the LNG lines at the berth. Between these LNG tank and berth areas, Plaquemines LNG proposes to install a stainless-steel outer pipe to collect spills from the LNG transfer lines. In response to the draft EIS, Plaquemines LNG commented on the recommendation requiring spill containment for the entire

length of the pipe-in-pipe system between the LNG storage tanks and the marine berth area. They said they disagree with this recommendation because the outer pipe in the pipe-in-pipe design serves as the containment/conveyance system so there would be no need for a spill containment trough. We do not agree with Plaquemines LNG's comment that the pipe-in-pipe design is sufficient in this particular case given the proximity of the LNG transfer lines to SH 23 and potential risk to the public. Therefore, we still recommend that containment be provided for this entire pipe-in-pipe system. We also recommend that where the piping system would cross over SH 23, the containment should be designed to withstand collisions or explosions, as discussed under the "Road" heading in the External Impact Review section, and also be demonstrated to withstand and capture the range of potential releases up to the full pipe diameter, considering the sudden cryogenic temperatures and the pressures of the releases. We also recommend in section 4.12.5 that the final design details of the pipe-in-pipe system be filed for review and approval.

In addition, Plaquemines LNG proposes to install a Process Area LNG Impoundment Basin near each of the two liquefaction trains to collect a potential spill from the liquefaction equipment and piping. Parts of the spill conveyance system are proposed to be constructed of steel, which would also need to be demonstrated to withstand the sudden cryogenic temperatures and pressures of the full range of potential spills, as steel typically needs a gradual cooldown to be prepared to handle cryogenic fluids. Plaquemines LNG would also provide a Refrigerant Impoundment Basin designed to contain a spill from the refrigerant storage tanks and refrigerant truck transfer area. Diked or curbed impoundments would be provided for each of the solvent, hot oil, diesel and aqueous ammonia storage tanks, as well as the diesel/hot oil truck transfer area. FERC staff was not able to verify the provision of containment for all significant amounts of hazardous liquids, such as for the condensate process area, liquid nitrogen storage area, the aqueous ammonia truck transfer area, and other hazardous fluid facilities. We recommend in section 4.12.5 that Plaquemines LNG provide additional information on the final design of the impoundment systems for review and approval.

Under NFPA 59A (2001) section 2.2.2.2, for all of DOT regulated facilities under 49 CFR 193, Subpart C, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume that can be discharged from any single accidental leakage source during a 10-minute period or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the DOT. If authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193, Subpart C and would be subject to DOT's inspection and enforcement programs. The impoundment system design for the marine facilities would be subject to the USCG's 33 CFR 127, which does not specify a spill or duration for impoundment sizing. However, FERC staff evaluated whether all hazardous liquids are provided with spill containment and whether they would be sized based on the largest flow capacity from a single pipe for 10 minutes plus de-inventory volumes or the capacity of the largest vessel served, whichever is greater and whether providing spill containment reduces consequences from a release. Some of the proposed impoundment system details appear to need clarification or adjustment during the final design phase, including but not limited to: calculation of the total sizing spill for the ship transfer header considering all pumps in both LNG tanks at pump run-out rates unless an adequate mechanism is proposed to prevent this; sizing of troughs to include the total pump run out flow volumes; clarification of the design of the spill conveyance from the pipe rack to grade at road crossings; clarification of maximum liquid levels for vessels and tanks; calculation of usable impoundment volumes considering only the depth

under any trough intersection and considering the volume used by any foundations and equipment; and technical justification for any hazardous liquid tank impoundments sized for less than the maximum liquid inventory of the tank. We would verify adequate sizing of the final containment design during our final design review, based on our recommendation in section 4.12.5 for review and approval of the final details. In addition, Plaquemines LNG proposes a shorter spill duration for sizing the marine impoundments, which it attempts to justify based on demonstrable surveillance and shutdown provisions. FERC staff reviewed this justification and recommends that Plaquemines LNG provides spill containment of a 10-minute duration given the potential consequences of overflowing the spill containment.

FERC staff also generally evaluate the means to remove water and snow from impounding areas to ensure impoundment volumes would not be reduced through accumulations of rainwater or snow. In addition, FERC staff generally evaluate whether there are provisions to ensure that hazardous fluids are not accidentally discharged through the systems intended to remove rainwater or snow. In addition, if authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. Plaquemines LNG indicated that the stormwater removal pumps for the LNG and refrigerant impoundments would be automatically regulated to remove rainwater and would be interlocked using low temperature and gas detectors to automatically shut off or prevent the pumps from operating when exposed to LNG or refrigerant temperatures or flammable gases. Plaquemines LNG would need to verify that the applicable sump pumps for DOT regulated impoundments meet the automatic shutdown controls and water removal requirements specified in 49 CFR 193, Subpart C. In addition, the curbed or diked impoundments are proposed to be equipped with a drain line and external isolation valve. Plaquemines LNG indicates that the drain valve would remain in the closed position at all times except for supervised drainage. We recommend that Plaquemines LNG consult with DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) on compliance with 49 CFR 193 for the water removal design using drains. If authorized, constructed, and operated, , final compliance with the requirements of 49 CFR 193, Subpart C would be subject to DOT's inspection and enforcement programs.

If the Project is authorized, constructed, and operated, Plaquemines LNG would install spill impoundments in accordance with its design and FERC staff would verify during construction inspections that the spill containment system including dimensions, and slopes of curbing and trenches, and capacity matches final design information. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facility to verify that impoundments are being properly maintained.

Spacing and Plant Layout

The spacing of vessels and equipment between each other, from ignition sources, and to the property line must meet the requirements of 49 CFR 193 Subparts C, D, and E, which incorporate NFPA 59A (2001). NFPA 59A (2001) includes requirements for spacing and plant layout further references NFPA Standards 30, NFPA 58, and NFPA 59 for additional spacing and plant layout requirements. If authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs.

In addition, we evaluated the spacing to determine if there could be cascading damage and to inform what fire protection measures may be necessary to reduce the risk of cascading damage. If it was not practical for spacing to mitigate the potential for cascading damage, FERC staff evaluated whether other mitigation measures were in place and evaluated those systems in further detail as discussed in subsequent sections in section 4.12.4.4. We evaluated the spacing of buildings in line with AIChE CCPS, *Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires*, API 752 and API 753, which provide guidance on identifying and evaluating explosion and fire impacts to buildings and occupants resulting from events external to the buildings. In addition, FERC staff evaluated other hazards associated with releases and whether any damage would likely occur at buildings or would result in cascading damage.

To minimize the risk of cryogenic spills causing structural supports and equipment from cooling below their minimum design metal temperature, Plaquemines LNG would generally locate cryogenic equipment away from noncryogenic process areas and would direct cryogenic releases to remote impoundment basins. In addition, for areas that would have cryogenic equipment and could be exposed to cryogenic temperatures, Plaquemines LNG would insulate structural steel and pipe racks or use materials of construction suitable for cryogenic temperatures, as discussed under Passive Cryogenic and Fire Protection.

To minimize risk for flammable or toxic vapor ingress into buildings and combustion air intakes, Plaquemines LNG would generally locate buildings away from process areas and would generally locate fired equipment and ignition sources away and generally upwind from process areas. Plaquemines LNG provided hazard analysis using two different software models that show flammable and toxic vapor dispersion would not reach their administration building, control room building, workshop building, or essential diesel generators, but may reach their warehouse building, various substations, and various equipment with air intakes. We note that in the case of one of the software packages, not all wind directions were considered for all release scenarios that could cause the flammable vapors to reach the administration building, control room building, or workshop building, or essential diesel generators. Therefore, we recommend in section 4.12.5 that Plaquemines LNG conduct a technical review of facility, for review and approval, identifying all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and verify that these areas would be adequately covered by hazard detection devices that would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.

To minimize flammable vapors reaching areas that could result in cascading damage from explosions, Plaquemines LNG proposed design of the process facilities minimizes confinement and congestion with the exception of a few areas described. In particular, we evaluated how flammable vapors would be prevented from accumulating within confined areas, such as underneath the LNG storage tanks. The LNG storage tanks would be located away from process equipment. However, Plaquemines LNG provided hazard analyses that showed that flammable vapor releases could disperse underneath the elevated LNG storage particularly for releases near the base of the tank. We recommend in section 4.12.5 that Plaquemines LNG file an analysis, for review and approval, to demonstrate that the flammable vapor dispersion from design spills would be prevented from dispersing underneath the elevated LNG storage tanks or detail how the LNG storage tanks would be able to withstand an overpressure due to ignition of the flammable vapors that disperse underneath the elevated LNG storage tanks. We also evaluated overpressures from

vapor cloud explosions at buildings, emergency equipment and the LNG storage tanks and refrigerant storage vessels. Plaquemines LNG provided hazard analyses that showed that overpressures would not exceed 1 psi at any of these structures, and they would also mound the refrigerant storage vessels.

To minimize the risk of pool fires from causing cascading damage that could exacerbate the initial hazard, Plaquemines LNG would generally locate spill impoundments such that the radiant heats would have a minimal impact on most areas of the plant. A pool fire from the LNG storage tank roof would result in less than 4,000 Btu/ft²-hr in most other areas of the plant with the exception of the BOG compressor area and northern portions of the liquefaction blocks. In addition, a pool fire at the proposed LNG Storage Tank Process Area Sump located between the four LNG storage tanks would result in high radiant heats at elevated pipe racks and troughs; a pool fire from the LNG marine impoundments would result in high radiant heats at the marine platforms; and a pool fire from the refrigerant impoundment would result in high radiant heats at adjacent process equipment, such as the plant air system, refrigerant storage vessels, process vessels, and pipe racks. To mitigate these radiant heat impacts from pool fires, the BOG compressors would be within shelters and the refrigerant storage vessels would be mounded. In addition, the liquefaction blocks, pipe racks, marine platforms, and other process areas would have passive structural protection, firewater monitors and deluge systems as described under firewater systems. There would also be emergency shutdown systems to minimize the volume and duration of releases.

To minimize the risk of pool fires from causing cascading damage that could exacerbate the initial hazard, Plaquemines LNG would generally locate flammable and combustible fluid-containing piping and equipment away from buildings and process areas that do not handle flammable and combustible materials. Jet fires would result in less than 1,600 Btu/ft²-hr at the administration building, control room building, warehouse building, and workshop. However in areas that handle flammable and combustible fluids, jet fire distances to 4,000 Btu/ft²-hr and 4,900 Btu/ft²-hr levels from piping and equipment could impact other components handling or supporting hazardous fluids. To mitigate jet fires within the plant, Plaquemines LNG indicates that measures would be in place to prevent cascading events, including fire-safe ESD valves with fire resistant instrument and power cabling, depressurization systems, fire and gas detectors, fire proofing of structural steel columns supporting critical equipment, deluge systems, water curtains, cellular foam blocks, and fire monitors and hydrants. However, details of these systems would be developed in the final design. We recommend in section 4.12.5 that Plaquemines LNG provide the final design of these thermal mitigation measures, for review and approval, to demonstrate cascading events would be mitigated. In addition, we recommend in section 4.12.5 that Plaquemines LNG provide an analysis, for review and approval, demonstrating the adjacent LNG storage tank can withstand the radiant heat from which it would be exposed from a LNG storage tank roof fire.

We also recommend in section 4.12.5 that Project facilities be subject to periodic inspections during construction to verify flammable/toxic gas detection equipment is installed in heating, ventilation and air condition intakes of buildings at appropriate locations. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facilities to continue to verify that flammable/toxic gas detection equipment installed in building air intakes function as designed and are being maintained and calibrated.

If the Project is authorized, Plaquemines LNG would finalize the plot plan, and we recommend in section 4.12.5 that Plaquemines LNG provide any changes for review and approval to ensure capacities and setbacks are maintained. If the facilities are constructed, Plaquemines LNG would install equipment in accordance with the spacing indicated on the plot plans, and we recommend in section 4.12.5 that Project facilities be subject to periodic inspections during construction to verify equipment is installed in appropriate locations and the spacing is met in the field. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facilities to continue to verify that equipment setbacks from other equipment and ignition sources are being maintained during operations.

Ignition Controls

Plaquemines LNG's plant areas would be designated with an appropriate hazardous electrical classification and process seals commensurate with the risk of the hazardous fluids being handled in accordance with NFPA 59A (2001), NFPA 70, and API RP 500. If authorized, constructed, and operated, LNG facilities, as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs, which require compliance, by incorporation by reference, with NFPA 59A (2001) and NFPA 70 (1999). The marine facilities must comply with similar electrical area classification requirements of NFPA 59A (1994) and NFPA 70 (1993), which are incorporated by reference into the USCG regulations in 33 CFR 127. Depending on the risk level, these areas would either be unclassified or classified as Class 1 Division 1, or Class 1 Division 2. Electrical equipment located in these areas would be designed such that in the event a flammable vapor is present, the equipment would have a minimal risk of igniting the vapor. We evaluated the Plaquemines LNG electrical area classification drawings to verify whether the Project would generally meet the electrical area classification requirements in NFPA 59A, 70, 497, and API RP 500 and found that some revisions would be needed to properly implement these classification areas, including but not limited to, illustrating Class 1 Division 1 and Division 2, as applicable, at all impoundment trenches, the LNG ship transfer connection, refrigerant truck transfer connection, diesel truck transfer connection, diesel and other combustible tank vents, power plant area, gas turbines, feed gas aftercoolers, mixed refrigerant (MR) coolers, and pig launchers. If the Project is authorized, Plaquemines LNG would finalize the electrical area classification drawings and would describes changes made from the FEED design. We recommend in section 4.12.5 that Plaquemines LNG file the final design of the electrical area classification drawings for review and approval. If facilities are constructed, Plaquemines LNG would install appropriately classed electrical equipment, and we recommend in section 4.12.5 that Project facilities be subject to periodic inspections during construction for FERC staff to spot check electrical equipment and verify equipment is installed per classification and are properly bonded or grounded in accordance with NFPA 70. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facility to ensure electrical equipment is maintained (e.g., bolts on explosion proof equipment properly installed and maintained, and panels provided with purge), and electrical equipment are appropriately de-energized and locked out and tagged out when being serviced.

In addition, submerged electric motor pumps and instrumentation that have a direct interface with a flammable fluid must be equipped with electrical process seals, and leak detection in accordance with NFPA 59A (2001) and NFPA 70 at each interface between a flammable fluid system and an electrical conduit or wiring system. We recommend in section 4.12.5 that

Plaquemines LNG provide, for review and approval, final design drawings showing process seals installed at the interface between a flammable fluid system and an electrical conduit or wiring system that meet the requirements of NFPA 59A (2001) and NFPA 70. In its application, Plaquemines LNG describes an electrical process seal design that may not “continuously vent to atmosphere” as required by NFPA 59A section 7.6.3.4. The design may also not detect a range of leak sizes through either side of the seal. Therefore, our recommendation includes language indicating that Plaquemines LNG should provide the results of consultation with DOT PHMSA indicating that the proposed electrical process seal design would be considered to meet the design requirements of NFPA 59A (2001), as incorporated by 49 CFR 193.2101, and that Plaquemines LNG should provide a means to detect a range of leak sizes in either side of the seal. In addition, we recommend in section 4.12.5 that Plaquemines LNG file, for review and approval, details of an air gap or vent equipped with a leak detection device that should continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facility to ensure electrical process seals for submerged pumps continue to conform to NFPA 59A and NFPA 70 and that air gaps are being properly maintained.

Hazard Detection, Emergency Shutdown, and Depressurization Systems

Plaquemines LNG would also install hazard detection systems to detect cryogenic spills, flammable and toxic vapors, and fires. The hazard detection systems would alarm and notify personnel in the area and control room to initiate an emergency shutdown, depressurization, or initiate appropriate procedures, and would meet NFPA Standard 72, ISA Standard 12.13.01, *Performance Requirements for Combustible Gas Detectors*, and other recommended and generally accepted good engineering practices. However, we note that Plaquemines LNG does not make reference to other recommended and generally accepted good engineering practices in their codes and standards list or data sheets, such as ISA 60079-29-2 or ISA 12.13.02, *Recommended Practice for the Installation, Operation and Maintenance of Combustible Gas Detection Instruments*, ISA 12.13.04, *Performance Requirements for Open Path Combustible Gas Detectors*, ISA 12.15.01, *Performance Requirements for Hydrogen Sulfide Detection Instruments*, ISA 12.15.02, *Installation, Operation and Maintenance of Hydrogen Sulfide Detection Instruments*, ISA 92.00.01, *Performance Requirements for Toxic Gas Detectors*, ISA 92.00.02, *Installation, Operation, and Maintenance of Toxic Gas-Detection Instruments*, ISA 92.04.01, *Performance Requirements for Instruments Used to Detect Oxygen Deficient/Oxygen Enriched Atmospheres*, and ISA 92.04.02, *Installation, Operation, and Maintenance of Instruments Used to Detect Oxygen Deficient/Oxygen Enriched Atmospheres*. In addition, Plaquemines LNG did not include a specification for hazard detection. Therefore, we recommend in section 4.12.5 that Plaquemines LNG provide specifications, for review and approval, of the final design of fire safety specifications, including hazard detection, hazard control, and firewater systems to verify it would meet these and other recommended and generally accepted good engineering practices, or equivalents. We also recommend in section 4.12.5 that Plaquemines LNG file a list of final hazard detection equipment, including the selected manufacturer and model that would allow FERC staff to verify whether it would generally meet these and other recommended and generally accepted good engineering practices, or equivalents.

We evaluated the adequacy of the general hazard detection type, location and layout to ensure adequate coverage to detect cryogenic spills, flammable and toxic vapors, and fires near potential release sources or in spill containment systems (i.e., pumps, compressors, sumps, trenches, flanges, and instrument and valve connections). Plaquemines LNG submitted spill containment drawings that show all LNG and refrigerant impoundments and trenches would include low temperature detection. In addition, Plaquemines LNG would have ammonia detectors. However, it was unclear if a number of other hazard detectors, such as low oxygen, hydrogen, and smoke detectors would be installed due to conflicting information. For example, Plaquemines LNG indicated in its hazard analyses that low oxygen detectors would be installed near the liquid nitrogen vessel, but they were not shown in its hazard detection drawings, hazard detection matrix, or described in the hazard detection basis of design. In addition, Plaquemines LNG indicated in its hazard detection basis of design that hydrogen gas detectors would be installed in battery rooms, but they were not shown in its hazard detection drawings, hazard detection matrix, or described in the hazard analyses. Other discrepancies existed for flammable gas detection at air intakes of equipment and HVAC intakes of buildings. As a result of that review, we recommend in section 4.12.5 that additional hazard detection be placed throughout the plant and supported by a performance based study in accordance with ISA 84.00.07 or equivalent methodologies, including near the diesel and hot oil tanks, steam turbine power plant, flare KO drums, ethylene packages, peaking generator, essential diesel generator, acid gas removal area, hot oil furnaces, thermal oxidizer, combustion air intakes and heating, ventilating, and air conditioning (HVAC) intakes of buildings. This evaluation would need to demonstrate that 90 percent or more of releases (unignited and ignited) that could result in an offsite or cascading impact would be detected by two or more detectors and result in isolation and de-inventory within 10 minutes. The analysis should take into account the set points, voting logic, wind speeds, and wind directions. We recommend in section 4.12.5 that Plaquemines LNG provide additional information, for review and approval, on the final design of all hazard detection systems (e.g., manufacturer and model, elevations, etc.) and hazard detection layout drawings.

We also reviewed the fire and gas cause and effect matrices to evaluate the detectors that would initiate an alarm, shutdown, depressurization, or other action based on the FEED. The fire and gas system cause and effect matrices only indicate shutdowns in the marine area and do not show any other shutdowns, such as for detection of flammable gas at the HVAC intake or equipment air intakes or shutdown of a sump pump upon detection of low temperature. Therefore, we recommend in section 4.12.5 that Plaquemines LNG provide final fire and gas cause and effects for review and approval. In addition, we recommend ESD pushbutton drawings of the final design be provided that demonstrate there is sufficient pushbuttons in each process area.

If authorized, constructed, and operated, Plaquemines LNG would install hazard detectors according to its final specifications and drawings, and we recommend in section 4.12.5 that Project facilities be subject to periodic inspections during construction to verify hazard detectors and ESD pushbuttons are appropriately installed per approved design and functional based on cause and effect matrixes prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facility to verify hazard detector coverage and functionality is being maintained and are not being bypassed without appropriate precautions.

Hazard Control

If ignition of flammable vapors occurred, hazard control devices would be installed to extinguish or control incipient fires and releases. Plaquemines LNG indicates hazard control layout and design would meet NFPA 59A (2001); NFPA 10, 12, 15, 17, and 2001; API 2510A; as well as other recommended and generally accepted good engineering practices. We evaluated the adequacy of the number and availability of handheld, wheeled, and fixed fire extinguishing devices throughout the site based on the FEED. We also evaluated whether the spacing of the fire extinguishers meet NFPA 10 and agent type and capacities meet NFPA 59A (2009 and later editions). In addition, we evaluated whether clean agent systems would be installed in all electrical switchgear, and instrumentation buildings systems in accordance with NFPA 2001 and CO₂ systems in gas turbine enclosures in accordance with NFPA 12. Based on those reviews, we recommend in section 4.12.5 that CO₂ systems be installed in gas turbine enclosures in accordance with NFPA 12, portable extinguishers be provided near the metering station and pig launchers, and portable extinguishers be provided at the top of all tanks. We also recommend additional portable extinguishers be provided in the liquefaction blocks in accordance with travel distances of NFPA 10. Additionally, we recommend Plaquemines LNG provide portable extinguishers in all buildings in accordance with NFPA 10 and include clean agent systems in buildings housing instrumentation in accordance with NFPA 2001. In addition, we recommend in section 4.12.5 that Plaquemines LNG file additional information on the final design of these systems, for review and approval, where details are yet to be determined (e.g., manufacturer and model, elevations, flowrate, capacities, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project.

If authorized, constructed, and operated, Plaquemines LNG would install hazard control equipment, and we recommend in section 4.12.5 that Project facilities be subject to periodic inspections during construction to verify hazard control equipment is installed in the field and functional prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facility to verify in the field that hazard control coverage and is being properly maintained and inspected.

Passive Cryogenic and Fire Protection

If cryogenic release or fires could not be mitigated from impacting facility components to insignificant levels, passive protection (e.g. – fireproofing structural steel, cryogenic protection, etc.) would be provided to prevent failure of structural supports of equipment and pipe racks. The structural fire protection would comply with NFPA 59A (2001) and other recommended and generally accepted good engineering practices. NFPA 59A (2001) section 6.4.1 requires pipe supports, including any insulation systems used to support pipe whose stability is essential to plant safety, to be resistant to or protected against fire exposure, escaping cold liquid, or both, if they are subject to such exposure. However, NFPA 59A (2001) does not provide the criteria for determining if they are subject to such exposure or the level of protection needed to protect the pipe supports against such exposures. In addition, NFPA 59A does not address pressure vessels or other equipment.

Therefore, FERC staff evaluated whether passive cryogenic and fire protection would be applied to pressure vessels and structural supports to facilities that could be exposed to cryogenic

liquids or to radiant heats of 4,000 Btu/ft²-hr or greater from fires with durations that could result in failures¹³ and that they are specified in accordance with recommended and generally accepted good engineering practices, such as: ISO 20088, API 2001, API 2010A, API 2218, ASCE/SFPE 29, ASTM E 84, ASTM E 2226, IEEE 1202, ISO 22899, NACE 0198, NFPA 58, NFPA 255, NFPA 290, OTI 95 634, UL 1709, and/or UL 2080, with protection commensurate with the cryogenic temperature and duration and fire radiant heat and duration to the exposure.

To minimize the risk of cryogenic spills causing structural supports and equipment from cooling below their minimum design metal temperature to a point of failure, Plaquemines LNG would specify materials of construction that would not fail when exposed to a cryogenic release or would insulate structural supports and equipment with materials that would be cryogenic resistant. In addition, Plaquemines LNG would generally locate cryogenic equipment away from non-cryogenic process areas and would direct cryogenic releases to remote impoundment basins. However, additional details were not provided on exact locations or equipment that would and would not be protected from cryogenic releases or the performance characteristics of the passive cryogenic protection. Therefore, we recommend in section 4.12.5 that Plaquemines LNG file drawings and specifications for the cryogenic structural protection and calculations or test results (e.g., ISO 20088) that demonstrate the effectiveness of the cryogenic structural protection.

To minimize the risk of pool and jet fires causing structural supports and equipment from heating above their maximum design metal temperatures to a point of failure, Plaquemines LNG would specify materials of construction that would not fail when exposed to a fire or would install structural fire protection. In addition, Plaquemines LNG would mound the refrigerant storage tanks to prevent cascading damage (i.e., BLEVEs) by protecting the refrigerant storage tanks from excessive radiant heat from nearby jet or pool fires. Plaquemines LNG indicated that cryogenic spill protection would be provided and that passive fire protection would also be provided, but that drawings for cryogenic structural passive protection would be developed in final design. Fireproofing requirements in the application make reference to API 2218 in absence of other specifications, but leave it up to the owner and indicate details for the would be resolved in final design. In addition, API 2218 requires structural fire protection in certain areas and also recommends fire envelopes be defined based on potential fire scenarios for defining where passive fire protection is needed. API 2218 recommends the use of UL 1709 for performance requirements of passive fire protection in areas that are determined to be subjected to pool fires and provides more limited guidance on defining what jet fire scenarios to consider or the performance requirements of passive fire protection. However, API 2218 does not define the pool fire or jet fire scenarios or the radiant heats to be used to determine the extent of passive fire protection. Therefore, we recommend in section 4.12.5 that Plaquemines LNG file drawings and specifications for the passive fire protection and calculations or test results (e.g., ISO 22899, NFPA 290, OTI 95 634, etc.) that demonstrate the effectiveness of the passive fire protection. We also recommend that passive protection be defined based on scenarios that could lead to offsite impacts or cascading damage and that structural supports may fail as low as 4,900 Btu/ft²-hr¹⁴ and

¹³ Pool fires from impoundments are generally mitigated through use of emergency shutdowns, depressurization systems, structural fire protection, and firewater, while jet fires are primarily mitigated through the use of emergency shutdowns, depressurization systems, and firewater without structural fire protection.

¹⁴ FERC staff's heat impact preliminary analyses indicate most carbon structural steels (e.g., ASTM A36), will begin to have a noticeable loss of strength at 570°F (300°C), lose approximately 1/3 of strength at 840°F (450°C),

pressurized equipment may fail as low as 4,000 Btu/ft²-hr¹⁵, and recognize pool fire tests under UL 1709 are for 65,000 Btu/ft²-hr (2,000°F) within 5 minutes and sustained for a 1 hour duration, which would provide thicker passive protection than may be necessary to prevent failure in some areas and thinner passive protection than may be necessary to prevent failure in other areas. We also note the application of fireproofing is sometimes prescribed in API 2218 to be 20 to 40 feet high, which may be less than or more than a pool fire height or jet fire flame length. Therefore, we also recommend in section 4.12.5 that Plaquemines LNG file a detailed quantitative analysis to demonstrate that adequate mitigation would be provided for each significant component within the 4,000 Btu/ft²-hr zone from pool or jet fires that could cause failure of the component. Trucks at the truck loading/unloading areas should be included in the analysis. A combination of passive and active protection for pool fires and passive and/or active protection for jet fires should be provided and demonstrate the effectiveness and reliability. Effectiveness of passive mitigation should be supported by calculations for the thickness limiting temperature rise and active mitigation should be justified with calculations demonstrating flow rates and durations of any cooling water would mitigate the heat absorbed by the vessel. In addition, we recommend in section 4.12.5 that Plaquemines LNG file the final design of these mitigation measures, for review and approval, to demonstrate cascading events would be mitigated.

In addition, it is unclear as to whether Plaquemines LNG would separate or have fire rated barriers between transformers to prevent cascading damage. Therefore, we recommend in section 4.12.5 that Plaquemines LNG either separate or provide fire walls for electrical transformers in accordance with NFPA 850 or equivalent that would prevent cascading damage

If the Project is authorized, constructed, and operated, Plaquemines LNG would install structural cryogenic and fire protection according to its design, and we recommend in section 4.12.5 that Project facilities be subject to periodic inspections during construction to verify structural cryogenic and fire protection is properly installed in the field as designed prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.5 that Project

and lose approximately 1/2 of strength at 1,000°F (540°C). These temperatures would correspond to black body radiant heats of approximately 2,000 Btu/ft²-hr (6.1 kW/m²), 4,900 Btu/ft²-hr (15.5 kW/m²), and 7,750 Btu/ft²-hr (24.5 kW/m²), respectively, and the latter radiant heats may correspond to when structural steel begins to exceed yield strengths and suffer possible structural damage based on allowable stress/strength designs in structural and mechanical design codes (e.g., ASCE 7, AISC 360, ASME B31.3, ASME BPVC, etc.), which most commonly limit stresses to 1/2 to 2/3 of yield strength. In addition, these values are in line with NFPA 59A (2016 edition and 2019 editions) that recommend similar temperature and corresponding radiant heats for steel, ABS Consulting, Consequence Assessment Methods for Incidents Involving Release from Liquefied Natural Gas Carriers, 2004 that reports long term exposures at approximately 8,000 Btu/ft²-hr (25 kW/m²) steel surfaces experience serious dislocation as well as paint peeling, and structural elements undergo substantial deformation according to damage resulting from thermal radiation for various materials, and Sandia National Laboratories, Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water, 2004, that reports durations of more than 10 minutes at approximately 12,000 Btu/ft²-hr causes temperatures to rise to 980°F (530°C) and result in 25 to 40 percent loss in steel strength and damages structures.

¹⁵ FERC staff recognize that pressurized equipment in accordance with ASME BPVC allows for pressure relief valves to pressures to rise to 1.2 times the design pressure, which would lower the pressure in the vessel to less than the bursting pressure of typically 3 to 4 times the design pressure but adds stress to the equipment above normal design conditions, and causes a reduction in temperature and subsequent reduction in radiant heat from 4,900 Btu/ft²-hr to 4,000 Btu/ft²-hr for when pressurized equipment may fail. We also recognize that 4,000 Btu/ft²-hr is a commonly used endpoint in fire analyses.

facilities be subject to regular inspections throughout the life of the facility to continue to verify that passive protection is being properly maintained.

Firewater Systems

Plaquemines LNG would also provide firewater systems, including remotely operated firewater monitors, sprinkler systems, fixed water spray systems, and firewater hydrants and hoses for use during an emergency to cool the surface of storage vessels, piping, and equipment exposed to heat from a fire. These firewater systems would be designed, tested, and maintained to meet NFPA 59A (2001), 11, 13, 14, 15, 20, 22, 24, and 25 requirements. Plaquemines LNG would have high expansion foam trailers at the facility to be used on an as-needed basis. These high expansion foam trailers would meet the requirements of NFPA 1901. We evaluate the adequacy of the general firewater coverage. We recommend in section 4.12.5 that Plaquemines LNG provide firewater coverage by two or more hydrants or monitors (or deluge systems) for all process areas that contain flammable or combustible fluids, including all three docks, diesel generators and storage, hot oil storage, and gas dehydration units. We recommend in section 4.12.5 that the LNG storage tanks be provided with firewater coverage. In addition, where coverage circles intersect pipe racks, large vessels or process equipment, the firewater coverage could be blocked, and the coverage circles should be modified to account for obstructions during the final design. In addition, where areas may be inaccessible or difficult to access in the event of an emergency, we recommend in section 4.12.5 that Plaquemines LNG install remotely operable monitors. We recommend in section 4.12.5 that Plaquemines LNG provide final firewater capacities for the monitors and hydrants in order to verify the appropriateness of the associated firewater demands of those systems and worst-case fire scenarios to size the firewater pumps that demonstrate the firewater monitors and hydrants provide sufficient firewater to reach and cool exposed equipment based on the throw distance, design density, and surface areas that are needed to be cooled. As comments to the draft EIS, we recommended that Plaquemines LNG clarify the water spray connection shown for the control building. Plaquemines LNG indicated that the water spray connection would connect to a riser for a firewater distribution system within the control building. However, it is not clear what the firewater system would protect. Generally, firewater is not provided in control rooms where they could damage electrical equipment, but may be provided in adjacent offices. Therefore, we recommend in section 4.12.5 that Plaquemines LNG provide final drawings for their firewater systems, which would include any firewater provided in the control room building. We also recommend in section 4.12.5 that Plaquemines LNG complete and document the firewater monitor and hydrant coverage test to verify that actual coverage area from each monitor and hydrant as shown on facility plot plan(s). We also recommend in section 4.12.5 that Plaquemines LNG complete and document the firewater monitor and hydrant coverage test to verify that actual coverage area from each monitor and hydrant as shown on facility plot plan(s).

We assessed whether the reliability of the firewater pumps and firewater source or onsite storage volume are appropriate. Firewater would be sourced from the Mississippi River from one main and one back diesel firewater pump. There would also be a tie in to the municipal water supply from the Plaquemines Parish Waterworks District to a firewater/firewater tank with two jockey pumps that would maintain pressure in the firewater piping. We recommend in section 4.12.5 that Plaquemines LNG specify the reducer on the suction side of the firewater pump to be eccentric or otherwise justify the use of an alternative reducer that will not cause air pockets to form and cause possible damage the firewater pump. We also recommend in section 4.12.5 that

Plaquemines LNG install a flow measurement test device that reads into the control room and historian. In addition, we recommend in section 4.12.5 that Plaquemines LNG file an updated fire protection evaluation performed on the final design, for review and approval, where details are yet to be determined (e.g., manufacturer and model, and nozzle types) and where the final design could change as a result of these details or other changes in the final design of the Project.

If authorized, constructed, and operated, Plaquemines LNG would install the firewater and foam systems based on the final specifications and drawings, and we recommend in section 4.12.5 that Project facilities be subject to periodic inspections during construction and that companies provide results of commissioning tests to verify the firewater and foam systems are installed and functional as designed prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facility to ensure firewater and foam systems are being properly maintained and tested.

4.12.4.6 Geotechnical and Structural Design Review

Plaquemines LNG provided geotechnical and structural design information for its facilities to demonstrate the site preparation and foundation designs would be appropriate for the underlying soil characteristics and to ensure the structural design of the Project facilities would be in accordance with federal regulations, standards, and recommended and generally accepted good engineering practices. The application focuses on the resilience of the Project facilities against natural hazards, including extreme geological, meteorological, and hydrological events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism.

Geotechnical Evaluation

FERC regulations under 18 CFR 380.12 (h) (3) require geotechnical investigations to be provided. In addition, FERC regulations under 18 CFR 380.12 (o) (14) require an applicant to demonstrate compliance with regulations under 49 CFR 193 and NFPA 59A (2001). If authorized, constructed, and operated, LNG facilities, as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. DOT regulations incorporate by reference NFPA 59A (2001). NFPA 59A (2001) section 2.1.4 requires soil and general investigations of the site to determine the design basis for the facility. However, no additional requirements are set out in 49 CFR 193 or NFPA 59A on minimum requirements for evaluating existing soil site conditions or evaluating the adequacy of the foundations, therefore we evaluated the existing site conditions, geotechnical report, and proposed foundations to ensure they are adequate for the LNG facilities as described below.

Plaquemines LNG contracted Fugro to conduct geotechnical investigations to evaluate the existing soil site conditions and proposed foundation design for the Project. The existing site elevation ranges from -2 feet to -4 feet NAVD88. The site would be cleared, grubbed, and prepared using standard earthmoving and compaction equipment. Site preparation would result in a final grade elevation of -2 feet NAVD88 for the process area, and a final elevation of -3 feet in the laydown area. In addition, the site would be surrounded by a levee topped with a flood wall with a final top of wall elevation of +26 feet NAVD88. Plaquemines LNG would not plan to dredge or

reshape the Mississippi River with fill material in order to construct loading docks or the berthing area.

Fugro conducted 86 soil borings to depths ranging from 60 feet to 300 feet below existing grade, 10 cone penetration tests (CPTs) to depths ranging from 142 feet to 148 feet (or to refusal) below existing grade (b.e.g.), and 2 seismic cone penetration tests (SCPTs) to depths ranging to 143 feet below existing grade. Over 14 different tests were conducted on 486 recovered soil samples, including soil identification and classification tests (water content, Atterberg liquid and plastic limits, sieve tests), strength and compressibility tests (consolidation tests, shear tests, triaxial tests), corrosion potential tests (pH, sulfate, chloride, electrical resistivity, and carbonate content), and organic content tests in general accordance with pertinent American Society for Testing and Materials standards. We evaluated the geotechnical investigation to ensure the adequacy in the number, coverage, and types of the geotechnical borings, CPTs, SCPTs, and other tests, and found them to more than adequately cover all major facilities, including the marine facilities, LNG storage tanks, liquefaction areas, pretreatment areas, flare system, buildings, power generation, and berms. We conclude that an adequate number of test borings were performed and soil samples were collected for the facility, but will continue our review of the results of the geotechnical investigation to ensure foundation designs are appropriate prior to construction of final design and throughout the life of the facilities.

Based on the test borings conducted, the site is composed of cohesive soils consisting of clay, silt, and silty clay to a depth of approximately 150 feet b.e.g., underlain by a layer of natural granular soils consisting of silty sand and clayey sand extending to a depth of approximately 175 feet b.e.g., underlain by another layer of cohesive soils consisting of clays and sandy clays to a depth of 300 feet b.e.g., where borings were terminated. The near-surface clays contain high amounts of preserved organic (vegetative) materials with some sand intermixed. Furthermore, the near-surface clays are plastic in nature could compress if not mitigated before the installation of foundations. Plasticity is a material property that directly influences deformation, which could risk the integrity of a foundation of corrective designs or replacement materials are not used. Due to the poor soil conditions at the Project site, Fugro has recommended the use of ground improvement measures to bring the site's soil conditions to an acceptable status. Corrosion tests indicate there is very high potential for corrosion of steel based on electrical resistivity results (chloride ion concentration generally indicated high and pH generally indicated mild to high corrosion potential), and a mild to moderate deterioration of concrete based on sulfate ion concentrations depending on location within the site. Based on these results, the Project has considerable potential for corrosion and concrete degradation in the design. Plaquemines LNG has indicated that it would provide engineering solutions consistent with standard practices.

Based on the subsurface conditions, shallow foundations would be suitable for only some lightly loaded, settlement insensitive structures; however, the majority of heavier loaded structures, including the LNG storage tanks, liquefaction trains, and many of the associated structures would require deep foundations in order to limit settlement to acceptable levels. The deep foundations would be supported by embedded pre-stressed precast square concrete piles, auger cast-in-place piles, displacement cast-in-place piles, and open-ended steel pipe piles. Fugro recommended that piles are proposed to be embedded to depths between an elevation of -80 feet and -220 feet NAVD88 depending on the equipment being supported, pile spacing, pile type, and pile diameter.

Regional subsidence is the sudden sinking or gradual downward settling of land with little or no horizontal motion, caused by movements on surface faults or by subsurface mining or pumping of oil, natural gas, or ground water. The results of Fugro's geotechnical investigation at the Project site indicate the Project site could be impacted by regional subsidence at a rate of approximately 0.27 to 0.42 inches per year, and that subsurface conditions are generally ill suited for the facilities, unless adequate site preparation, foundation design, and construction methods are implemented. Because subsidence is a recognized concern in the area of the Project, Plaquemines LNG proposes to install all key liquefaction facilities on deep piles, including but not limited to: loading facilities and trestles, LNG storage tanks, LNG booster pumps, gas turbines, pre-treatment and liquefaction equipment, and all compressors and blowers. Plaquemines LNG has been recommended by Fugro to develop a monitoring plan for foundations and other critical facilities to ensure they are maintained within acceptable limits. Site preparation activities would be monitored to ensure adherence to the geotechnical design. Surface subsidence would be controlled by potential use of lime stabilization of the fill materials during placement and compaction with monitoring settlement and systematic reworking, as needed. Foundations would be constructed with deep pile supports to protect equipment and interconnecting piping from differential movement. Earth-supported elements, such as the storm surge barrier and plant roads, would require periodic maintenance to mitigate the long-term effects of settlements and differential movements. Because site-specific geotechnical mitigation has been incorporated into the Project (e.g., pile-supported foundations) in accordance with NFPA 59A (2001) and where applicable, NFPA 59A (2006), subsidence would not be a significant hazard to the facilities.

The results of Plaquemines LNG's geotechnical investigation at the Project site indicate that subsurface conditions are generally suitable for the facilities, if proposed site preparation, foundation design, and construction methods are implemented appropriately.

Structural and Natural Hazard Evaluation

FERC regulations under 18 CFR 380.12 (m) requires applicants to address the potential hazard to the public from failure of facility components resulting from accidents or natural catastrophes, evaluate how these events would affect reliability, and describe the design features and procedures that would be used to reduce potential hazards. In addition, 18 CFR 380.12 (o) (14) require an applicant to demonstrate how they would comply with 49 CFR 193 and NFPA 59A. In addition, if authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193 have some specific requirements on designs to withstand certain loads from natural hazards and also incorporates by reference NFPA 59A (2001 and 2006) and ASCE 7-05 and ASCE 7-93 via NFPA 59A (2001). NFPA 59A (2001) Section 2.1.1(c) also requires that Plaquemines LNG consider the effects of natural hazards, such as flooding, storm surge, and seismic activities, for plant site location. This was covered in DOT PHMSA's LOD on 49 CFR 193, Subpart B. However, the LOD would not cover whether the facility is designated appropriately against these hazards, which would be part of 49 CFR 193, Subpart C. If authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. The marine facilities would be subject to 33 CFR 127, which requires, if the waterfront facility handling LNG is in a region subject to earthquakes, that the piers and wharves must be designed to resist earthquake forces. In addition, USCG regulations under 33

CFR 127 incorporates by reference certain portions of NFPA 59A (1994) and ASCE 7-88 via NFPA 59A (1994). However, USCG regulations do not provide criteria for a region subject to earthquakes or the earthquake forces the piers and wharves are to withstand and NFPA 59A (1994) section referenced in 33 CFR 127 is for seismic design only and is applicable to stationary LNG containers, which would not be under 33 CFR 127. Therefore, we evaluated the basis of design for all facilities for all natural hazards under FERC jurisdiction, including those under DOT and USCG jurisdiction.

If authorized, the proposed facilities would be constructed to the requirements in the 2009 International Building Code (IBC), ASCE 7-05 for LNG facilities and the 2012 IBC and ASCE 7-10 for non-LNG facilities. These standards require various structural loads to be applied to the design of the facilities, including live (i.e., dynamic) loads, dead (i.e., static) loads, and environmental loads. We also evaluated potential the engineering design to withstand impacts from natural hazards, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism. We recommend in section 4.12.5 that Plaquemines LNG file final design information (e.g., drawings, specifications, and calculations) and associated quality assurance and quality control procedures with the documents reviewed, approved, and stamped and sealed by a professional engineer of record registered in the state of Louisiana. If the Project is authorized, constructed, and operated, Venture Global would install equipment in accordance with its final design. In addition, we recommend in section 4.12.5 that Plaquemines LNG file, for review and approval, settlement results during hydrostatic tests of the LNG storage containers and periodically thereafter to verify settlement is as expected and does not exceed the applicable criteria in API 620, API 625, API 653, and ACI 376.

Earthquakes, Tsunamis, and Seiche

Earthquakes and tsunamis have the potential to cause damage from shaking ground motion and fault ruptures. Earthquakes and tsunamis often result from sudden slips along fractures in the earth's crust (i.e., faults) and the resultant ground motions caused by those movements, but can also be a result of volcanic activity or other causes of vibration in the earth's crust. The damage that could occur as a result of ground motions is affected by the type/direction and severity of the fault activity and the distance and type of soils the seismic waves must travel from the hypocenter (or point below the epicenter where seismic activity occurs). To assess the potential impact from earthquakes and tsunamis, Venture Global evaluated historic earthquakes along fault locations and their resultant ground motions.

The USGS maintains a database containing information on surface and subsurface faults and folds in the United States that are believed to be sources of earthquakes of greater than 6.0 magnitude occurring during the past 1.6 million years (Quaternary Period).¹⁶ The location of the Project is within the Gulf Coast Basin geologic tectonic province. The Gulf Coast Basin is characterized as having thick sedimentary rocks above basement rock structures. The province's sedimentary strata thickens toward the south, with salt domes and relatively shallow listric growth faults that run parallel to the Gulf of Mexico Coastline. Movement within the fault system has

¹⁶ USGS. Earthquake Hazards Program. Quaternary Fault and Fold Database of the United States. Website: <https://earthquake.usgs.gov/hazards/qfaults/>. Accessed: August 2018.

been classified as a general creep as opposed to the breaking of rocks, which is often associated with earthquake events (Stevenson and McCulloh, 2001). Salt domes are prevalent throughout the Gulf Coast Basin and are characterized by having a system of faults arranged in a circular pattern around them (Gagliano, 1999).

Plaquemines LNG conducted a site-specific growth fault analysis for the Project, involving field investigations and subsequent data evaluation. The Phase 1 Geologic Fault Study included the examination of growth faults in the region of the Project area. These growth fault systems have previously been assessed by the USGS as not capable of generating significant earthquakes, and these faults have not previously been considered as seismogenic sources. While growth faults are not a source of seismic hazard for the Project site, there may be a potential source of surface deformation. The closest mapped suspected surface faults are the South of Bayou Dupont Fault, Bayou Dupont Fault, Bayou Barataria Fault, and the Round Lake Fault. The Round Table Lake fault is located approximately 1 mile south of the site. The South of Bayou Dupont Fault, Bayou Dupont Fault, Bayou Barataria Fault each strike generally east-west and are located approximately 7 miles west of the site. Where the suspected faults are currently mapped, they do not extend into the site. If these faults do extend further east than they are currently mapped, the suspected faults could pose a risk to the site. An evaluation of topographic maps, aerial imagery, and light detection and ranging imagery maps indicate linear geomorphic features 5 miles southwest of the site that coincides with the Round Lake Fault. In addition, Fugro also evaluated subsurface structure maps of drilled oil and gas wells that indicate growth faults at depth with projections that are estimated to be approximately 2,000 feet south of the southern boundary of the site and one of the two identified coincides with the Round Lake Fault southwest of the site. Visual observations of the site also did not show evidence of surface faulting. While Fugro found no credible evidence indicating that a surface fault extends into the site, a review of literature on surface faulting in the area has identified several known and suspected surface faults west and southwest of the site. These faults trend in the general direction of the site, although they are not shown to extend into the site. As such, the site is at a higher-than-normal risk of being impacted by a fault. As a result, Fugro recommends the logs of oil and gas explorations be interpreted to develop a higher degree of confidence as to the presence or absence of faults that could impact the site. Fugro has identified six well logs that would be useful for this purpose. These logs would be interpreted for offsets in stratigraphic markers indicative of subsurface faulting. It should be noted though that depending on the results of the interpretation of oil and gas well logs, further study using geophysically logged borings may be required to determine the presence or absence of a fault extending across the site. Therefore, we recommend in section 4.12.5 that Plaquemines LNG conduct further study using geophysically logged boring to determine the presence or absence of a fault extending across the site prior to initial site preparation. If growth faults are determined to be present, we recommend in section 4.12.5 that Plaquemines LNG file a plan to avoid or mitigate growth fault impacts with the Secretary that is stamped and sealed by the professional engineer-of-record, registered in Louisiana.

While the presence of growth and seismogenic faults can require special consideration, the presence or lack of growth or seismogenic faults identified near the site does not define whether earthquake ground motions can impact the site because ground motions can be felt large distances away from an earthquake hypocenter depending on number of factors.

To address the potential ground motions at the site, DOT regulations in 49 CFR 193.2101, under Subpart C require that field-fabricated LNG tanks must comply with section 7.2.2. of NFPA 59A (2006) for seismic design. NFPA 59A (2006) requires LNG storage tanks to be designed to continue safely operating with earthquake ground motions at the ground surface at the site that have a 10 percent probability of being exceeded in 50 years (475 year mean return interval), termed the operating basis earthquake (OBE). In addition, DOT regulations in 49 CFR 193.2101, under Subpart C require that LNG tanks be designed to have the ability to safely shutdown when subjected to earthquake ground motions which have a 2 percent probability of being exceeded in 50 years (2,475 year mean return interval) at the ground surface at the site (termed the safe shutdown earthquake [SSE]). DOT regulations in 49 CFR 193.2101, under Subpart C also incorporate by reference of NFPA 59A (2001) Chapter 6, which require piping systems conveying flammable liquids and flammable gasses with service temperatures below -20 degrees Fahrenheit, be designed as required for seismic ground motions. The facilities, once constructed, would be subject to the DOT's inspection and enforcement programs.

In addition, we recognize Plaquemines LNG would also need to address hazardous fluid piping with service temperatures at -20 degrees Fahrenheit and higher and equipment other than piping and LNG storage containers. We also recognize the current FERC regulations under 18 CFR 380.12 (h) (5) continues to incorporate NBSIR 84-2833. NBSIR 84-2833 provides guidance on classifying stationary storage containers and related safety equipment as Category I and classifying the remainder of the LNG project structures, systems, and components as either Category II or Category III, but does not provide specific guidance for the seismic design requirements for them. Absent any other regulatory requirements, this guidance recommends that other LNG project structures classified as Seismic Category II or Category III be seismically designed to satisfy the Design Earthquake (DE) and seismic requirements of the ASCE 7-05 in order to demonstrate there is not a significant impact on the safety of the public. ASCE 7-05 is recommended as it is a complete American National Standards Institute consensus design standard, its seismic requirements are based directly on the National Earthquake Hazards Reduction Program Recommended Provisions, and it is referenced directly by the IBC. Having a link directly to the IBC and ASCE 7 is important to accommodate seals by the engineer of record because the IBC is directly linked to state professional licensing laws while the National Earthquake Hazards Reduction Program Recommended Provisions are not.

The geotechnical investigations of the existing site indicate the site is classified as Site Class E¹⁷ in accordance with ASCE 7-05 and in accordance with IBC 2006 based on a site average shear wave velocity that ranged between 300 and 350 feet per second (Fugro, 2016a) in the upper 100 feet of strata. Sites with soil conditions of this type could experience significant amplifications of surface earthquake ground motions. However, due to the absence of a major fault in proximity to the site and lower ground motions, the seismic risk to the site is considered low.

¹⁷ There are six different site classes in ASCE 7-05, A through F, that are representative of different soil conditions that impact the ground motions and potential hazard ranging from Hard Rock (Site Class A), Rock (Site Class B), Very dense soil and soft rock (Site Class C), Stiff Soil (Site Class D), Soft Clay Soil (Site Class E), to soils vulnerable to potential failure or collapse, such as liquefiable soils, quick and highly sensitive clays, and collapsible weakly cemented soils (Site Class F).

Fugro performed a site-specific seismic hazard study for the site. The study concluded that the LNG facility would have an OBE PGA of 0.036 g, an SSE PGA of 0.092 g, a 0.2-second design spectral acceleration value of 0.119 g, a DE 1.0-second design spectral acceleration at the site of 0.132 g and a DE PGA of 0.055 g (Fugro, 2016b). We independently evaluated the OBE PGA, SSE PGA, 0.2-second design spectral acceleration, and 1.0-second design spectral accelerations for the site using the USGS Earthquake Hazards Program Seismic Design Maps¹⁸ and Unified Hazard¹⁹ tools for all occupancy categories (I-IV). We conclude that the SSE PGA, OBE PGA, and 5 percent-damped spectral design accelerations used by Plaquemines LNG are acceptable. These ground motions are relatively low compared to other locations in the United States. Based on the design ground motions for the site and the importance of the facilities, the facility seismic design is assigned Seismic Category I for LNG containers, systems required for isolation of LNG containers, and systems required for safe shutdown or fire protection. Seismic Category II structures include facilities and systems not included in Category I required for safe plant operation, which include LNG liquefaction trains, inlet facilities, pre-treatment area(s), power generation area(s), fuel gas system, interconnecting piping systems, metering systems, LNG pumps, and other items. Seismic Category III includes all other facilities that are not included in Categories I and II, including administration buildings, dock service equipment, waste treatment plant, and incoming electrical power supply.

ASCE 7-05 also requires determination of the Seismic Design Category based on the Occupancy Category (or Risk Category in ASCE 7-10 and 7-16) and severity of the earthquake design motion. The Occupancy Category (or Risk Category) is based on the importance of the facility and the risk it poses to the public.²⁰ We have identified the Project as a Seismic Design Category B based on the ground motions for the site and an Occupancy Category (or Risk Category) of III, this seismic design categorization would appear to be consistent with the 2006 IBC and ASCE 7-05 (and ASCE 7-10).

Seismic events can also result in soil liquefaction in which saturated, non-cohesive soils temporarily lose their strength/cohesion and liquefy (i.e., behave like viscous liquid) as a result of increased pore pressure and reduced effective stress when subjected to dynamic forces such as intense and prolonged ground shaking. Areas susceptible to liquefaction may include saturated soils that are generally sandy or silty. Typically, these soils are located along rivers, streams, lakes, and shorelines or in areas with shallow groundwater. The site-specific geotechnical investigations

¹⁸ USGS. Changes to U.S. Seismic Design Maps Web Tools.

<https://earthquake.usgs.gov/designmaps/us/application.php>. Accessed: April 2019.

¹⁹ USGS. Unified Hazards Tool. <https://earthquake.usgs.gov/hazards/interactive/>. Accessed: April 2019.

²⁰ ASCE 7-05 defines Occupancy Categories I, II, III, and IV. Occupancy Category I represents facilities with a low hazard to human life in even of failure, such as agricultural facilities; Occupancy Category III represents facilities with a substantial hazard to human life in the event of failure or with a substantial economic impact or disruption of day to day civilian life in the event of failure, such as buildings where more than 300 people aggregate, daycare facilities with facilities greater than 150, schools with capacities greater than 250 for elementary and secondary and greater than 500 for colleges, health care facilities with 50 or more patients, jails and detention facilities, power generating stations, water treatment facilities, telecommunication centers, hazardous facilities that could impact public; Occupancy Category IV represents essential facilities, such as hospitals, fire, rescue, and police stations, emergency shelters, power generating stations and utilities needed in an emergency, aviation control towers, water storage and pump structures for fire suppression, national defense facilities, and hazardous facilities that could substantially impact public; and Occupancy Category II represents all other facilities. ASCE 7-10 changed the term to Risk Categories I, II, III, and IV with some modification.

indicate the presence of layers of silty sands and sandy silts that are dense to very dense. These sand layers could be liquefiable under sufficiently strong ground motions. However, due to the low seismicity of the region, the potential for soil liquefaction to occur is low. In addition, Plaquemines LNG would address possible issues relating to the potential for soil liquefaction and loss of soil strength by using piles in the foundation design. Should soil improvement be required to counteract soil liquefaction, Plaquemines LNG would utilize ground improvement techniques (e.g., cementitious strengthening).

Seismic events in waterbodies can also cause tsunamis or seiches by sudden displacement of the sea floors in the ocean or standing water. Tsunamis and seiche may also be generated from volcanic eruptions or landslides. Tsunami wave action can cause extensive damage to coastal regions and facilities. The LNG terminal's low lying position would make it potentially vulnerable were a tsunami to occur. There is little evidence that the northern Gulf of Mexico is prone to tsunami events, but the occurrence of a tsunami is possible. Two did occur in the Gulf of Mexico in the early 20th century and had wave heights of 3 feet or less (USGS, 2009), which is not significantly higher than the average breaking wave height of 1.5 feet (Owen, 2008). Hydraulic modeling conducted for off the coast of Louisiana in 2009, based off of historic submarine landslides, indicated that the maximum tsunami run-up could be as high as 13 feet above mean sea level. No earthquake generating faults have been identified that are likely to produce tsunamis, despite recorded seismic activity in the area.

The potential for tsunamis associated with submarine landslides is more likely a source in the Gulf of Mexico and remains a focus of government research (USGS, 2009). Plaquemines LNG's *Seismic Hazard Assessment* report included a Tsunami Hazard Assessment for the Project area. There are four main submarine landslide hazard zones in the Gulf of Mexico including the Northwest Gulf of Mexico, Mississippi Canyon and Fan, the Florida Escarpment, and the Campeche Escarpment (USGS, 2009). Based on modeling and limited historical data, it is estimated that tsunamis generated from landslides would be more than 2 feet and less than 13 feet. These tsunami run-up elevations are significantly less than the hurricane design storm surge elevations discussed below, so any tsunami hazard has already been considered in design.

Hurricanes, Tornadoes, and other Meteorological Events

Hurricanes, tornadoes, and other meteorological events have the potential to cause damage or failure of facilities due to high winds and floods, including failures from flying or floating debris. To assess the potential impact from hurricanes, tornadoes, and other meteorological events, Plaquemines LNG evaluated such events historically. The severity of these events are often determined on the probability that they occur and are sometimes referred to as the average number years that the event is expected to re-occur, or in terms of its mean return/recurrence interval.

Because of its location, the Project site would likely be subject to hurricane-force winds during the life of the Project. Plaquemines LNG states that all LNG facilities, as defined in 49 CFR 193, would be designed to withstand a 183 mph 3-second gust. The designed wind speed would also have a load factor of 1.6 applied in accordance with Chapter 2 of ASCE 7-05. Other Project facilities classified as Risk Category III would be designed in accordance with ASCE 7-10 to withstand a 170 mph 3-second gust, including the oily water sump pumps; butane, propane, ethylene, and pentane storage drums and transfer pumps; power generation and steam turbine

components; heat recovery steam and gas turbine generators and associated and aqueous ammonia emission control systems; and instrument air, water, electrical and other utility components. Project facilities classified as Risk Category II would be designed to withstand a 157 mph 3-second gust including water treatment and sanitary waste components, sump pumps, admin building, warehouses, and guardhouses. A 183 mph 3-second gust would convert to a sustained wind speed of 150 mph, using the Durst Curve in ASCE 7-05 or using a 1.23 gust factor recommended for offshore winds at a coastline in World Meteorological Organization, *Guidelines for Converting between Various Wind Averaging Periods in Tropical Cyclone Conditions*. These wind speeds are equivalent to approximately 7,000-year mean return interval or 0.25 percent probability of exceedance in a 50 year period for the site, based on whether ASCE 7-05 wind speed return period conversions. The 183 mph 3-second gust equates to a strong Category 4 Hurricane using the Saffir-Simpson scale (130-156 mph sustained winds, 166-195 mph 3-second gusts). A 170 mph 3-second gust would equate to approximately a 2,750-year return period and weak Category 4 hurricane, and a 157 mph 3-second gust would equate to approximately a 1,200-year return period and moderate Category 3 hurricane. Plaquemines LNG must meet 49 CFR 193.2067, under Subpart B for wind load requirements. In accordance with the MOU, the DOT evaluated in its LOD whether Plaquemines LNG's proposed Project meets the DOT siting requirements under Subpart B. If the Project is authorized, constructed, and operated, the LNG facilities, as defined in 49 CFR 193, would be subject to the DOT's inspection and enforcement programs. Final determination of whether the facilities are in compliance with the requirements of 49 CFR 193 would be made by the DOT staff. However, DOT has indicated structures that do not fall under the definition of LNG facilities in 49 CFR 193 would not be subject to the design wind speed requirements in 49 CFR 193.2067, under Subpart B. Plaquemines LNG would specify facilities not covered by DOT's LOD be designed to withstand basic wind speeds in accordance with ASCE 7-16 based on appropriate Risk Category.

However, as noted in the limitation of ASCE 7-05 section 6.5.4.3 and ASCE 7-10 section 26.5.4, tornadoes were not considered in developing basic wind speed distributions. This leaves a potential gap in potential impacts from tornadoes. Therefore, we evaluated the potential for tornadoes. Appendix C of ASCE 7-05 makes reference to American Nuclear Society 2.3 (1983 edition), *Standard for Estimating Tornado and Extreme Wind Characteristics at Nuclear Power Sites*. This document has since been revised in 2011 and reaffirmed in 2016 and is consistent with Nuclear Regulation NUREG/CR-4461, Tornado Climatology of the Contiguous U.S. Rev. 2 (U.S. Nuclear Regulatory Commission, 2007). These documents provide maps of a 100,000 mean year return period for tornadoes using 2° latitude and longitude boxes in the region to estimate a tornado striking within 4,000 feet of an area. Figures 5-8 and 8-1 from NUREG/CR-4461 indicate a 100,000-year maximum tornado wind speeds would be approximately 140 mph 3-second gusts for the project site location. Later editions of ASCE 7 (ASCE 7-10 and ASCE 7-16) make reference to International Code Council 500, Standard for Design and Construction of Storm Shelters, for 10,000-year tornadoes. However, the International Code Council 500 maps were conservatively developed based on tornadoes striking regions and indicate a 200 mph 3-second gust for a 10,000-year event, which is higher than the 140 mph 3-second gust in American Nuclear Society 2.3 and NUREG/CR-4461.

ASCE 7 also recognizes the facility would be in a wind borne debris region. Wind borne debris has the potential to perforate equipment and the LNG storage tanks if not properly designed to withstand such impacts. The potential impact is dependent on the equivalent projectile wind

speed, characteristics of projectile, and methodology or model used to determine whether penetration or perforation would occur. Unfortunately, no criteria is provided in 49 CFR 193 or ASCE 7 for these specific parameters. However, NFPA 59A (2016) recommends CEB 187 be used to determine projectile perforation depths. In order to address the potential impact, we recommend in section 4.12.5 that Plaquemines LNG provide a projectile analysis, for review and approval, to demonstrate that the outer concrete impoundment wall of a full-containment LNG tank could withstand wind borne projectiles prior to construction of the final design. The analysis should detail the projectile speeds and characteristics and method used to determine penetration or perforation depths. We would compare the analysis and specified projectiles and speeds using established methods, such as CEB 187, and DOE and Nuclear Regulatory Commission guidance.

In addition, we evaluated historical tropical storm, hurricane, and tornado tracks in the vicinity of the Project facilities using data from NOAA's Historical Hurricane Tracker.²¹ Between 1865 and August 2017, 45 hurricanes and tropical storms made landfall within 60 miles of the Project site. Of the 45 storm events, 5 were considered major hurricanes, defined as Category 3 or greater; including Unnamed (Category 4) hurricane in 1893, Unnamed (Category 4) hurricane in 1915, Hurricane Betsy (Category 4) in 1965, Hurricane Camille (Category 5) 1969, and Hurricane Katrina (Category 3) 2005. During Hurricane Camille storm surges were observed to reach heights of up to 20 feet, and during Hurricane Katrina storm surges were observed to reach heights of up to 18 feet (USGS, 2004).

Potential flood levels may also be informed from the FEMA Flood Insurance Rate Maps, which identifies Special Flood Hazard Areas (base flood) that have a 1 percent probability of exceedance in 1 year to flood (or a 100-year mean return interval) and moderate flood hazard areas that have a 0.2 percent probability of exceedance in 1 year to flood (or a 500-year mean return interval). According to the FEMA National Flood Insurance Rate Maps (FEMA, 1985) for Plaquemines Parish, Louisiana, the 100-year Base Flood Elevation for the Project site is +15.8 ft. NAVD88. We also recognize that a 500-year flood event has been recommended as the basis of design for critical infrastructure in publications, including ASCE 24, *Flood Resistant Design and Construction*. Therefore, we believe it is good practice to design critical energy infrastructure to withstand 500-year event from a safety and reliability standpoint for both SWEL and wave crests. The proposed design would be able to withstand a 500-year flood event. Furthermore, we determined the use of intermediate values from NOAA for sea level rise and subsidence is more appropriate for design and higher projections are more appropriate for planning in accordance with NOAA 2017,²² which recommends defining a central estimate or mid-range scenario as baseline for shorter-term planning, such as setting initial adaptation plans for the next two decades and defining upper bound scenarios as a guide for long-term adaptation strategies and a general planning envelope.

The entire LNG terminal site, with the exception of the marine facilities, would be enclosed for flood protection by construction of a levee topped with a floodwall. The floodwall top elevation is proposed to be +26 feet NAVD88 with levee crest elevations ranging from +24.5 feet to +27 feet NAVD88. The channel-side earthen levee height is designed for a 500-year still water

²¹ NOAA. Historical Hurricane Tracker. Available at: <https://coast.noaa.gov/hurricanes/>. Accessed August 2018.

²² Global and Regional Sea Level Rise Scenarios for the United States. U.S. Department of Commerce. National Ocean and Atmospheric Administration. National Ocean Service Center for Operational Oceanographic Products and Services. January 2017.

elevation (SWEL) of 19.1 feet NAVD88, a 500-year wave of 5.0 feet, and 1.1 feet of sea level rise and subsidence over the life of the Project, yielding an initial crest height of 25.2 feet with a final initial elevation of +26 feet NAVD88, which provides an over build allowance of 0.5 feet to account for downdraft effects on piles. Given the uncertainty in conditions and settlement, we recommend in section 4.12.5 that Plaquemines LNG file a plan for maintaining the levee and floodwall total elevation of +26 feet for the life of the Project.

We generally evaluate the design against a 500-year SWEL with a 500-year wave crest and sea level rise and subsidence. Using maximum envelope of water (MEOW) storm surge inundation maps generated from the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model developed by NOAA National Hurricane Center, a 500-year event would equate to a Category 2 Hurricane and approximately 9-12 feet MEOW.²³ This is lower than indicated in the 500-year FEMA maps. In addition, while NOAA seems to provide higher resolution of topographic features, it limits its SLOSH maps to storm surge levels at high tide above 9 feet. As a result, we evaluated the storm surge against other sources using SLOSH maps that indicate a similar upper range of 6-9 feet MEOW for Category 2 Hurricanes, and also indicated 8-12 feet MEOW for Category 3 Hurricanes, 12-15 feet MEOW for Category 4 Hurricanes, and 15-20 feet MEOW for Category 5 Hurricanes.²⁴ This data suggests that Plaquemines LNG design may withstand Category 4 Hurricane storm surge SWEL equivalent to 1,000- to 10,000-year mean return intervals. In addition, wave heights would likely impact the channel side, but would not reach the landward side. We also would expect the sea level rise to be closer to the 1.1 feet intermediate projection provided by NOAA. Sea level rise projections are 1.1 feet over 30 years. However, given the uncertainty in the 500-year SWEL data, 500-year wave data, SLOSH maps, sea level rise and subsidence projections, and settlement projections and uncertainties, we agree that the 26 feet NAVD88 post settlement storm surge floodwall would provide adequate protection of the Plaquemines LNG site and should be periodically monitored and maintained to assure the crest elevation would not be lower than 26 feet NAVD88 on the channel side. We also recommend in section 4.12.5 that Plaquemines LNG provide the monitoring and maintenance plan that has been reviewed, approved, stamped and sealed by the professional engineer of record registered in the state of Louisiana.

The Texas and Louisiana Gulf Coast area is experiencing the highest rates of coastal erosion and wetland loss in the United States (Ruple, 1993). Louisiana experiences 90 percent of the coastal wetland loss for the continental United States. Of this erosion loss, six percent affects the basins in which this Project is located. Aerial photography taken from 1998 to 2015 indicates little or no shoreline loss on the Mississippi River adjacent to the Project site. Shoreline erosion could occur at the Project site and along the opposite shoreline as a result of waves, currents, and vessel wakes. To prevent erosion along the river bank, an articulated concrete mattress was installed by the USACE. Even though shoreline erosion is a concern for this geography, implemented mitigation measures would minimize erosion and scour impacts.

²³ U.S. Department of Commerce. NOAA. National Hurricane Center. National Storm Surge Hazard Maps. Available at: <https://www.nhc.noaa.gov/nationalstormsurge/#pop>. Accessed August 2018.

²⁴ Masters. J.. Weather Underground. Storm Surge Inundation Maps for the U.S. Coast. Available at: https://www.wunderground.com/hurricane/surge_images.asp. Accessed August 2018.

Landslides and other Natural Hazards

Landslides involve the downslope movement of earth materials under force of gravity due to natural or human causes. Due to the low relief across the LNG terminal there is little likelihood that landslides or slope movement at the LNG terminal would be a realistic hazard. In general, the clay soils have a comparatively lower risk of forming a landslide, subject to numerous other factors.

Volcanic activity is primarily a concern along plate boundaries on the West Coast and Alaska and also Hawaii. Based on our review of maps from USGS²⁵ and Department of Homeland Security²⁶ of the nearly 1,500 volcanoes with eruptions since the Holocene period (in the past 10,000 years) there are no known active or historic volcanic activity within proximity to the site with the closest volcano being 1,785 miles of the Project across the Gulf of Mexico in Los Atlícos, Mexico.

Geomagnetic disturbances (GMDs) may occur due to solar flares or other natural events with varying frequencies that can cause geomagnetically induced currents, which can disrupt the operation of transformers and other electrical equipment. USGS provides a map of GMD intensities with an estimated 100-year mean return interval.²⁷ The map indicates the Plaquemines LNG site could experience GMD intensities of 20-70 nano-Tesla with a 100-year mean return interval. However, Plaquemines LNG would be designed such that if a loss of power were to occur the valves would move into a fail-safe position. In addition, Plaquemines LNG is an export facility that does not serve any U.S. customers.

4.12.4.7 External Impact Review

To assess the potential impact from external events that are dependent on the site location, Plaquemines LNG provided FERC with a series of studies that evaluate transportation routes and land use and activities within and surrounding their site and the safeguards in place to mitigate the risk from events, where warranted. We reviewed these studies in coordination with other federal agencies to assess these impacts for potential vehicle impacts from nearby external roads and rail; aircraft impacts from nearby airports, heliports, and military facilities; pipeline incident impacts from nearby pipelines, and adjacent facilities that handle hazardous materials. Mitigation of impacts from use of internal roadways, rail, helipads, airstrips, or pipelines would also be considered as part of the engineering review done in conjunction with the NEPA review. FERC staff takes a risk-based approach in assessing the potential impact of the external events and on the adequacy of the mitigation. The risk-based approach is informed by data on the frequency of events that could lead to an impact and the potential severity of consequences to the Project and the resulting consequences to the public beyond the initiating events. The frequency is based on

²⁵ U.S. Geological Survey. U.S. Volcanoes and Current Activity Alerts. Available at: <https://volcanoes.usgs.gov/index.html>. Accessed August 2018.

²⁶ Department of Homeland Security. Homeland Infrastructure. Foundation-Level data (HIFLD). Natural Hazards. hifld-geoplatform.opendata.arcgis.com. accessed Aug 2018

²⁷ U.S. Geological Survey. Magnetic Anomaly Maps and Data for North America. Available at: <https://mrdata.usgs.gov/magnetic/map-us.html#home>. Accessed August 2018.

past incidents and the consequences is based on past incidents as well as hazard modeling of potential failures.

Road

FERC staff reviewed whether any truck operations would be associated with the Project and whether any existing roads would be located near the site. FERC staff uses this information to evaluate whether the Project and any associated truck operations could increase the risk along the roadways and subsequently to the public and whether any pre-existing unassociated vehicular traffic could adversely increase the risk to the Project site and subsequently increase the risk to the public. If authorized, constructed, and operated, LNG facilities, as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155(a)(5)(ii), under Subpart C require that structural members of an impoundment system must be designed and constructed to prevent impairment of the system's performance reliability and structural integrity as a result of a collision by or explosion of a tank truck that could reasonably be expected to cause the most severe loading if the liquefaction facility adjoins the right-of-way of any highway. Similarly, NFPA 59A (2001), section 8.5.4, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. The marine facilities subject to USCG regulations, including 33 CFR 127.001, incorporate NFPA 59A (1994), which requires pipelines be located on the dock or pier so that they are not exposed to damage from vehicular traffic or other possible cause of physical damage. However, the DOT and USCG regulations and NFPA 59A (2001 and 1994) requirements do not prescribe or indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. Therefore, FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts.

FERC staff evaluated the risk of the truck operations based on the consequences from a release, incident data from the DOT Federal Highway Administration (FHWA)²⁸, DOT National Highway Traffic Safety Administration (NHTSA)²⁹, and DOT PHMSA³⁰, EPA, NOAA³¹, and other reports^{32, 33, 34}, and frequency of trucks and proposed mitigation to prevent or reduce the impacts of a vehicular incident.

Incident data from DOT's FHWA, NHTSA, and PHMSA, indicates hazardous material incidents are very infrequent (4e-3 incidents per lane-mile per year) and nearly 75-80 percent of

²⁸ U.S. DOT FHWA, Office of Highway Policy Information, Highway Statistics 2016, <https://www.fhwa.dot.gov/policyinformation/statistics/2016/>, accessed March 2019.

²⁹ U.S. DOT NHTSA, Traffic Safety Facts Annual Report Tables, <https://cdan.nhtsa.gov/tsftables/tsfar.htm>, accessed March 2019.

³⁰ U.S. DOT PHMSA, Office of Hazardous Material Safety, Incident Reports Database Search, <https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/Welcome.aspx>, accessed March 2019.

³¹ U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, ALOHA®, User's Manual, The CAMEO® Software System, February 2007.

³² Birk, A.M., BLEVE Response and Prevention Technical Documentation, 1995.

³³ American Institute of Chemical Engineers, Center for Chemical Process Safety, Guidelines for Vapor Cloud Explosion, Pressure Vessel Burst, BLEVE, and Flash Fire Hazards, Second Edition, 2010.

³⁴ Lees, F.P., Lees Loss Prevention in the Process Industries, Hazard Identification, Assessment, and Control, Volume 2, Second Edition, 1996.

hazardous material vehicular incidents occur during unloading and loading operations while the other 20-25 percent occur while in transit or in transit storage. In addition, approximately 99 percent of releases are 1,000 gallons or less and catastrophic events that would spill 10,000 gallons or more make up less than 0.1 percent of releases. In addition, less than 1 percent of all reportable hazardous material incidents with spillage result in injuries and less than 0.1 percent of all reportable hazardous material incidents with spillage result in fatalities.

The EPA and NOAA report that 80 percent of fires that lead to container ruptures results in projectiles and that 80 percent of projectiles from liquefied petroleum gas (LPG) incidents, which constitute the largest product involved in BLEVEs, travel less than 660 feet. The EPA also reports that on average container ruptures would result in less than four projectiles for cylindrical containers and 8.3 for spherical vessels. FERC staff evaluated other reports that affirmed the EPA estimates based on data for approximately 150 experimental and accidental pressure vessel bursts (PVB) and BLEVEs with approximately 683 total projectiles (4.6 average fragments per incident) that showed approximately 80 percent of fragments traveled 490 to 820 feet and within 6.25 times the estimated or observed fireball radius. The data also showed projectiles have traveled up to 3,900 feet for large LPG vessels and 1,200 feet for LPG rail cars. In all the documented cases, the projectiles traveled less than 15 times the fireball diameter, but one of the reports indicated up to 30 times the fireball diameter is possible albeit very rare.

Unmitigated consequences under average ambient conditions from releases of 1,000 gallons through a 1-inch hole would result in much more modest distances ranging from 25-200 feet for flammable vapor dispersion, and 75-175 feet for jet fires. Unmitigated consequences under worst-case weather conditions from catastrophic failures of trucks proposed at the site generally can range from 200-2,000 feet for flammable vapor dispersion, 275-350 feet for radiant heat of 5 kW/m² from jet fires, 800-1,050 feet to a 1 psi overpressure from a BLEVE, 850-1,500 feet for a heat dose equivalent to a radiant heat of 5 kW/m² over 40 seconds from 250-325 feet radii fireballs burning 5-15 seconds from a boiling liquid expanding vapor explosion (BLEVE), and projectiles from BLEVEs possibly extending farther. Based on distribution function of the projectile distances, FERC staff estimate approximately 90 percent of all projectiles for a 10,000 gallon tanker truck would be within 0.5 mile and there is approximately a 1 percent probability they would extend beyond 1 mile and less than 0.1 percent probability they would extend 30 times the fireball diameter. These values are also close to the distances provided by DOT FHWA³⁵ for designating hazardous material trucking routes (0.5 mi for flammable gases for potential impact distance) and DOT PHMSA³⁶ for emergency response (0.5-1 mi for initial evacuation and 1 mi for potential BLEVEs for flammable gases).

During operation of the Project, Plaquemines LNG estimates 15 refrigerant make-up trucks, one hot oil truck, and two nitrogen trucks would be needed at the site annually. Plaquemines LNG indicated they do not plan to utilize any trucks for condensate removal or to deliver LNG.

SH 23 would bisect the LNG terminal between the process area, which includes the LNG storage tanks, and the marine berth area. The speed limit is 65 mph along SH 23 near the LNG

³⁵ U.S. DOT FHWA. Office of Highway Safety. Guidelines for Applying Criteria to Designate Routes for Transporting Hazardous Materials. September 1994.

³⁶ U.S. DOT PHMSA. Emergency Response Guidebook. 2016.

terminal site. Plaquemines LNG provided a Traffic Management Plan for the LNG terminal during the construction period and describes the current usage of SH 23.

Plaquemines LNG provided a Road Safety and Reliability Impact Study (RSRIS). The RSRIS addresses potential safety and reliability impacts of proposed tanker trucks loaded or unloaded at the LNG terminal, and from commercial and recreational roadway traffic along SH 23. Plaquemines LNG has held several meetings with the Louisiana DOTD discussing a variety of mitigation measures to be adopted into the design of the pipe trestle crossing SH 23. One such mitigation measure would be to incorporate 42-inch-tall F-shaped or safety shaped reinforced concrete barriers along with tier type transition guardrails, as prescribed in the Louisiana DOTD “Bridge Design and Evaluation Manual” (July 2018), to provide protection to the pipe trestle supports that would be located in the median of SH 23. Also the process area would be protected from a vehicular incident from the 26-foot-tall storm surge barrier that surrounds the entire process area. The marine berth area would be protected by the Mississippi River levee that has an approximate height of 16 feet. Given the potential consequences of a vehicle impacting the LNG transfer line and SH 23 serving as the only road for evacuation, we recommend that Plaquemines LNG provide details of the vehicle collision protection at the road crossing of the LNG transfer line that demonstrate it can withstand impact from the most severe loading, including potential explosion loads from any trucks carrying hazardous materials.

With the implementation of our recommendation, we conclude the proposed Project would not pose a significant increase in risk to the public because of the height of the pipe trestle clearance from SH 23, the setback distances of the process area and marine berth area, the fact the facilities would be protected by a storm surge floodwall and the Mississippi River Levee, and the recommended vehicular barrier protection for the pipe trestle supports.

Rail

We reviewed whether any rail operations would be associated with the Project and whether any existing rail lines would be located near the site. We use this information to evaluate whether the Project and any associated rail operations could increase the risk along the rail line and subsequently to the public and whether any pre-existing unassociated rail operations could adversely increase the risk to the Plaquemines LNG site and subsequently increase the risk to the public. If authorized, constructed, and operated, LNG facilities, as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to the DOT’s inspection and enforcement programs. DOT regulations under 49 CFR §193.2155(a)(5)(ii), under Subpart C states if the LNG facility adjoins the right-of-way of any railroad that applicants should evaluate the potential impact and loading on the dike due to collision by or explosion of a train or tank car that could reasonably be expected to cause the most severe loading. Section 8.5.4 of NFPA 59A (2001), incorporated by reference in 49 CFR 193, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements.

Section 8.5.4 of NFPA 59A (2001), incorporated by reference in 49 CFR 193, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. The marine facilities subject to USCG regulations, including 33 CFR 127.001, incorporate NFPA 59A (1994), which requires pipelines be located on

the dock or pier so that they are not exposed to damage from vehicular traffic or other possible cause of physical damage. However, the DOT and USCG regulations and NFPA 59A (2001 and 1994) requirements do not prescribe or indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. Therefore, FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts.

FERC staff evaluated the risk of the rail operations based on incident data from the DOT Federal Rail Administration (FRA), DOT PHMSA, and frequency of rail operations nearby the Plaquemines LNG project. Incident data from DOT FRA and DOT PHMSA indicates hazardous material incidents are very infrequent (6×10^{-3} incidents per rail-mile per year). In addition, approximately 95 percent of releases are 1,000 gal or less, and catastrophic events that would spill 30,000 gal or more make up less than 1 percent of releases. In addition, less than 1 percent of hazardous material incidents result in injuries and less than 0.1 percent result in fatalities.

As previously discussed, the EPA and NOAA report that 80 percent of fires that lead to container ruptures results in projectiles and that 80 percent of projectiles from LPG incidents, which constitute the largest product involved in BLEVEs, travel less than 660 feet. The EPA and NOAA also report that container ruptures average less than four projectiles for cylindrical containers and 8.3 for spherical vessels. FERC staff evaluated other reports that affirmed the EPA and NOAA estimates based on data for approximately 150 experimental and accidental PVBs and BLEVEs with approximately 683 total projectiles (4.6 average fragments per incident) that showed approximately 80 percent of fragments traveled 490 to 820 feet and within 6.25 times the estimated or observed fireball radius. The data also showed projectiles have traveled up to 3,900 feet for large LPG vessels and 1,200 feet for LPG rail cars. In all the documented cases, the projectiles traveled less than 15 times the fireball diameter, but one of the reports indicated up to 30 times the fireball diameter is possible albeit very rare.

Unmitigated consequences under average ambient conditions from releases of 1,000 gallons through a 1-inch hole would result in distances ranging from 25-200 feet for flammable vapor dispersion, and 75-175 feet for jet fires. Unmitigated consequences under worst-case weather conditions from catastrophic failures of rail cars containing various flammable products generally can range from 300-3,000 feet for flammable vapor dispersion, 450-575 feet for radiant heat of 5 kW/m^2 from jet fires, 1,225 to 1,500 feet to a 1 psi overpressure from a BLEVE, 1,250-2,100 feet for a heat dose equivalent to a radiant heat of 5 kW/m^2 over 40 seconds from 350 to 450 feet radii fireballs burning for 7 to 20 seconds from a BLEVE, and projectiles from BLEVEs possibly extending farther. Based on distribution function of the projectile distances, FERC staff estimate approximately 80 percent of all projectiles for a 30,000 gallon rail car would be within 0.5 mile and there is approximately a 5 percent probability they would extend beyond 1 mile and less than 0.1 percent probability they would extend 30 times the fireball diameter. These values are also close to the distances provided by DOT PHMSA for emergency response (0.5-1 mi for initial evacuation and 1 mi for potential BLEVEs for flammable gases).

There would be no rail associated with the Project. The closest rail line is located approximately 5.5 miles away from the Project. This would be farther than the consequence distances under unmitigated worst-case weather conditions and events. Given the distance from the rail line and lack of rail associated with the project, we conclude the proposed Project would

not pose a significant risk or significant increase in risk to the public from proximity of the Project to the rail lines.

Air

We reviewed whether any aircraft operations would be associated with the Project (e.g., helipads) and whether any existing aircraft operations would be located near the site. We use this information to evaluate whether the Project and any associated aircraft operations could increase the risk to the public and whether any pre-existing unassociated aircraft operations could adversely increase the risk to the Project site and subsequently increase the risk to the public. In addition, if authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155(b), Subpart C, require an LNG storage tank must not be located within a horizontal distance of 1 mile from the ends, or 1/4 mile from the nearest point of a runway, whichever is longer and that the height of LNG structures in the vicinity of an airport must comply with DOT FAA requirements. In addition, FERC staff evaluated the risk of an aircraft impact from nearby airports.

There would be no aircraft associated with the proposed Project (e.g., helipads) that would warrant a review that would increase the risk to the public from aircraft operations. The closest airport to the LNG terminal site is the Birdwin Airport, which is approximately 16 miles away to the southeast. There are nine heliports, two general aviation airports, and one naval air station within the 22-mile radius. The other airport within a 20-mile radius is the Braithwaite Park Airport, which is approximately 20 miles to the north. These are all farther than the 0.25-mile distance referenced in DOT regulations.

The DOT FAA regulations in 14 CFR 77 require Plaquemines LNG to provide a notice to the FAA of its proposed construction. This notification should identify all equipment that are more than 200 feet above ground level or lesser heights if the facilities are within 20,000 feet of an airport (at 100:1 ratio or 50:1 ratio depending on length of runway) or within 5,000 feet of a helipad (at 100:1 ratio). In addition, mobile objects, including the LNG marine vessel that would be above the height of the highest mobile object that would normally traverse it would require notification to DOT FAA. The FAA aeronautical study would identify which structures and mobile objects (e.g., LNG marine vessels) exceed obstruction standards and would indicate if the identified structures would be a hazard to air navigation. Based on this study, FAA would issue a determination for each structure and mobile object that exceeds the obstruction standards.

The facilities include equipment taller than 200 feet and would utilize construction cranes that could reach up to 350 feet. Therefore, the regulations in 14 CFR 77 apply to that equipment and require Plaquemines LNG to provide notice to the FAA of its proposed construction. On January 16, 2017, Plaquemines LNG submitted notice to the FAA for an aeronautical obstruction study required under 14 CFR Part 77 for the tallest structure at its property boundaries. On January 25, 2017, DOT FAA issued a determination of no hazard to air navigation provided the structure is marked/lighted in accordance with FAA circular 70/7460-1 L change 1, Obstruction Marking and Lighting, a med-dual system - Chapters 4,8 (MDual), and 12. These determinations were set to expire on July 25, 2018, but Plaquemines LNG filed for extensions of all the determinations and they were granted on July 19, 2018.

In addition, FERC staff analyzed existing aircraft operation frequency data based on the airports identified above and their proximity to the LNG storage tank and process areas, the type and frequency of aircraft operations, take-off and landing directions, and the non-airport flight paths using the DOE Standard, DOE-STD-3014-2006, *Accident Analysis for Aircraft Crash into Hazardous Facilities*. DOE Standard 3014 uses a 22-mile radius from the hazardous facility as the threshold for consideration of hazards posed by airport and heliport operations. Per the DOE Standard 3014, heliports need only be considered if there are local overflights associated with facility operations and/or area operations; because Plaquemines LNG does not have facility or area-associated helicopter flights, and does not have an on-site heliport, the impact risk due to heliport operations is considered insignificant. The two general aviation airports, Birdwin Airport and Southern Seaplane Airport, are located 16.2 miles SE and 20.0 miles NNW of the site, respectively. The runway orientations and associated offsets of the runways of the two airports relative to Plaquemines LNG deems the threat from general aviation operations insignificant. Lastly, the New Orleans Naval Air Station is located 17.7 miles NNW of the site, with the orientation and associated offsets of its runways deeming threats from military aircraft operations also insignificant.

Based upon the DOT requirements, FAA determinations, and our review, we conclude the Project would not pose a significant risk or significant increase in risk to the public due to nearby aircraft operations as a result of the potential consequences, incident data, and distance and position of the closest aircraft operations relative to the populated areas north of the LNG terminal.

Pipelines

FERC staff reviewed whether any pipeline operations would be associated with the proposed Project and whether any existing pipelines would be located near the site. FERC staff uses this information to evaluate whether the Project and any associated pipeline operations could increase the risk to the pipeline facilities and subsequently to the public and whether any pre-existing unassociated pipeline operations could adversely increase the risk to the Project site and subsequently increase the risk to the public. In addition, pipelines associated with this Project must meet DOT regulations under 49 CFR 192 and are discussed in section 4.12.7. If authorized, constructed, and operated, LNG facilities as defined in 49 CFR 193, must comply with the requirements of 49 CFR 192 and 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. FERC staff evaluated the risk of a pipeline incident impacting the Project and the potential of cascading damage increasing the risk to the public based on the consequences from a release, incident data from the DOT PHMSA, and proposed mitigation to prevent or reduce the impacts of a pipeline incident from the Project.

We identified one pipeline that is approximately 0.5 miles to the west of the terminal. We evaluated the potential risk from an incident from the pipeline and its' potential impacts by considering the design and operating conditions and location of the pipeline. Given the proximity of the pipeline to the Project and populations, we conclude the Project would not pose a significant risk or increase in risk to the public.

Hazardous Material Facilities and Power Plants

FERC staff reviewed whether any EPA RMP regulated facilities handling hazardous materials and power plants were located near the site to evaluate whether the facilities could adversely increase the risk to the LNG terminal and whether the LNG terminal could increase the risk to the EPA RMP facilities and subsequently increase the risk to the public. There were no adjacent facilities handling hazardous materials identified by the site. The closest facilities handling hazardous materials are the Elmwood Marine Services and International Marine Terminals, which are both greater than one mile from the LNG terminal. The closest power plant identified was at a refinery approximately 7 miles from the terminal. Given the distance and position of the facilities relative to the populated areas near the LNG terminal, we conclude the Project would not pose a significant increase in risk to the public.

4.12.4.8 Onsite and Offsite Emergency Response Plans

As part of its application, Plaquemines LNG submitted a draft ERP and indicated that it would be further developed with local, state, and federal agencies as well as other stakeholders. The emergency procedures would provide for the protection of personnel and the public as well as the prevention of property damage that may occur as a result of incidents at the Project facilities. The facility would also provide appropriate personnel protective equipment to enable operations personnel and first responder access to the area.

As required by 49 CFR 193.2509, under Subpart F, Plaquemines LNG would need to prepare emergency procedures manuals 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, 49 CFR 193.2509(b)(3) requires “Coordinating with appropriate local officials in preparation of an emergency evacuation plan...,” which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. DOT regulations under 49 CFR 193.2905, under Subpart J also require at least two access points in each protective enclosure to be located to minimize the escape distance in the event of emergency. In addition, FERC staff verified roads were at least 20 ft wide to accommodate emergency apparatus.

Title 33 CFR 127.307 also requires the development of emergency manual that incorporates additional material, including LNG release response and emergency shutdown procedures, a description of fire equipment, emergency lighting, and power systems, telephone contacts, shelters, and first aid procedures. In addition, 33 CFR 127.207 establishes requirements for warning alarm systems. Specifically, 33 CFR 127.207(a) requires that the LNG marine transfer area to be equipped with a rotating or flashing amber light with a minimum effective flash intensity, in the horizontal plane, of 5,000 candelas with at least 50 percent of the required effective flash intensity in all directions from 1.0 degree above to 1.0 degree below the horizontal plane. Furthermore, 33 CFR 127.207(b) requires the marine transfer area for LNG to have a siren with a minimum 1/3- octave band sound pressure level at 1 meter of 125 dB referenced to 0.0002 microbars. The siren must be located so that the sound signal produced is audible over 360 degrees in a horizontal plane. Lastly, 33 CFR 127.207(c) requires that each light and siren must be located so that the warning alarm is not obstructed for a distance of 1.6 km (1 mile) in all directions. The

warning alarms would be required to be tested in order to meet 33 CFR 127. Plaquemines LNG would be required to meet the warning alarms requirements specified in 33 CFR 127.207.

In accordance with the EPOA 2005, FERC must also approve an emergency response plan covering the LNG terminal and LNG carrier transit prior to construction. Section 3A(e) of the NGA, added by Section 311 of the EPOA 2005, stipulates that in any order authorizing an LNG terminal, the Commission must require the LNG terminal operator to develop an ERP in consultation with the USCG and state and local agencies. The final ERP would need to be evaluated by appropriate emergency response personnel and officials. Section 3A(e) of the NGA (as amended by EPOA 2005) specifies that the ERP must 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 in proximity to LNG carriers that serve the facility. The Cost-Sharing Plan must specify what the LNG terminal operator would provide to cover the cost of the state and local resources required to manage the security of the LNG terminal and LNG carrier, and the state and local resources required for safety and emergency management, including:

- direct reimbursement for any per-transit security and/or emergency management costs (for example, overtime for police or fire department personnel);
- capital costs associated with security/emergency management equipment and personnel base (for example, patrol boats, firefighting equipment); and
- annual costs for providing specialized training for local fire departments, mutual aid departments, and emergency response personnel; and for conducting exercises.

The cost-sharing plan must include the LNG terminal operator's letter of commitment with agency acknowledgement for each state and local agency designated to receive resources.

Plaquemines LNG provided a draft of an ERP with its application. As part of FEED, we evaluated the initial draft of the ERP to ensure that it would cover the hazards associated with the Project. In addition, we recommend in section 4.12.5 that Plaquemines LNG provide additional information, for review and approval, on development of the ERP prior to initial site preparation. We also recommend in section 4.12.5 that Plaquemines LNG file, for review and approval, three-dimensional drawings, or other documentation, which demonstrate there is a sufficient number of access and egress locations. If this Project is authorized, constructed, and operated, Plaquemines LNG would coordinate with local, state, and federal agencies on the development of an ERP and cost-sharing plan. We recommend in section 4.12.5 that Plaquemines LNG provide periodic updates on the development of these plans and ensure they are in place prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.5 that Project facilities be subject to regular inspections throughout the life of the facility and would continue to require companies to file updates to the ERP.

4.12.5 Recommendations from FERC Preliminary Engineering and Technical Review

Based on our preliminary engineering and technical review of the reliability and safety of the Project, we recommend the following mitigation as conditions to any order authorizing the

Project. These recommendations would be implemented prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout the life of the facility to enhance the reliability and safety of the facility and to mitigate the risk of impact on the public.

- **Prior to initial site preparation,** Plaquemines LNG should file with the Secretary a study that determines the presence or absence of growth faults extending across the site using geophysically logged borings that is stamped and sealed by the professional engineer-of-record, registered in Louisiana. If growth faults are determined to be present, Plaquemines LNG should file a plan to avoid or mitigate growth fault impacts with the Secretary that is stamped and sealed by the professional engineer-of-record, registered in Louisiana.
- **Prior to construction of final design,** Plaquemines LNG should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:
 - a. site preparation drawings and specifications;
 - b. LNG terminal structures and foundation design drawings and calculations (including prefabricated and field constructed structures);
 - c. seismic specifications for procured equipment; and
 - d. quality control procedures to be used for civil/structural design and construction.

In addition, Plaquemines LNG should file, in its Implementation Plan, the schedule for producing this information.

- **Prior to commencement of service,** Plaquemines LNG should file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Louisiana, for the perimeter levee that ensures the crest elevation relative to mean sea level will be maintained for the life of the facility considering berm settlement, subsidence, and sea level rise.

Information pertaining to these specific recommendations should be filed with the Secretary, for review and written approval by the Director of OEP, or the Director's designee, within the timeframe indicated by each recommendation. Plaquemines LNG should submit specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, as critical energy infrastructure information pursuant to Title 18 of the Code of Federal Regulations, Part 388.113 (18 CFR 388.113). See *Critical Electric Infrastructure Security and Amending Critical Energy Infrastructure Information*, Order No. 833, 81 Fed. Reg. 93,732 (December 21, 2016), FERC Stats. & Regs. 31,389 (2016). Information pertaining to items such as offsite emergency response, procedures for public notification and evacuation, and construction and operating reporting requirements will be subject to public disclosure. All information should be filed **a minimum of 30 days** before approval to proceed is requested.

- **Prior to initial site preparation,** Plaquemines LNG should file an overall Project schedule, which includes the proposed stages of the commissioning plan.

- **Prior to initial site preparation**, Plaquemines LNG should file quality assurance and quality control procedures for construction activities.
- **Prior to initial site preparation**, Plaquemines LNG should file procedures for controlling access during construction.
- **Prior to initial site preparation**, Plaquemines LNG should file its design wind speed criteria for all other facilities not covered by DOT PHMSA's LOD to be designed to withstand wind speeds commensurate with the risk and reliability associated with the facilities in accordance with ASCE 7-16 or equivalent.
- **Prior to initial site preparation**, Plaquemines LNG should develop an ERP (including evacuation) and coordinate procedures with the USCG; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies. This plan should include at a minimum:
 - a. designated contacts with state and local emergency response agencies;
 - b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;
 - c. procedures for notifying residents and recreational users within areas of potential hazard;
 - d. evacuation routes/methods for residents and public use areas that are within any transient hazard areas along the route of the LNG marine transit;
 - e. locations of permanent sirens and other warning devices; and
 - f. an "emergency coordinator" on each LNG marine vessel to activate sirens and other warning devices.

Plaquemines LNG should notify FERC staff of all planning meetings in advance and should report progress on the development of its ERP at 3-month intervals.

- **Prior to initial site preparation**, Plaquemines LNG should file 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. This comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. Plaquemines LNG should notify FERC staff of all planning meetings in advance and should report progress on the development of its Cost-Sharing Plan at 3-month intervals.
- **Prior to construction of final design**, Plaquemines LNG should include spill containment (e.g., a trough collection system) for the entire length of the pipe-in-pipe system between the LNG storage tanks and the marine berth area sized for a full guillotine rupture of the pipe-in-pipe line based on a 10-minute duration.
- **Prior to construction of final design**, Plaquemines LNG should file details of the pipe-in-pipe system design, including wall thicknesses, spacers, expansion bellows or loops, and transitions.
- **Prior to construction of final design**, Plaquemines LNG should file change logs that list and explain any changes made from the front-end engineering design

provided in Plaquemines LNG's application and filings. A list of all changes with an explanation for the design alteration should be provided and all changes should be clearly indicated on all diagrams and drawings.

- **Prior to construction of final design**, Plaquemines LNG should file information/revisions pertaining to the response numbers 14 of its October 11, 2018, filing, response numbers 8, 15, 24, 25, 27, 39, 40, and 43 of its October 16, 2018, filing, and response numbers 11, 31, and 38 of its October 30, 2018, filing, which indicated features to be included or considered in the final design.
- **Prior to construction of final design**, Plaquemines LNG should file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.
- **Prior to construction of final design**, Plaquemines LNG should file drawings of the storage tank piping support structure and support of horizontal piping at grade including pump columns, relief valves, pipe penetrations, instrumentation, and appurtenances.
- **Prior to construction of final design**, Plaquemines LNG should file an up-to-date equipment list, process and mechanical data sheets, and specifications. The specifications should be in consistent units and include:
 - a. building specifications (e.g., control buildings, electrical buildings, compressor buildings, storage buildings, pressurized buildings, ventilated buildings, blast resistant buildings);
 - b. mechanical specifications (e.g., piping, valve, insulation, rotating equipment, heat exchanger, storage tank, pressure vessel, other specialized equipment);
 - c. electrical and instrumentation specifications (e.g., power system, control system, safety instrument system [SIS], cable, other electrical and instrumentation);
 - d. security and fire safety specifications (e.g., lighting, cameras, vehicle barriers, passive protection, hazard detection, hazard control, firewater).
- **Prior to construction of final design**, Plaquemines LNG should specify and design their control systems and human machine interfaces in accordance with the ISA Standards 5.3, 5.5, 60.1, 60.3, 60.4, and 60.6, or other equivalent standards and recommended practices for designing control buildings, displaying graphic symbols for human machine interfaces, and consideration of other human factors.
- **Prior to construction of final design**, Plaquemines LNG should file a list of all codes and standards and the final specification document number where they are referenced.
- **Prior to construction of final design**, Plaquemines LNG should file three-dimensional plant drawings, or other documentation, to confirm plant layout for maintenance, access, egress, and congestion.
- **Prior to construction of final design**, Plaquemines LNG should file up-to-date process flow diagrams (PFDs) and piping and instrument diagrams (P&IDs). The PFDs should include heat and material balances. The P&IDs should include the following information:

- a. equipment tag number, name, size, duty, capacity, and design conditions;
 - b. equipment insulation type and thickness;
 - c. storage tank pipe penetration size and nozzle schedule;
 - d. valve high-pressure side and internal and external vent locations;
 - e. piping with line number, piping class specification, size, and insulation type and thickness;
 - f. piping specification breaks and insulation limits;
 - g. all control and manual valves numbered;
 - h. relief valves with size and set points; and
 - i. drawing revision number and date.
- **Prior to construction of final design**, Plaquemines LNG should include a means to remove mercury as part of the design to limit concentrations to less than 0.01 micrograms per normal cubic meter or alternatively provide monitoring for mercury by means of an analyzer or preventive maintenance inspections of the heat exchangers and connections for a mercury removal package.
 - **Prior to construction of final design**, Plaquemines LNG should file layout and design specifications of the pig trap, inlet separation and liquid disposal, inlet/send-out meter station, filters, and pressure control.
 - **Prior to construction of final design**, Plaquemines LNG should file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs.
 - **Prior to construction of final design**, Plaquemines LNG should file documentation demonstrating that the recommendations from the Front End Engineering Design Hazard Identification are complete and consistent with the requirements of the final design as determined by the engineering, procurement, and construction contractor.
 - **Prior to construction of final design**, Plaquemines LNG should file a hazard and operability review prior to issuing the P&IDs for construction. A copy of the review, a list of the recommendations, and actions taken on the recommendations should be filed.
 - **Prior to construction of final design**, Plaquemines LNG should file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (i.e., temperature, pressures, flows, and compositions).
 - **Prior to construction of final design**, Plaquemines LNG should include LNG tank fill flow measurement with high-flow alarm.
 - **Prior to construction of final design**, Plaquemines LNG should include BOG flow, tank density profile and temperature profile measurement for each tank.
 - **Prior to construction of final design**, Plaquemines LNG should file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system for review and approval. The cause-and-effect matrices should include alarms and shutdown functions, details of the voting and shutdown logic, and set points.

- **Prior to construction of final design**, Plaquemines LNG should specify that all ESD valves are to be equipped with open and closed position switches connected to the Distributed Control System (DCS)/SIS.
- **Prior to construction of final design**, Plaquemines LNG should specify the minimum distance required for valve maintenance, between the LNG loading header and the first valve in the discharge piping to the loading arm.
- **Prior to construction of final design**, Plaquemines LNG should specify that piping and equipment that may be cooled with liquid nitrogen is to be designed for liquid nitrogen temperatures, with regard to allowable movement and stresses.
- **Prior to construction of final design**, Plaquemines LNG should include any isolation valves necessary for startup, operation, shutdown, restart, and maintenance procedures.
- **Prior to construction of final design**, Plaquemines LNG should demonstrate that, for hazardous fluids, piping and piping nipples 2 inches or less in diameter are designed to withstand external loads, including vibrational loads in the vicinity of rotating equipment and operator live loads in areas accessible by operators.
- **Prior to construction of final design**, Plaquemines LNG should specify that all drains from high-pressure hazardous fluid systems are to be equipped with double isolation and bleed valves or equivalent positive isolation.
- **Prior to construction of final design**, Plaquemines LNG should file the sizing basis and capacity for the final design of the flares and/or vent stacks as well as the pressure and vacuum relief valves for major process equipment, vessels, and storage tanks.
- **Prior to construction of final design**, Plaquemines LNG should file pressure-relieving protection for flammable liquid piping segments (i.e., refrigerants, liquid hydrocarbons, condensate products) that can be isolated by valves.
- **Prior to construction of final design**, Plaquemines LNG should file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations should be filed. The evaluation should justify the type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, firewater, and emergency response equipment, training, and qualifications in accordance with NFPA 59A (2001). The justification for the flammable and combustible gas detection and flame and heat detection should be in accordance with ISA 84.00.07 or equivalent methodologies that would demonstrate 90 percent or more of releases (unignited and ignited) that could result in an offsite or cascading impact would be detected by two or more detectors and result in isolation and deinventory within 10 minutes. The analysis should take into account the set points, voting logic, wind speeds, and wind directions. The justification for firewater should provide calculations for all firewater demands (including firewater coverage on the LNG storage tanks) based on design densities, surface area, and throw distance and specifications for the corresponding hydrant and monitors needed to reach and cool equipment.

- Prior to construction of final design, Plaquemines LNG should file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comer that would transfer spills from the tank top to the ground-level impoundment system. The spill containment drawings should show containment for all hazardous fluids, including all liquids handled above their flashpoint, from the largest flow from a single line for 10 minutes, including de-inventory, or the maximum liquid from the largest vessel (or total of impounded vessels) or otherwise demonstrate that providing spill containment would not significantly reduce the flammable vapor dispersion or radiant heat consequences of a spill. In addition, Plaquemines LNG should demonstrate that the stainless steel piping spill trays at each LNG storage tank would withstand the force and shock of a sudden cryogenic release.
- Prior to construction of final design, Plaquemines LNG should consult with the DOT PHMSA on compliance with 49 CFR 193 for the water removal design using drains.
- Prior to construction of final design, Plaquemines LNG should file electrical area classification drawings. The drawings should be updated with the latest design, including liquefaction blocks and full containment tanks, and demonstrate compliance with NFPA 59A, NFPA 70, NFPA 497, API 500, or equivalent, including but not limited to, illustrating Class 1 Division 1 and Division 2, as applicable, at all impoundment trenches, the LNG ship transfer connection, refrigerant truck transfer connection, diesel truck transfer connection, diesel and other combustible tank vents, power plant area, gas turbines, feed gas aftercoolers, mixed refrigerant (MR) coolers, and pig launchers.
- Prior to construction of final design, Plaquemines LNG should file detailed calculations to confirm that the final firewater volumes would be accounted for when evaluating the capacity of the impoundment system during a spill and fire scenario.
- Prior to construction of final design, Plaquemines LNG should file an analysis demonstrating the flammable vapor dispersion from design spills would be prevented from dispersing underneath the elevated LNG storage tanks, or demonstrating the LNG storage tanks would be able to withstand the overpressure due to ignition of the flammable vapors that disperses underneath the elevated LNG storage tanks.
- Prior to construction of final design, Plaquemines LNG should file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001 edition). Plaquemines LNG should also provide the results of consultation with the DOT PHMSA indicating that the proposed electrical process seal design would be considered to meet the design requirements of NFPA 59A (2001), as incorporated by 49 CFR 193.2101.
- Prior to construction of final design, Plaquemines LNG should file details of an air gap or vent installed downstream of process 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, alarm the hazardous condition, and shut down the appropriate systems.

- **Prior to construction of final design**, Plaquemines LNG should file an analysis of the localized hazards to operators from a potential liquid nitrogen release and should also provide spill containment and low oxygen detectors to mitigate liquid nitrogen releases.
- **Prior to construction of final design**, Plaquemines LNG should file a drawing showing the location of the emergency shutdown buttons. Emergency shutdown buttons should be easily accessible, conspicuously labeled, and located in an area that would be accessible during an emergency.
- **Prior to construction of the final design**, Plaquemines LNG should install a plant-wide shutdown button or provide a human reliability analysis that demonstrates the multiple pushbutton approach does not significantly increase the risk compared to a plant-wide shutdown button.
- **Prior to construction of final design**, Plaquemines LNG should file complete drawings and a list of the hazard detection equipment. The drawings should clearly show the location and elevation of all detection equipment, including near the diesel and hot oil tanks, steam turbine power plant, flare KO drums, ethylene packages, peaking generator, essential diesel generator, acid gas removal area, hot oil furnaces, thermal oxidizer, combustion air intakes and HVAC intakes of buildings. The list should include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.
- **Prior to construction of final design**, Plaquemines LNG should account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for methane, propane, butane, ethylene, and condensate.
- **Prior to construction of final design**, Plaquemines LNG should account for the calibration gas of hazard detectors when determining the set points for toxic components such as aqueous ammonia, natural gas liquids and hydrogen sulfide. Include a list of alarm and shutdown set points for each hazard detector.
- **Prior to construction of final design**, Plaquemines LNG should file a technical review of facility design that:
 - a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and
 - b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.
- **Prior to construction of final design**, Plaquemines LNG should file an analysis of the off gassing of hydrogen in battery rooms and ventilation calculations that limit concentrations below the lower flammability limits (e.g., 25 percent LFL) and should also provide hydrogen detectors that alarm (e.g., 20 to 25 percent LFL) and initiate mitigative actions (e.g., 40 to 50 percent LFL).

- **Prior to construction of final design**, Plaquemines LNG should specify smoke detection in occupied buildings.
- **Prior to construction of final design**, Plaquemines LNG should specify hazard detection suitable to detect high temperatures and smoldering combustion products in electrical buildings and control room buildings.
- **Prior to construction of final design**, Plaquemines LNG should file an evaluation of the voting logic and voting degradation for hazard detectors.
- **Prior to construction of final design**, Plaquemines LNG should file facility plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Plan drawings should clearly show the location by tag number of all fixed dry chemical stations in accordance with NFPA 17, and wheeled and hand-held extinguishers along normal paths of access and egress in accordance with NFPA 10 travel distances including, but not limited to, at the liquefaction blocks, near the metering station and pig launchers, on top of all tanks, and in all buildings. The list should include the equipment tag number, manufacturer and model, agent type, agent capacity, discharge rate, automatic and manual remote signals initiating discharge of the units, and equipment covered.
- **Prior to construction of final design**, Plaquemines LNG should specify carbon dioxide systems installed in accordance with NFPA 12 or equivalent in gas turbine enclosures.
- **Prior to construction of final design**, Plaquemines LNG should specify clean agent systems installed in accordance with NFPA 2001 or equivalent in instrumentation buildings.
- **Prior to construction of final design**, Plaquemines LNG should file drawings and calculations for the structural passive protection systems to protect equipment and supports from cryogenic releases.
- **Prior to construction of final design**, Plaquemines LNG should file calculations or test results for the structural passive protection systems to demonstrate that equipment and supports are protected from cryogenic releases.
- **Prior to construction of final design**, Plaquemines LNG should file drawings and specifications for the structural passive protection systems to demonstrate the equipment and supports are protected from pool and jet fires.
- **Prior to construction of final design**, Plaquemines LNG should file a detailed quantitative analysis to demonstrate that adequate mitigation would be provided for each significant component within the 4,000 BTU/ft²-hr zone from pool and jet fires that could cause failure of the component. Trucks at the truck loading/unloading areas should be included in the analysis. A combination of passive and active protection for pool fires and passive and/or active protection for jet fires should be provided and demonstrate the effectiveness and reliability. Effectiveness of passive mitigation should be supported by calculations or test results for the thickness limiting temperature rise and active mitigation should be justified with calculations or test results demonstrating flow rates and durations of any cooling water will mitigate the heat absorbed by the vessel.

- **Prior to construction of final design**, Plaquemines LNG should file a projectile analysis to demonstrate that the outer concrete impoundment wall of a full-containment LNG storage tank could withstand projectiles from explosions and high winds. The analysis should detail the projectile speeds and characteristics and method used to determine penetration or perforation depths.
- **Prior to construction of final design**, Plaquemines LNG should file specifications and drawings demonstrating how cascading damage of transformers would be prevented (e.g., firewalls or spacing) in accordance with NFPA 850 or equivalent.
- **Prior to construction of final design**, Plaquemines LNG should file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings should clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings should also include piping and instrumentation diagrams of the firewater and foam systems. The firewater coverage drawings should illustrate firewater coverage by two or more hydrants or monitors accounting for obstructions (or deluge systems) for all process areas that contain flammable or combustible fluids, including all three docks, diesel generators and storage, hot oil storage, gas dehydration units, and LNG storage tanks.
- **Prior to construction of final design**, Plaquemines LNG should specify remotely operated or automatic firewater monitors in areas inaccessible or difficult to access in the event of an emergency.
- **Prior to construction of final design**, Plaquemines LNG should specify firewater capacities for the monitors and hydrants.
- **Prior to construction of final design**, Plaquemines LNG should design the firewater pump shelter for maintenance access to the firewater pumps.
- **Prior to construction of final design**, Plaquemines LNG should specify that a firewater flow test meter is installed and equipped with a transmitter and that a pressure transmitter is installed upstream of the flow transmitter. The flow transmitter and pressure transmitter should be connected to the DCS and recorded.
- **Prior to construction of final design**, Plaquemines LNG should specify the reducer on the suction side of the firewater pump to be eccentric or otherwise justify the use of an alternative reducer that will not cause air pockets to form and cause possible damage to the firewater pump.
- **Prior to construction of final design**, Plaquemines LNG should file an analysis of the structural integrity of the outer containment of the full containment storage tanks when exposed to a roof tank top fire or adjacent tank top fire.
- **Prior to construction of final design**, Plaquemines LNG should file drawings and specifications for protecting transfer piping, pumps, and compressors, etc. to ensure that they are located away from roadway or protected from inadvertent damage from vehicles.
- **Prior to construction of final design**, Plaquemines LNG should file specifications, drawings, and details of vehicle barriers at each facility entrance for access control.

- **Prior to construction of final design**, Plaquemines LNG should file specifications, drawings, and details of the vehicle collision protection at the SH 23 road crossing of the LNG transfer line that demonstrate it can withstand impact from the most severe loading, including potential explosion loads from any trucks carrying hazardous materials.
- **Prior to construction of final design**, Plaquemines LNG should file security camera drawings showing the location, areas covered, and features of the camera (e.g., fixed, tilt/pan/zoom, motion detection alerts, low light, and mounting height) to verify camera coverage of the entire perimeter with redundancies and cameras interior to the facility, including atop the LNG storage tanks, that would enable rapid monitoring of the LNG plant.
- **Prior to construction of final design**, Plaquemines LNG should file a photometric lighting simulation or other calculations that demonstrate lighting coverage adequately covers, in accordance with API 540, the interior and perimeter of the facility, including in liquefaction blocks, oily water treatment plant area, exterior of buildings, and along paths/roads of access and egress.
- **Prior to construction of final design**, Plaquemines LNG should file details of fencing with barbed or razor wire, or equivalent, at road crossing that would restrict and deter access.
- **Prior to construction of final design**, Plaquemines LNG should file drawings of the security fence. The fencing drawings should provide details of fencing that demonstrates it would restrict and deter access around the entire facility and has a setback from exterior features (e.g., power lines, trees, etc.) and from interior features (e.g., piping, equipment, buildings, etc.) that does not allow the fence to be overcome.
- **Prior to construction of final design**, Plaquemines LNG should provide an evaluation that demonstrates the storm surge barrier, including any gated areas and water discharge through the storm surge barrier, would prevent LNG from extending offsite in the event of a release of the full contents of a LNG storage tank. The evaluation should also demonstrate whether and how high the sheet piles would need to be protected from embrittlement..
- **Prior to commissioning**, Plaquemines LNG should file a detailed schedule for commissioning through equipment startup. The schedule should include milestones for all procedures and tests to be completed: prior to introduction of hazardous fluids and during commissioning and startup. Plaquemines LNG should file documentation certifying that each of these milestones has been completed before authorization to commence the next phase of commissioning and startup will be issued.
- **Prior to commissioning**, Plaquemines LNG should file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms.
- **Prior to commissioning**, Plaquemines LNG should provide procedures for removing the spent H₂S catalyst.

- **Prior to commissioning**, Plaquemines LNG should tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.
- **Prior to commissioning**, Plaquemines LNG should file and maintain a detailed training log to demonstrate that operating, maintenance, and emergency response staff has completed the required training.
- **Prior to commissioning**, Plaquemines LNG should file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service.
- **Prior to commissioning**, Plaquemines LNG should file the procedures for pressure/leak tests that address the requirements of ASME VIII and ASME B31.3.
- **Prior to commissioning**, Plaquemines LNG should file a plan for clean-out, dry-out, purging, and tightness testing. This plan should address the requirements of the American Gas Association's Purging Principles and Practice, and should provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing.
- **Prior to commissioning**, Plaquemines LNG should equip the LNG storage tanks and adjacent piping and supports with permanent settlement monitors to allow personnel to observe and record the total and relative settlement between the LNG storage tank and adjacent piping. The settlement record should be reported in the semi-annual operational reports.
- **Prior to introduction of hazardous fluids**, Plaquemines LNG should file settlement results from the hydrostatic tests of the LNG storage containers and shall file a plan to periodically verify settlement is as expected and does not exceed the applicable criteria set forth in API 620, API 625, API 653, and ACI 376.
- **Prior to introduction of hazardous fluids**, Plaquemines LNG should complete all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the DCS and SIS that demonstrates full functionality and operability of the system.
- **Prior to introduction of hazardous fluids**, Plaquemines LNG should develop and implement an alarm management program to ensure effectiveness of process alarms.
- **Prior to introduction of hazardous fluids**, Plaquemines LNG should complete a firewater pump acceptance test and firewater monitor and hydrant coverage test. The actual coverage area from each monitor and hydrant should be shown on facility plot plan(s).
- **Prior to introduction of hazardous fluids**, Plaquemines LNG should complete and document foam system and sprinkler system acceptance tests.
- **Prior to introduction of hazardous fluids**, Plaquemines LNG should complete and document a clean agent acceptance tests.
- **Prior to introduction of hazardous fluids**, Plaquemines LNG should complete and document a pre-startup safety review to ensure that installed equipment meets the

design and operating intent of the facility. The pre-startup safety review should include any changes since the last hazard review, operating procedures, and operator training. A copy of the review with a list of recommendations, and actions taken on each recommendation, should be filed.

- **Plaquemines LNG should file a request for written authorization from the Director of OEP prior to unloading or loading the first LNG commissioning cargo. After production of first LNG, Plaquemines LNG should file weekly reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports should include a summary of activities, problems encountered, and remedial actions taken. The weekly reports should also include the latest commissioning schedule, including projected and actual LNG production by each liquefaction train, LNG storage inventories in each storage tank, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports should include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude should be reported to FERC within 24 hours.**
- **Prior to commencement of service, Plaquemines LNG should label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001 edition).**
- **Prior to commencement of service, Plaquemines LNG should file any preventive and predictive maintenance program that performs periodic or continuous equipment condition monitoring to ensure mechanical integrity of equipment.**
- **Prior to commencement of service, Plaquemines LNG should file procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by Plaquemines LNG staff.**
- **Prior to commencement of service, Plaquemines LNG should notify FERC staff of any proposed revisions to the security plan and physical security of the plant.**
- **Prior to commencement of service, Plaquemines LNG should file a request for written authorization from the Director of OEP. Such authorization would only be granted following a determination by the USCG, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the Maritime Transportation Security Act of 2002, and the Security and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by Plaquemines LNG or other appropriate parties.**

In addition, we recommend that the following measures should apply throughout the life of the facility.

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least an annual basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Plaquemines 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 P&IDs 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 to identify changes in facility design and operating conditions; abnormal operating experiences; activities (e.g., LNG marine vessel arrivals, quantity and composition of imported and exported LNG, liquefied and vaporized quantities, boil off/flash gas); and plant modifications, including future plans and progress thereof. Abnormalities should include, but not be limited to, unloading/loading/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, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil-off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and December 31. In addition to the above items, a section entitled “Significant Plant Modifications Proposed for the Next 12 Months (dates)” should be included in the semi-annual operational reports. Such information would provide FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities.
- In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission should be notified within 24 hours and procedures for corrective action should be specified.
- Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) should be reported to FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification should be made immediately, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances, notification should be made to FERC staff within 24 hours. This notification practice should be incorporated into the LNG facility’s emergency plan. Examples of reportable hazardous fluids-related incidents include:
 - a. fire;
 - b. explosion;
 - c. estimated property damage of \$50,000 or more;
 - d. death or personal injury necessitating in-patient hospitalization;
 - e. release of hazardous fluids for 5 minutes or more;

- f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of a facility that contains, controls, or processes hazardous fluids;
- g. any crack or other material defect that impairs the structural integrity or reliability of a facility that contains, controls, or processes hazardous fluids;
- h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (MAOP; or working pressure for facilities) plus the build-up allowed for operation of pressure-limiting or control devices;
- i. a leak in a facility that contains or processes hazardous fluids 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 a facility that contains or processes hazardous fluids;
- l. safety-related incidents from hazardous fluids transportation 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 terminal'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.

4.12.6 Conclusions on LNG Reliability and LNG Carrier Reliability and Safety

As part of the NEPA review, Commission staff assesses the potential impact on the human environment in terms of safety and whether the proposed facilities would operate safely, reliably, and securely.

As a cooperating agency, the DOT assisted FERC staff by determining whether Plaquemines LNG's proposed design would meet the DOT's 49 CFR 193 Subpart B siting requirements. On April 3, 2019, the DOT issued an LOD to FERC regarding the proposed Project's compliance with the 49 CFR 193, Subpart B regulatory requirements. The LOD provides PHMSA's analysis and conclusions regarding 49 CFR 193, Subpart B regulatory requirements,

including the determination of legal control of exclusion zones, for the Commission's consideration in its decision on the Project application. If the Project is authorized, constructed, and operated, the facility would be subject to the DOT's inspection and enforcement program and final determination of whether a facility is in compliance with the requirements of 49 CFR Part 193 would be made by the DOT staff.

As a cooperating agency, the USCG also assisted FERC staff by reviewing the proposed LNG terminal and the associated LNG carrier traffic. The USCG reviewed a Waterway Suitability Assessment submitted by Plaquemines LNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On January 23, 2017, the USCG issued a Letter of Recommendation to FERC staff indicating the Lower Mississippi River could be made suitable for accommodating the type and frequency of LNG marine traffic associated with this Project, based on the WSA and in accordance with the guidance in the USCG's NVIC 01-11. If the Project is authorized, constructed, and operated, the facility would be subject to the USCG's inspection and enforcement program to ensure compliance with the requirements of 33 CFR Part 105 and 33 CFR Part 127.

FERC staff conducted a preliminary engineering and technical review of the Plaquemines LNG design, including potential external impacts based on the site location. Based on this review, we recommend the Commission consider incorporating into the order a number of proposed mitigation measures to be implemented prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the facility to enhance the reliability and safety of the facility to mitigate the risk of impact on the public. Based on our external impact analysis and preliminary evaluations of the engineering design and with the incorporation of these mitigation measures and oversight, we conclude that the Plaquemines LNG terminal design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

4.12.7 Pipeline System Safety

The transportation of natural gas by pipeline involves some incremental risk to the public due to the potential for accidental release of natural 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 auto-ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between 5.0 percent and 15.0 percent in air. An unconfined mixture of methane and air is not explosive; however, it may ignite and burn if there is an ignition source. 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 prescribe minimum safety standards to protect against risks posed by pipeline facilities under Title 49, U.S.C. Chapter 601. The DOT's PHMSA 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 that set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. The PHMSA's safety mission is to ensure 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.

Title 49, U.S.C. Chapter 601 provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement actions. Louisiana has delegated authority to inspect interstate pipeline facilities.

The DOT pipeline standards are published in Parts 190-199 of Title 49 of the CFR. Part 192 specifically addresses natural gas pipeline safety issues.

Under a MOU on Natural Gas Transportation Facilities (Memorandum) dated January 15, 1993, between the DOT and 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 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. Alternatively, an applicant must 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. FERC accepts this certification and does not impose additional safety standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipelines under the Commission's jurisdiction.

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 Project must be designed, constructed, operated, and maintained in accordance with the DOT's Minimum Federal Safety Standards for the Transportation of Natural and Other Gas by Pipeline in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. The DOT specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion.

The DOT 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 below:

- 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. For instance, 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; MAOP; inspection and testing of welds; and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas.

Currently, the entire pipeline system is in a Class 1 location. If a subsequent increase in population density adjacent to the right-of-way results in a change in class location for the pipeline, the operator would reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness, if required to comply with DOT requirements for the new class location.

The US DOT's Pipeline Safety Regulations require operators to develop and follow a written integrity management program that contain all the elements described in 49 CFR 192.911 and address the risks on each transmission pipeline segment. The rule establishes an integrity management program that applies to all high consequence areas (HCAs).

The DOT has published rules that define 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 for DOT 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 radius³⁷ is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle³⁸; or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.

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.

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 along its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at section 192.911. The pipeline integrity management rule for HCAs requires inspection of the pipeline HCAs every 7 years.

Currently, there are no HCAs along the pipeline system.

The DOT prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Each pipeline operator is required to establish an emergency plan that includes procedures to minimize the hazards of 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 system shutdown and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and

³⁷ The potential impact radius is calculated as the product of 0.69 and the square root of the MAOP of the pipeline in psig multiplied by the square of the pipeline diameter in inches.

³⁸ The potential impact circle is a circle of radius equal to the potential impact radius.

- protecting people first and then property, and making them safe from actual or potential hazards.

The DOT requires that each operator establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials. Plaquemines LNG would provide the appropriate training to local emergency service personnel before the pipeline is placed in service.

4.12.7.2 Pipeline Accident Data

The DOT requires all operators of natural gas transmission pipelines to notify DOT of any significant incident and to submit a report within 30 days. Significant incidents are defined as any leaks that:

- caused a death or personal injury requiring hospitalization; or
- involved property damage of more than \$50,000 (1984 dollars).³⁹

During the 20-year period from 1995 through 2014, a total of 1,265 significant incidents were reported on the more than 300,000 total miles of natural gas transmission pipelines nationwide.

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12-1 provides a distribution of the causal factors as well as the number of each incident by cause.

The dominant causes of pipeline incidents are corrosion and pipeline material, weld or equipment failure constituting 49.6 percent of all significant incidents. The pipelines included in the data set in table 4.12-1 vary widely in terms of age, diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

The frequency of significant incidents is strongly dependent on pipeline age. Older pipelines have a higher frequency of corrosion incidents and material failure, because corrosion and pipeline stress/strain is a time-dependent process.

³⁹ \$50,000 in 1984 dollars is approximately \$112,955.73 as of May 2015 (CPI, Bureau of Labor Statistics, 2015).

Table 4.12-1 Natural Gas Transmission Pipeline Significant Incidents by Cause (1996-2015) ^a		
Cause	Number of Incidents	Percentage
Pipeline material, weld, or equipment failure	354	27.0
Corrosion	311	23.7
Excavation	210	16.0
All other causes ^b	165	12.6
Natural forces ^c	146	11.1
Outside force ^d	84	6.4
Incorrect operation	40	3.1
Total	1,310	100
a All data gathered from PHMSA's Oracle BI Interactive Dashboard website for Significant Transmission Pipeline Incidents, https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FSC%20Incident%20Trend&Page=Significant&Action=Navigate&col1=%22PHP%20-%20Geo%20Location%22.%22State%20Name%22&val1=%22%22 b All other causes include miscellaneous, unspecified, or unknown causes. c Natural force damage includes earth movement, heavy rain, floods, landslides, mudslides, lightning, temperature, high winds, and other natural force damage. d Outside force damage includes previous mechanical damage, electrical arcing, static electricity, fire/explosion, fishing/maritime activity, intentional damage, and vehicle damage (not associated with excavation).		

The use of both an external protective coating and a cathodic protection system,⁴⁰ required on all pipelines installed after July 1971, significantly reduces the corrosion rate compared to unprotected or partially protected pipe.

Outside force, excavation, and natural forces are the cause in 34.2 percent of significant pipeline incidents. These 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 4.12-2 provides a breakdown of external force incidents by cause.

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 movement.

Since 1982, operators have been required to participate in “One Call” public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The “One Call” program is a service used by public utilities and some private sector companies (e.g., oil pipelines and cable television) to provide preconstruction information to

⁴⁰ Cathodic protection is a technique to reduce corrosion (rust) of the natural gas pipeline through the use of an induced current or a sacrificial anode (like zinc) that corrodes at faster rate to reduce corrosion.

contractors or other maintenance workers on the underground location of pipes, cables, and culverts.

Table 4.12-2 Excavation, Natural Forces, and Outside Force Incidents by Cause (1996-2015) ^a		
Cause	Number of Excavation, Natural Forces, and Outside Force Incidents	Percentage of All Incidents ^{b,c}
Third party excavation damage	172	13.1
Heavy rain, floods, mudslides, landslides	74	5.7
Vehicle (not engaged with excavation)	49	3.7
Earth movement, earthquakes, subsidence	32	2.4
Lightning, temperature, high winds	27	2.1
Operator/contractor excavation damage	25	1.9
Unspecified excavation damage/previous damage	13	1.0
Other or unspecified natural forces	13	1.0
Fire/explosion	9	0.7
Fishing or maritime activity	9	0.7
Other outside force	9	0.7
Previous mechanical damage	6	0.5
Electrical arcing from other equipment/facility	1	0.1
Intentional damage	1	0.1
Total	440	33.5
^a All data gathered from PHMSA's Oracle BI Interactive Dashboard website for Significant Transmission Pipeline Incidents, . ^b Percentage of all incidents was calculated as a percentage of the total number of incidents natural gas transmission pipeline significant incidents (i.e., all causes) presented in table 4.12-1. ^c Due to rounding, column does not equal 33.6 percent.		

4.12.7.3 Impact on Public Safety

The service incidents data summarized in table 4.12-1 include natural gas transmission system failures of all magnitudes with widely varying consequences.

Table 4.12-3 presents the annual injuries and fatalities that occurred on natural gas transmission lines from incidents for the 5-year period between 2010 and 2014. The majority of fatalities from pipelines are due to local distribution pipelines not regulated by FERC. These are natural gas pipelines that distribute natural gas to homes and businesses after transportation through interstate natural gas transmission pipelines. In general, these distribution lines are smaller diameter pipes and/or plastic pipes, which are more susceptible to damage. Local distribution systems do not have large rights-of-way and pipeline markers common to FERC regulated natural gas transmission pipelines. Therefore, incident statistics inclusive of distribution pipelines are inappropriate to use when considering natural gas transmission projects.

Table 4.12-3 Injuries and Fatalities – Natural Gas Transmission Pipelines ^a				
Year	Injuries		Fatalities	
	Employees	Public	Employees	Public
2011	1	0	0	0
2012	3	4	0	0
2013	0	2	0	0
2014	1	0	1	0
2015	12	2	6	0
a All data gathered from PHMSA Pipeline Incident Flagged Files (USDOT, 2015).				

The nationwide totals of accidental fatalities from various anthropogenic and natural hazards are listed in table 4.12-4 in order to provide a relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. The data nonetheless indicate a low risk of death due to incidents involving natural gas transmission pipelines compared to the other categories. Furthermore, the fatality rate is much lower than the fatalities from natural hazards such as lightning, tornados, or floods.

The available data show that natural gas transmission pipelines continue to be a safe, reliable means of energy transportation. From 1996 to 2015, there were an average of 65 significant incidents, nine injuries and two fatalities per year. The number of significant incidents over the more than 303,000 miles of natural gas transmission lines indicates the risk is low for an incident at any given location. The operation of the pipeline system would represent a slight increase in risk to the nearby public.

**Table 4.12-4
Nationwide Accidental Fatalities by Cause**

Type of Accident	Annual Number of Deaths
All unintentional deaths	146,571
Motor vehicle ^a	35,369
Poisoning ^a	38,851
Falls ^a	30,208
Pedestrians from vehicle crash ^b	5,977
Drowning ^a	3,391
Fire, smoke inhalation, burns ^a	2,760
Floods ^c	81
Tornado ^c	72
Lightning ^c	49
Hurricane ^c	47
Natural gas distribution lines ^d	13
Natural gas transmission pipelines ^d	2
a Accident data presented for motor vehicle, poisoning, falls, drowning, fire, smoke inhalation, and burns represent the annual accidental deaths recorded in 2013 (Centers for Disease Control and Prevention, 2013) b National Highway Traffic Safety Administration 2017 data, October 2018 c Accident data presented for floods, tornados, lightning, and hurricanes represent the 30-year average of accidental deaths between 1985 and 2014 (NOAA, 2016) d Accident data presented for natural gas distribution lines and transmission pipelines represent the 20-year average between 1996 and 2015 (USDOT, 2016b)	

4.13 CUMULATIVE IMPACTS

In accordance with NEPA, we considered the cumulative impacts of the Project with other projects or actions within the geographic and temporal scope of the Project. As defined by CEQ, a cumulative effect is the impact on the environment that results from the incremental effects of the proposed action when added to other past, present, and reasonably foreseeable actions, regardless of what agency or person undertakes such actions (CEQ, 1997). Although the individual impact of each separate project may be minor, the additive effects of multiple projects can be significant. The potential direct and indirect impacts of the Project on environmental resources are described in previous sections of this EIS.

The purpose of this analysis is to identify and describe cumulative impacts that would potentially result from construction and operation of the Project. Inclusion of actions is based on identifying commonalities of impacts from other actions to the Venture Global's potential impacts on various environmental resources. To ensure that the analysis focuses on relevant projects and potentially significant impacts, this cumulative impacts analysis includes other actions meeting the following criteria:

- the action impacts a resource that would be affected by the Project;
- the action causes impacts within all or part of the geographic scope of the Project; and
- the action causes impacts within all or part of the temporal scope of the Project.

The regional landscape in the Project area has been significantly altered since the latter part of the nineteenth century, initially by agriculture and later by the development of industrial complexes, oil and gas support facilities, port facilities, residential and commercial centers, and attendant public infrastructure (schools, hospitals, roads, etc.). These developments, along with associated upgrades to flood protection and drainage systems (levees, ditches, pumping stations, etc.), have had a permanent impact on the regional landscape. Consistent with CEQ guidelines (2005), we have aggregated past actions that helped shape the current environment into our discussion of the affected environment in section 4.0. Thus, we discuss present and reasonably foreseeable actions in this section.

Based on our evaluations in section 4.0, the Project would have negligible or no impacts on groundwater, recreation, and cultural resources. As a result, the Project would not contribute to potentially significant cumulative effects on these three resources. However, the Project could contribute incrementally to cumulative impacts on other resources in the Project area.

Most present and reasonably foreseeable actions with impacts during the Project's temporal extent would commence construction or operation during the Project's construction period. One exception is a recently announced container terminal that is so early in the planning phase we assumed it would only overlap the Project's operation period. The Project anticipates construction would begin in 2019 and continue until late 2023. Operation of Phase I facilities would commence in 2022, and Phase II facilities would be operational by 2023. The Project would continue operations for at least 30 years. Thus, actions identified in this assessment were those for which publicly available sources indicated that (i) some portion of construction would occur during years

2019-2023, or (ii) some phase of operation would commence in 2019 or later. We also considered actions that commenced operation in 2017 or 2018 because their effects may not have been realized prior to the analyses in section 4.0.

Actions with resource impacts within the same geographic scope as the Project would occur within a prescribed distance from the Project, uniquely defined based on the characteristics of the resource and how far the Project's effects might extend. Geographic scope, then, defines how far out from the Project a cumulative impact could occur. Table 4.13-1 provides the geographic scope for each resource and the reasoning behind its establishment.

As in section 4.1 through 4.12, we use specific terms to describe the intensity and duration of cumulative impacts. The intensity of a cumulative impact could be negligible, minor, moderate, or significant. The duration of a cumulative impact could be temporary, short term, or long term if the resource would return to its preconstruction condition; otherwise, the impact would be permanent. Temporary impacts may continue for a few months after construction. For ecological and physical resources, short-term impacts could extend up to 3 years, and long-term impacts would last longer than 3 years. For socioeconomic resources, a short-term impact could extend up to 5 years, and a long-term impact would continue after 5 years.

Table 4.13-1 Resource-Specific Geographic Scope and Temporal Extent of Project Impacts		
Resource	Geographic Scope	Reasoning
Geology and Soils	Project workspace	Effects would not extend beyond the area of the Project's direct disturbance.
Groundwater	Aquifers within the HUC-12 subwatersheds directly affected by the Project	Because an HUC-12 subwatershed is a localized drainage basin, runoff, spills, etc., from the Project could travel across affected HUC-12 subwatersheds and affect aquifers beneath them.
Surface Waters and Aquatic Wildlife and Habitat	Waterbodies crossed by and downstream of the Project that are within the HUC-12 subwatersheds directly affected by the Project	Runoff, spills, discharges, etc., from the Project could travel across affected HUC-12 subwatersheds and drain into downstream waterbodies.
Wetlands	Wetlands within the HUC-12 subwatersheds directly affected by the Project	Runoff, spills, discharges, etc., from the Project could travel across affected HUC-12 subwatersheds and intercept wetlands.
Vegetation and Wildlife	Vegetation and wildlife communities within the HUC-12 subwatersheds directly affected by the Project	Runoff, spills, etc., from the Project could travel across affected HUC-12 subwatersheds and intercept the vegetative cover.
Land Use and Recreation	Land use within the broader west bank community and land cover within the HUC-12 subwatersheds directly affected by the Project; recreation within 1.0 mile of the Project	Land uses are planned at the community level; land cover that is not yet paved is partially affected by water flow patterns within the watershed or subwatershed.
Visual Resources	Common viewpoints from which Project or Project activities would be visible	Accounts for visual impacts at the viewshed level.
Socioeconomics	Plaquemines Parish and, to a lesser extent, Jefferson and Orleans parishes	Economic, housing, and public service impacts distribute through local jurisdictions and are not confined to the neighborhood or community around a development.

Table 4.13-1 Resource-Specific Geographic Scope and Temporal Extent of Project Impacts		
Resource	Geographic Scope	Reasoning
Roadway Traffic	West bank in Plaquemines Parish	Traffic flow effects from the Project would primarily impact SH 23, which runs the length of the west bank.
Vessel Traffic	Mississippi River in Plaquemines Parish and waterways in the Barataria Basin	The LNG terminal would generate traffic along the river, which would be concentrated in the reach within the parish; the pipeline system would generate traffic on west bank inland waterways.
Cultural Resources	Area of Potential Effect (as defined in section 4.10)	See section 4.10
Air Quality		
Construction	Concurrently constructed projects within 0.25 mile of the Project	Vehicle, vessel, and equipment emissions and dust generated during construction would not travel farther than 0.25 mile.
Operation	31-mile radius around LNG terminal	Matches EPA's distance for cumulative modeling of large PSD sources during permitting.
Noise		
Construction	Concurrently constructed projects within 0.25 mile of the Project and within 0.5 mile of HDD entry and exit points and pile-driving activities	Distances represent the furthest construction noise could potentially adversely affect NSAs, given the temporary duration.
Operation	1.0-mile radius around LNG terminal	Distance represents the furthest that operation noise could potentially adversely affect NSAs, given the permanent duration.
Key: EPA = U.S. Environmental Protection Agency HDD = horizontal directional drilling HUC = hydrologic unit code NSA= noise-sensitive area PSD = prevention of significant deterioration SH = State Highway		

4.13.1 Projects and Activities Considered

This analysis identified several different types of present, proposed, and permitted actions that could cause a cumulative impact when considered along with the Project. The actions were provided by Venture Global and by a general literature review of several online website sources including, but not limited to:

- FERC eLibrary;
- LDEQ;
- Louisiana Economic Development;
- USACE Regulatory Public Notices;
- Greater New Orleans, Inc., Regional Economic Development;

- Plaquemines Association of Business and Industry; and
- CPRA.

Table 4.13-2 summarizes the actions that have the potential for cumulative impacts because of their location and timing. The actions are mapped on figure 4.13-1. Of the 16 total actions, including the Project, there are:

- two non-jurisdictional facilities associated with the Project;
- seven major industrial developments;
- one major transportation project;
- two drainage and shoreline protection projects;
- four wetland mitigation and restoration projects; and
- one dredging project.

**Table 4.13-2
Present and Future Actions Considered in the Cumulative Impact Analysis^a**

Action/ Proponent	Closest Distance to Project (Location)	Project Type	Description	Estimated Construction Period or Start Date (years) ^b	Estimated Operation Period or Start Date (years)	Action Site (acres, feet, or miles) ^c	Resources that May Be Cumulatively Affected ^d
Plaquemines LNG and Gator Express Pipeline Project	0 miles	Major Industrial	Project nameplate capacity of 20.0 MTPA LNG export capacity	2019–2023	2022 (Phase I)	637 acres – LNG terminal 27 miles– pipeline system	All except groundwater, recreation, and cultural resources
Entergy Electric Utility Connection/ Entergy Louisiana, LLC	0 miles, tie-in at LNG terminal	Non-jurisdictional Utility Line	Temporary tie-in using a 1,500-foot-long electrical line from an existing power line on SH 23 to a temporary construction electrical distribution center within the LNG terminal site. Ground disturbance would involve an electrical junction box, meters, and associated equipment. Following start-up of the LNG terminal power plant, the temporary line would be removed.	2019	2019–2021	1,500 feet within project workspace	None - the disturbed resources are accounted for in the evaluation of the LNG terminal in sections 4.1 through 4.12.
Plaquemines Parish Water Line Connection/ Plaquemines Parish Water Works	0 miles, tie-in at LNG terminal	Non-jurisdictional Utility Line	Temporary or permanent tie-in using a 1,500-foot-long aboveground pipeline from an existing water line along SH 23 to a distribution point at the LNG terminal site. Installation would require temporary ground disturbance. <u>Status</u> Venture Global's evaluation of water supply sources is ongoing, as are discussions with the parish; the 1,500-foot-long tie-in is one option of three alternatives and may not be selected.	2019	2019–2024	1,500 feet within project workspace	None - the disturbed resources are accounted for in the evaluation of the LNG terminal in sections 4.1 through 4.12.
NOLA Oil Terminal/ NOLA Oil Terminal, LLC	4 miles northwest of LNG terminal (west bank)	Major Industrial	New bulk liquid petroleum product blending, storage, and transfer terminal with up to 54 storage tanks having up to 8.2 million barrels capacity. This marine loading operation would receive various oil products (e.g., fuel oil, crude oil, heavy oil carbon black feedstock, and other materials) from barge or ship. Site still lacks feedstock pipeline connection. <u>Permit status</u> 2013: LDEQ Title V air and USACE permits issued 2013: Plaquemines Parish building permit issued 2016: LPDES permit issued	Unavailable	Unavailable	128 acres <i>Information about future pipeline connection unavailable</i>	Surface Water & Aquatic Wildlife; Wetlands; Veg & Wildlife; Land Use; Visual; Socioec - <i>net benefit</i> ; Road Traffic; Vessel Traffic; Air Quality; Safety

**Table 4.13-2
Present and Future Actions Considered in the Cumulative Impact Analysis^a**

Action/ Proponent	Closest Distance to Project (Location)	Project Type	Description	Estimated Construction Period or Start Date (years) ^b	Estimated Operation Period or Start Date (years)	Action Site (acres, feet, or miles) ^c	Resources that May Be Cumulatively Affected ^d
Braithwaite Methanol Plant/ Castleton Commodities International Port Nickel, LLC	18 miles north of LNG terminal (Braithwaite, east bank)	Major Industrial	New methanol manufacturing facility with 5,000-metric ton daily production capacity (1.8 million tons per annum). Feedstock natural gas to be supplied via pipeline, although this connection has not been identified. The final product to be stored on-site prior to being shipped off-site via marine vessels. Market conditions became unfavorable in period after permits first issued. The site is the former Amax Nickel site. <u>Permit status</u> 2014: LDEQ Title V air and USACE permits issued 2017: LDEQ issued extension of construction start-date (or binding agreement to construct) to June 29, 2019 2017: Extension requested for USACE permit	2019 (extension granted to delay construction start-date deadline to June 2019)	2021 (construction reported to require 2 years)	36 acres <i>Information on future pipeline connection unavailable</i>	Surface Water & Aquatic Wildlife Wetlands; Veg & Wildlife; Socioec- <i>net benefit</i> ; Vessel Traffic; Air Quality;
Gulf Coast Methanol Complex/ IGP Methanol LLC	2 miles northwest of LNG terminal (Myrtle Grove, west bank)	Major Industrial	New methanol manufacturing facility with 200,000-metric ton daily production capacity. Feedstock natural gas to be supplied via ~13-mile-long lateral to Tennessee Gas Pipeline near Happy Jack, Louisiana. The final product, pure methanol, to be stored on-site prior to being shipped off-site via marine vessels. At full build-out, four operating units, each producing 1.8 million tons per annum. Estimated construction period is 5–7 years, with each phase staggered 12 months. <u>Permit status</u> 2018 LDEQ Title V air permit issued	2018–2025	2020 or 2021 (first phase)	140 acres – terminal ~13 miles – pipeline	Surface Water & Aquatic Wildlife ; Wetlands; Veg & Wildlife; Land Use; Visual; Socioec - <i>net benefit</i> ; Road Traffic; Vessel Traffic; Air Quality; Safety

**Table 4.13-2
Present and Future Actions Considered in the Cumulative Impact Analysis^a**

Action/ Proponent	Closest Distance to Project (Location)	Project Type	Description	Estimated Construction Period or Start Date (years)^b	Estimated Operation Period or Start Date (years)	Action Site (acres, feet, or miles)^c	Resources that May Be Cumulatively Affected^d
Pointe Celeste Container Terminal/ Plaquemines Port Harbor and Terminal District and American Patriot Holdings LLC	3 miles southeast of LNG terminal (Pointe Celeste, west bank)	Major Industrial	Container terminal equipped to receive 20,000 Twenty-Foot Equivalent Unit vessels or any post-Panamax vessel with three berths exceeding 60 feet. It would provide inland self-propelled vessel service to deliver containers to and from other ports on Mississippi and Illinois Rivers. Container terminal is part of Port District's plan to develop a modernized port facility on 4,200 acres of Port property. The Venture Global Project is considered one element of the new port. The container terminal, along with an envisioned breakbulk terminal, would comprise 1,000 acres. Status Pre-feasibility studies conducted to demonstrate project value. Current effort focused on attracting investors and a terminal operator.	<i>Unavailable:</i> overlap not assumed	<i>Unavailable</i>	Up to 1,000 acres	Surface Water & Aquatic Wildlife; Wetlands; Veg & Wildlife; Land Use; Visual; Socioec; Road Traffic; Vessel Traffic; Air Quality; Safety
Pointe LNG/ Pointe LNG LLC and Pointe Pipeline Company, LLC	8 miles southeast of LNG terminal (east bank)	Major Industrial	LNG export facility consisting of three liquefaction trains with combined production capacity of 6.0 MTPA. Project will include two gas supply pipeline laterals extending north and south, 3.2 miles and 3.4 miles respectively. Two LNG storage tanks of 160,000m ³ will be onsite, which will be surrounded by a floodwall. Power will be generated on-site by gas turbines. The leased property is the site of the proposed Louisiana LNG Project, which submitted a pre-filing process request in 2014 but was later abandoned. The founders of Pointe LNG are the same founders of the defunct Louisiana LNG.	2022–2025	2025	600 acres	Socioec; Vessel Traffic; Air Quality; Safety
Delta LNG	Adjacent Land	Major Industrial	The Project will liquefy domestic natural gas received from the new Delta Express Pipeline and store and deliver LNG as needed to LNG carriers for export overseas. The Delta Express Pipeline will supply feed gas to the LNG terminal. It stretches 287 miles from Perryville, LA to the terminal site.	2021–2024	2024	524	Surface Water, Habitat, Wetlands, Aquatic Resources, Socioec; Vessel Traffic; Air Quality; Safety

**Table 4.13-2
Present and Future Actions Considered in the Cumulative Impact Analysis^a**

Action/ Proponent	Closest Distance to Project (Location)	Project Type	Description	Estimated		Action Site (acres, feet, or miles) ^c	Resources that May Be Cumulatively Affected ^d
				Construction Period or Start Date (years) ^b	Operation Period or Start Date (years)		
Mid-Barataria Sediment Diversion Project/ Louisiana Coastal Protection and Restoration Authority	<u>Diversion</u> structure: 5 miles northwest of LNG terminal; <u>Targeted</u> area: <u>portion</u> of the Barataria Basin that encompasses the project (Lower Mississippi River and Barataria Basin)	Wetland Mitigation and Restoration	Project would restore marshes in the Barataria Basin by reintroducing sediment and nutrients that historically built up the area. Expected to reduce land loss in portion of the Barataria Basin by 20,000 to 32,000 acres over 50 years. The project would create an opening in the West Bank levee just north of Ironton, L.A. <u>Permit status</u> October 2022: Target date for design completion and permit acquisition. Construction would start following permits and take 2 to 4 years.	2022–2026	2026	4.5 acres 20,000 to 32,000 acres – area benefited	Surface Water & Aquatic Wildlife - <i>net benefit</i> ; Wetlands - <i>benefit</i> ; Socioec - <i>net benefit</i> ; Air Quality
NOV/NFL Hurricane Risk Reduction Project- Levee Upgrade/ USACE	0 miles (adjacent to pipeline system) and 0.3 mile south of LNG terminal (total project covers west and east banks)	Drainage and Shoreline Protection	In lower Plaquemines Parish, these complimentary projects involve upgrading or restoring existing levees and completing unconstructed authorized ones to achieve storm risk reduction. Seven levee reaches, comprising 58 miles, are being upgraded, either to a 20- to 25-year or 50-year storm level of risk reduction. Subset of NOV/NFL adjacent to the project (Plaquemines Parish non-federal levee project): 34 miles of levees from Oakville to St. Jude originally constructed by the parish to be replaced or modified, some of which will be incorporated into the NOV federal system. Upgraded levee will be crossed by the Southwest laterals. Construction began in 2012 and is scheduled to finish in 2024. <u>Status of levee segment adjacent to the project</u> In design as of December 2016.	2012–2024 (Levee segment adjacent to the project: <i>construction date</i> <i>unavailable</i>)	Ongoing (Levee segment adjacent to the project: <i>by</i> <i>2024</i>)	58 miles affected (<i>not</i> <i>all within</i> <i>geographic</i> <i>scope</i>)	Surface Water & Aquatic Wildlife - <i>net</i> <i>benefit</i> ; Wetlands; Veg & Wildlife; Land Use - <i>benefit</i> ; Road Traffic; Air Quality; Noise; Safety - <i>benefit</i>

**Table 4.13-2
Present and Future Actions Considered in the Cumulative Impact Analysis^a**

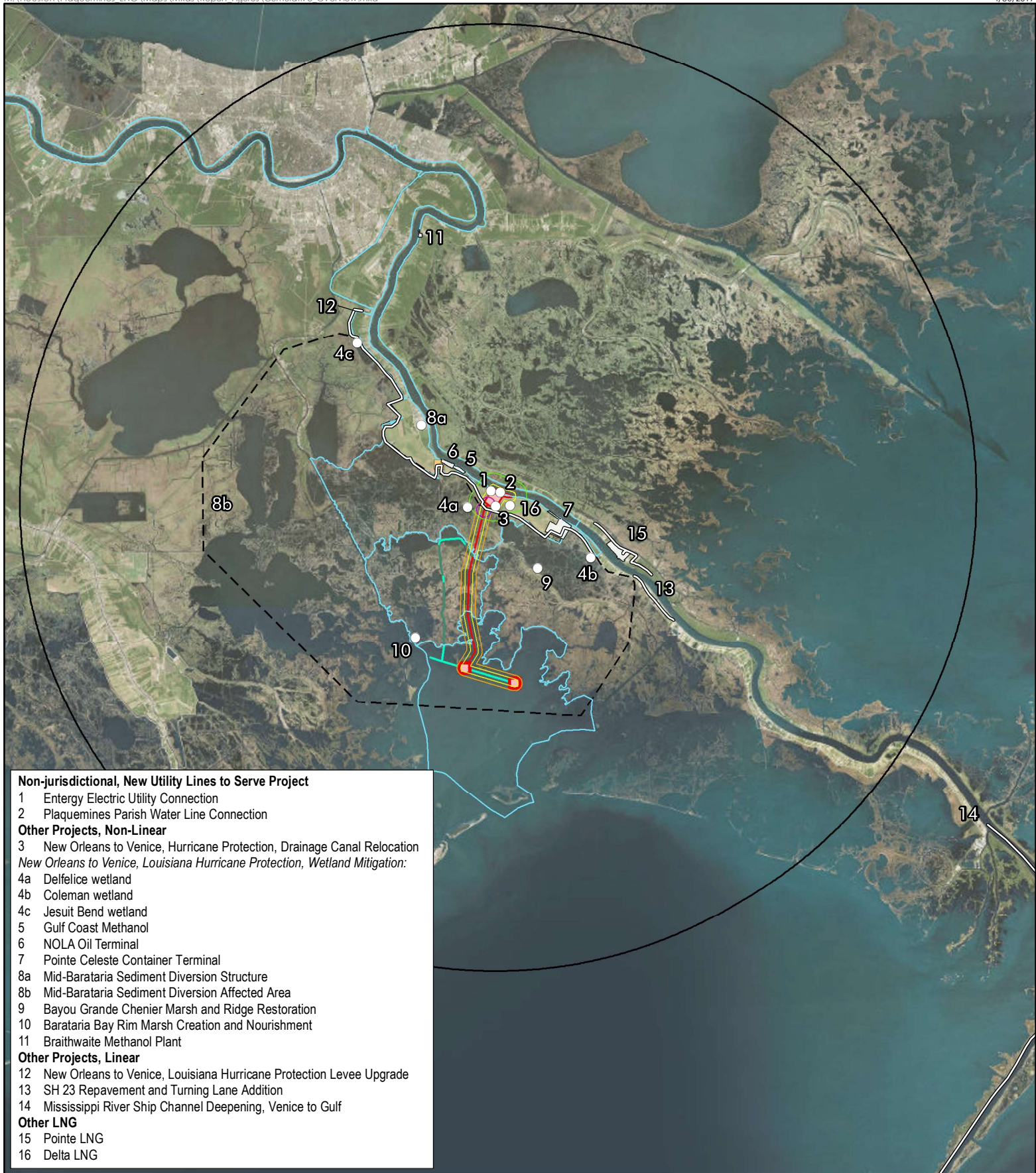
Action/ Proponent	Closest Distance to Project (Location)	Project Type	Description	Estimated Construction Period or Start Date (years)^b	Estimated Operation Period or Start Date (years)	Action Site (acres, feet, or miles)^c	Resources that May Be Cumulatively Affected^d
NOV/NFL Hurricane Risk Reduction Project - Wetland Mitigation/ USACE	1 mile west of pipeline system (total project crosses four parishes)	Wetland Mitigation and Restoration	Wetland mitigation projects for some, but not all, of the NOV/NFL Hurricane Risk Reduction Project. The Environmental Assessment #543 discusses the impacts of creating and nourishing nine distinct marshes, three of which are within the HUC-12 subwatersheds intersected by the project: Delfelice (345 acres brackish marsh); Coleman (230 acres brackish marsh); Jesuit Bend (225 bottom land hardwood-wet and 95 acres swamp). Dredge material from 606 acres within Mississippi River would provide sediment.	2019	2021	Acres within geographic scope for wetlands; 670 acres non- forested wetlands 225 acres forested wetlands	Surface Water & Aquatic Wildlife - <i>benefit</i> ; Wetlands - <i>benefit</i> ; Vessel Traffic
NOV/NFL Hurricane Risk Reduction Project- Drainage Canal Relocation/ USACE and Plaquemines Parish Government	0 miles (adjacent to pipeline system) and 0.3 mile south of LNG terminal (west bank)	Drainage and Shoreline Protection	Because of the expansion of portions of the non- federal levee base, the existing drainage canal located on the levee's protected side would be filled; as part of the overall project, Plaquemines Parish government would redirect the water flow to the canal that fringes the southern edge of the terminal and improve it to accommodate the additional flow.	Prior to August 2024	By August 2024	~1.8 acres (80,000 square feet) ^a	Surface Water & Aquatic Wildlife- <i>benefit</i> ; Wetlands; Road Traffic; Noise; Air Quality; Safety - <i>benefit</i>
Mississippi River Ship Channel Deepening, Venice to Gulf/ USACE and Louisiana Department of Transportation and Development	35 miles southeast of the terminal (Lower Mississippi River)	Dredging	Increase depth from 45 feet to 50 feet in the southernmost segment of the Mississippi River ship channel ~35 miles from river mile 13.4 above Head of Passes to river mile 22.0 below Head of Passes in Southwest Pass. This is the next phase of construction in an overarching plan to deepen the majority of the ship channel from Baton Rouge to Venice. <u>Status</u> Draft Integrated General Reevaluation Report and Supplemental Environmental Impact Statement was issued November 2016.	<i>Unavailable</i> : overlap not assumed	<i>Unavailable</i>	~400-foot length of canal along the 400- foot pipeline system workspace at the pipe bridge	Vessel Traffic; Socioec - <i>benefit</i> ; Air Quality; Safety

**Table 4.13-2
Present and Future Actions Considered in the Cumulative Impact Analysis^a**

Table 4.13-2 Present and Future Actions Considered in the Cumulative Impact Analysis ^a							
Action/ Proponent	Closest Distance to Project (Location)	Project Type	Description	Estimated Construction Period or Start Date (years) ^b	Estimated Operation Period or Start Date (years)	Action Site (acres, feet, or miles) ^c	Resources that May Be Cumulatively Affected ^d
SH 23 Improvement Project/ Louisiana Department of Transportation and Development	10 miles southeast of terminal (Happy Jack to Port Sulphur, west bank)	Major Transportation	Resurfacing 2-lane section of SH 23 between Happy Jack and Port Sulphur, Louisiana (almost 4 miles), and adding turning lanes in Port Sulphur at Civic Drive, Freeport Drive, and the entrance to Plaquemines Medical Center. Minor drainage work included replacing deficient cross drains. SH 23 is the main artery in the west bank and is the evacuation route.	Completed March 2017	2017	4-mile-long road section	Road Traffic - <i>benefit</i>
Bayou Grande Chenier Marsh and Ridge Restoration/ Coastal Protection and Restoration Authority	2 miles east of pipeline system (west bank)	Wetland Mitigation and Restoration	Creating and nourishing marsh and forested ridge habitat with dredged material from Mississippi River. Material would be hydraulically dredged and piped. <u>Status</u> Construction services agreement signed in January 2015.	<i>Unavailable</i>	<i>Unavailable</i>	Total wetlands: 486 acres 342 acres – created Approximately 132 acres – nourished 12 acres – forested ridge creation	Surface Water & Aquatic Wildlife - <i>net benefit</i> ; Wetlands - <i>benefit</i> ; Vessel Traffic; Air Quality
Barataria Bay Rim Marsh Creation and Nourishment/ Coastal Protection and Restoration Authority	2 miles west of pipeline system; adjacent to barge route for pipeline system construction (west bank)	Wetland Mitigation and Restoration	Creating marsh with dredged material from the Barataria Bay. The site is at the northwest end of the Barataria Bay, adjacent to Mud Lake. <u>Status</u> The project was approved for Phase I engineering and design in January 2016, and construction was scheduled for November 2020 through November 2021, pending funding approval. However, an update from Coastal Protection shows status as “awaiting additional funding for implementation” through end of 2021.	2020-21, pending funding	2021, pending funding	Total wetlands: 517 acres 251 acres – created 266 acres – nourished	Surface Water & Aquatic Wildlife - <i>net benefit</i> ; Wetlands - <i>benefit</i> ; Vessel Traffic; Air Quality

**Table 4.13-2
Present and Future Actions Considered in the Cumulative Impact Analysis^a**

Action/ Proponent	Closest Distance to Project (Location)	Project Type	Description	Estimated Construction Period or Start Date (years) ^b	Estimated Operation Period or Start Date (years)	Action Site (acres, feet, or miles) ^c	Resources that May Be Cumulatively Affected ^d
a This table lists those activities that are most likely to contribute to cumulative impacts within the vicinity of the Project; it is not intended to provide an all-inclusive listing of activities in the region. b Actions with “<i>unavailable</i>” construction dates are assumed to undergo construction concurrent with Project construction, unless otherwise noted. c Some of the area within a project site may not be disturbed or affected by an activity. d Actions’ effects on listed resources are adverse unless otherwise noted as “<i>benefit</i>” or “<i>net benefit</i>,” implying some effect would be adverse. e Abbreviated resource categories are as follows: SurfWater & Aquatic Wildlife = Surface Water and Aquatic Wildlife and Habitat Veg & Wildlife = Vegetation and Wildlife Socioec = Socioeconomics [jobs, revenues and stimulus, taxes, housing, and public services] Safety = Safety and Reliability Key: HUC = hydrologic unit code LDEQ = Louisiana Department of Environmental Quality LNG = liquefied natural gas LPDES = Louisiana Pollutant Discharge Elimination System MTPA = million metric tons per annum NFL = Non-Federal Levees NOV = New Orleans to Venice SH = State Highway USACE = U.S. Army Corps of Engineers							



Projects With Potential Cumulative Impacts

○ Non-linear Projects*

— Linear Projects

□ Boundary of Project 8b

*Boundaries delineated for selected projects

Project Components and Buffers

■ Interconnects

■ Parking Area for Pipeline Construction Employees

— Laterals (TETCO & TGP)

— Barge Access Channel - Dredge/Excavation Proposed

— Barge Access Channel - No Dredge Required

■ Terminal Site Boundary

□ 0.25-mi buffer of Terminal and Pipeline

□ 0.5-mi buffer of HDD entry/exit

□ 0.5-mi buffer of Pipeline

□ 1-mi buffer of Terminal

□ 31-mi buffer of Terminal (air-operations)

□ HUC-12 Subwatersheds Intersected by Project

Figure 4.13-1
Projects with Potential
Cumulative Impacts
Plaquemines Parish,
Louisiana

ecology and environment, inc.
environmental specialists in the environment

Source: DigitalGlobe 2017, USGS 2018

As a simplifying assumption, we assumed permitted actions with unavailable construction start dates would be constructed concurrently with the Project. However, we did not assume concurrent construction with announced actions that are in an early planning stage and have not filed a permit application. Rather, we assumed these actions would eventually operate concurrently with the Project.

In the case of the Project and its vicinity, several planned actions identified within the geographic and temporal scope would not likely compound adverse impacts of the Project such that they would cause long-term or permanent degradation of a local environmental resource. Of the 14 identified actions, six are designed specifically to improve environmental quality or safety (i.e., the wetland nourishment and wetland creation actions and the levee and drainage canal improvements). Construction associated with these improvements would generate vessel traffic and associated air emissions and could adversely affect water quality and aquatic species during construction. However, the chief effects of these actions would be the restoration of different marsh types, improved surface water flow, and enhanced sedimentation patterns to mitigate wetland and other land loss. Whether constructed concurrently with each other and the Project, or in sequence during Project construction, these actions have low potential for tipping the scale and resulting in significant adverse cumulative impacts.

4.13.1.1 Non-jurisdictional Activities

Non-jurisdictional facilities are those components of an interstate natural gas transmission project or liquefied natural gas project that are not under the jurisdiction of FERC. The two non-jurisdictional actions—construction of an electrical utility tie-in and a water utility tie-in to serve the LNG terminal—are negligible in scale compared with the LNG terminal and the other major industrial developments identified in the geographic and temporal extent. Each utility tie-in would extend approximately 1,500 feet from existing utilities along SH 23, originating from the segment of SH 23 that passes through the LNG terminal site. Thus, almost all ground disturbance would occur within the LNG terminal site. The non-jurisdictional actions would not have any minor or greater impacts beyond those already accounted for in the evaluation of the LNG terminal.

4.13.1.2 Major Transportation Projects

One major transportation project had temporal and geographic overlap with the Project. The major transportation project—the recent resurfacing of SH 23 between Happy Jack and Port Sulphur, Louisiana, and the addition of turn lanes at three intersections—could potentially enhance or improve traffic flow in this part of lower Plaquemines Parish, a benefit to all potential developments in the region. The SH 23 improvement was completed after Venture Global conducted its LNG terminal and pipeline system transportation studies, so it was carried forward in this cumulative effects analysis.

The dredging project, which involves deepening 35 miles of the Mississippi River ship channel from the Gulf entrance to Venice, is intended to reduce transportation costs by decreasing the need for bulk carriers, tankers, and container ships to “light load” in order to reach inland ports (USACE New Orleans District, 2016). It would also permit easier maneuvering and reduce shoaling between each maintenance dredging cycle. The dredging location, at least 35 miles from the LNG terminal, would not contribute cumulative effects during the excavation. When

completed, however, the channel deepening would improve vessel maneuvering and reduce the incidence of shoaling. The overall effect on vessel counts is unknown, though we assume the count of large vessels would increase. In balance, the dredging project would improve vessel transportation along the ship channel, negating its potential to cause a significant adverse effect cumulatively with other actions.

4.13.1.3 Major Industrial Developments

The remaining actions are major industrial developments planned or proposed along the lower Mississippi River. Three have acquired permits from LDEQ or USACE, or both, one was only recently announced in 2017 and one in 2018. Although we acknowledge and discuss the other actions on our list, we focus much of our analysis and scrutiny on these five projects. Two permitted actions are within 4 miles of the LNG terminal—the Gulf Coast Methanol Complex and NOLA Oil Terminal. NOLA Oil Terminal acquired its first federal permit in 2013 but has not yet commenced construction. A feedstock pipeline is a critical limiting factor for the proposed bulk liquid petroleum blending, storage, and transfer facility; and, to date, plans to construct or connect one have not been made public. The Gulf Coast Methanol Complex, classified as a major air emissions source, was issued an LDEQ air permit in January 2018. The methanol manufacturing plant would receive natural gas from Tennessee Gas pipeline and extract and refine methanol for use as a fuel, and as a fuel for plastics and other material manufacturing. The Braithwaite Methanol Manufacturing Plant on the east bank in Braithwaite, 18 miles from the LNG terminal, acquired its first major permit in 2014. However, the project is on hold as proponents seek financing. The Point Celeste Terminal was only recently announced in 2017 as a joint partnership between Plaquemines Port Harbor and Terminal District and American Patriot Holdings LLC to develop a container ship terminal on port-owned property 3 miles from the LNG terminal. They plan to negotiate agreements with upriver ports on the Mississippi, particularly in Memphis and St. Louis, to create a more efficient system of inland cargo delivery and transportation that could attract customers to the new container port. The parties are in the preliminary phase and seeking investor interest. Pointe LNG was announced in 2018 and is located approximately 8 miles southeast of the Project while Delta LNG was announced in 2019 and is located adjacent to Plaquemines LNG. Both are expected to carry similar environmental impacts as the Project.

4.13.1.4 Drainage and Shoreline Protection Activities

Three drainage and shoreline protection activities are proposed or underway in the vicinity of the Project facilities.

The Mid-Barataria Sediment Diversion Project is proposed by the CPRA to restore the riverine and estuarine habitat between the Mississippi River and the Mid-Barataria basin. The reintroduction of freshwater and sediment to reestablish the deltaic process is expected to build, sustain, and maintain land and mimic historic deltaic sediment deposition (CPRA, 2012). The proposed diversion structure is approximately 5 miles northwest of the terminal site on the west bank of the Mississippi River, near river mile 61. Planning is underway, and completion of design and permitting is expected in October 2022. Construction is expected to commence shortly thereafter and last 2 to 4 years.

The New Orleans to Venice (NOV/NFL) Hurricane Risk Reduction Project is proposed by the USACE to provide storm risk reduction for Plaquemines Parish. The project involves upgrading approximately 90 miles of existing federal and non-federal levees on the east and west banks of the Mississippi River (USACE, 2016c). The geographic range of this activity will span from Phoenix to Bohemia on the east bank, and from St. Jude to Venice on the west bank. This is an ongoing activity and the USACE began awarding contracts in 2012, with the most recent contracts awarded in June 2016. Construction is anticipated to continue into 2024. Sections of this activity are adjacent to the terminal site and will be crossed by the Southwest laterals.

This levee upgrade requires an expansion of the non-federal levee base during the NOV/NFL Hurricane Risk Reduction Project that will fill the existing drainage canal on the protected side, necessitating its relocation. Thus, the Plaquemines Parish government, with funds from USACE, intends to redirect the water flow to the canal that fringes the southern edge of the terminal and, to accommodate the additional flow. To date, the construction schedule for this activity has not been announced, although funds for this work were released by the USACE in 2016.

4.13.1.5 Marsh and Wetland Mitigation Activities

The NOV/NFL Hurricane Risk Reduction Project includes two wetland mitigation projects. These two projects are sponsored by the USACE and involve regional wetland mitigation initiatives totaling approximately 876 acres, including marsh creation, to offset the impacts of the New Orleans to Venice, Louisiana, Hurricane Protection Project (BA-0067). Construction start-up is scheduled for the 1st quarter of 2019, with completion scheduled for the 2nd quarter of 2021.

The Barataria Bay Rim Marsh Creation and Nourishment Project is sponsored by the CPRA and NRCS. The project would use dredged material from Barataria Bay to create approximately 251 acres of marsh and nourish approximately 266 acres of marsh to mitigate wetland loss in the area (USACE, 2015; Louisiana Coastal Wetlands Conservation and Restoration Task Force, 2016). The proposed site is located at the northwest end of Barataria Bay, adjacent to Mud Lake, and is approximately 9.6 miles southwest of the terminal site. Construction is scheduled for the 4th quarter of 2020 through the 4th quarter of 2021, pending funding approval.

The Bayou Grande Chenier Marsh and Ridge Restoration Project (BA-173) is sponsored by the CPRA and U.S. Fish and Wildlife Service. The project will create approximately 342 acres of marsh and 12 acres of forested ridge habitat at a site about 3.3 miles southeast of the pipeline system proposed route. The project also involves marsh nourishment. Material will be hydraulically dredged and piped from the Mississippi River for this purpose. Phase I engineering design has been completed, but no additional schedule details are publicly available at this time.

During the draft EIS comment period, a commenter questioned if terminal construction would lock in sand resources that could be used for renourishment projects as described above. According to the Louisiana Sand Resources Database (LASARD) Deposit Borrow Areas layer on the Coastal Information Management System (CIMS) provided by the CPRA, the LNG terminal site and marine facilities are not located over mapped sand resources. The nearest potential borrow area within the Mississippi River is located on the river bottom about 1,000 feet off the west bank. Further, the marine facilities would be in an area that has been previously been modified by

placement of riprap and concrete revetment blankets, likely precluding its consideration as a potential borrow area. In short, the Project would not affect the potential use of the river as a sand borrow area for future use in wetland restoration projects.

4.13.2 Potential Cumulative Impacts by Resource

Based on our evaluations in section 4.1 through 4.12, the Project would have only negligible impacts on groundwater, recreation, and cultural resources. As a result, the Project would not contribute to potentially significant cumulative effects on these three resources.

For each remaining resource, the following sections address the potential cumulative impacts from Venture Globals's Project and other projects identified within the cumulative impact area on specific environmental resources. We briefly summarize the anticipated Project-specific construction and operational impacts in order to associate the other projects' actions to potential impacts on the resources. In some cases, the resource area was too broad a category to evaluate collectively, and we identified impacts on a subset instead. For example, under land use we consider the change in the amount of agricultural land, not the change in land use categories generally. We advise the reader that when we summarize the effects of the Project, we assume that mitigation measures in section 4.1 through 4.12 would be implemented.

4.13.2.1 Geology and Soils

Aside from the non-jurisdictional utility lines, only one of the actions in table 4.13-2 would occur within the workspaces of the Project, which comprise the geographic scope for cumulative effects on geologic resources and soils. Delta LNG would likely have an overlap of workspaces from feed gas pipelines. However, geologic resources and soils affected by the Project would not sustain significant impacts from the present or foreseeable actions; therefore, no cumulative effects would occur. As stated in section 4.13.1, effects from the non-jurisdictional utility lines are already accounted for in sections 4.1 through 4.12 and, therefore, would not have additive or cumulative effects. The utility lines would be located on the LNG terminal site.

Although prime farmland is a subset of soils, it is also associated with land use and, as such, is discussed in the cumulative evaluation of land use on the west bank in section 4.13.2.6.

4.13.2.2 Groundwater

As described in the introduction to this section, our evaluation determined that construction of the LNG terminal and pipeline would have only negligible effects on groundwater. As a result, there would be no contribution to cumulative effects on this resource. Moreover, Venture Global would not withdraw groundwater for hydrostatic testing of the pipeline system facilities, nor would it use groundwater for hydrostatic testing of the LNG storage tanks, terminal piping, and non LNG tanks, which constitute the largest user of hydrostatic test water among the LNG terminal facilities.

Based on these factors, we found that construction and operation of the Project would not likely affect groundwater resources. Given this low likelihood of occurrence, we conclude that the Project would not contribute to an adverse cumulative effect on groundwater resources within the geographic scope.

4.13.2.3 Surface Waters and Aquatic Wildlife and Habitat

Surface waters and aquatic wildlife and habitat are combined in this analysis because activities that affect surface waters also affect fish and other aquatic species such as marine mammals and sea turtles, as well as their habitats. The surface waters affected by the Project are the Lower Mississippi River and several waterbodies in the Barataria Basin (see tables 4.3-2 for specific waterbodies in the Barataria Basin). Our evaluation determined that the Project would have minor deleterious effects on these waterbodies and associated aquatic resources.

Excavation and pile driving to construct the LNG loading docking in the Mississippi River would increase suspended sediment and turbidity. Other in-water and shore-based construction activities—including use of in-water construction equipment, shore-based equipment, and vessel transits to and from the work site—could cause erosion and sediment resuspension. Pile driving in the river could injure or induce behavioral changes in fish or marine mammals and, should they occur, leaks or spills from the marine offloading facilities or construction support vessels could contaminate the river. During operation, stormwater that washes over the marine facilities would drain to the Mississippi River, while stormwater over the landward portion of the LNG terminal would be collected into sump pumps and eventually discharged into the Mississippi River via pipeline. LNG carriers calling at the terminal would discharge ballast water, increasing the potential to introduce invasive species, and their transits could cause sediment resuspension and erosion.

In the Barataria Basin, trenching and installation of the pipeline system and dredging of specific segments of the barge routes would increase suspended sediment and turbidity. Hydrostatic test water would be discharged into the basin, as would stormwater from the LNG terminal during construction, when stormwater would be directed to the canals bordering the site and then eventually pumped to Lake Judge Perez in the Barataria Basin. The majority of hydrostatic test water for the LNG terminal and pipeline system would be withdrawn from industrial canals in the Barataria Basin. Pile driving for two pipeline system metering stations in the Barataria Basin could injure or induce behavioral changes in fish, sea turtles, and marine mammals; and oyster reefs within the pipeline right-of-way would be removed. During operation, the only minor effect in the basin would be risk of a spill or leak from the pipeline system.

Eleven other actions could occur within the geographic and temporal extent for cumulative impacts on surface waters, fish, and aquatic resources and also affect those same resources (see table 4.13-3). Four of the actions would benefit those resources in the Barataria Basin, and two of the actions would, at a minimum, improve drainage in and around the region. Although the site of Bayou Grande Chenier Marsh and Ridge Restoration is outside the HUC 12 subwatersheds intersected by the Project, we included the site because it would occur in the Barataria Basin only 2 miles from the pipeline system.

Cumulative Impacts on the Mississippi River

Given our assumptions about Project schedules, Gulf Coast Methanol Park, NOLA Oil Terminal, Braithwaite Methanol Manufacturing Plant, Delta LNG and the Mid-Barataria Sediment Diversion structure would be constructed concurrently with the LNG terminal between 2019 and 2023 and would also affect the Mississippi River. The major industrial facilities, including the

Pointe Celeste Container Terminal when it comes online and Delta LNG, would affect the river during operation,

Table 4.13-3 Other Actions with the Potential to Cumulatively Impact Surface Waters and Aquatic Wildlife and Habitat					
Action	Site Area (acres/miles)	Closest Distance to Project	Affected Waterbodies with Potential Cumulative Impacts	Construction Overlap	Operation Overlap
Project	637 acres	-	Lower Mississippi River, Barataria Basin	-	-
Gulf Coast Methanol	140 acres	2 miles	Lower Mississippi River	X	X
NOLA Oil Terminal	128 acres	4 miles	Lower Mississippi River, Barataria Basin (primarily Wilkinson Canal)	X	X
Pointe Celeste Container Terminal	up to 1,000 acres	3 miles	Lower Mississippi River		X
Braithwaite Methanol Manufacturing Plant	36 acres	18 miles	Lower Mississippi River	X	X
Delta LNG	524 acres	0 miles	Lower Mississippi River	X	X
Actions with Net Benefits					
NOV/NFL Levee Upgrade	58 miles – not all within geographic scope	0 miles	Barataria Basin	X	X
NOV/NFL Drainage Canal Relocation	1.8 acres	0 miles	Barataria Basin	X	X
Mid-Barataria Sediment Diversion	4.5 acres – diversion structure on west bank	5 miles	Lower Mississippi River	X	X
	20,000 to 32,000 acres – marsh and open water to benefit from sedimentation	0 miles	Barataria Basin	-	X
NOV/NFL Wetland Mitigation	895 acres	1 mile	Barataria Basin	X	X
Bayou Grande Chenier Marsh and Ridge Restoration	486 acres	2 miles	Barataria Basin	X	X
Barataria Bay Rim Marsh Creation and Nourishment	517 acres	2 miles	Barataria Basin	X	X
Key: - = not applicable NFL = Non-Federal Levees NOV = New Orleans to Venice					

If the aforementioned actions were constructed concurrently, the chief concern about effects on river water quality would be increases in suspended sediments, turbidity, stormwater effluent and shoreline erosion from in-water construction, site-based modifications near the shore, and vessel traffic. In-water and shore-based construction activities associated with the methanol manufacturing plants, NOLA Oil Terminal, and Delta LNG would be similar to those at the LNG terminal. The scale of shore-based construction associated with the NOLA Oil Terminal, Gulf Coast Methanol Complex, and Delta LNG would be commensurate with the LNG terminal—their sites each have approximately 5,000 feet of river frontage compared with the LNG terminal's 7,000 feet. Braithwaite Methanol Manufacturing Plant would require less shore-based construction because its frontage is about 3,000 feet, and proponents propose to modify existing docking facilities rather than construct new ones. Construction of the 4.5-acre Mid-Barataria Sediment Diversion structure would also increase suspended sediment loads and turbidity if the majority of construction activities occur in the river.

Similar to the LNG terminal, turbidity and suspended sediment increases from each action's construction would be localized and would be flushed through the system rapidly. The river discharges 400 billion gallons daily, indicating the volume of water that moves through it regularly. Turbidity and suspended sediment is high in the Mississippi River, even with the high flushing rates, such that turbidity and sediment contributions from the six actions occurring simultaneously, including the LNG terminal, would have a minor, temporary effect on water quality. For the reasons stated, sediment and turbidity effects would be similarly minor when the actions are operating and the Pointe Celeste Container Terminal and Delta LNG are under construction.

In addition to the physical environment that would minimize impacts on water quality, the regulatory environment would help ensure erosion, sediment loads, and effluents in stormwater discharges do not impair water quality during construction and operation. The LPDES program (Construction General Permit for stormwater discharges and a Project-specific SWPPP, as required under the CWA and Louisiana law) would require erosion control devices and sediment barriers at all of the industrial sites during construction until restoration or surface stabilization is complete. In compliance with the LPDES, the other actions would collect and process stormwater through oil/water separators or comparable filters to remove effluents. They would also test for hazardous materials prior to discharge.

Pile driving in the river from each of the actions could injure or induce behavioral changes in fish and marine mammals, though several mitigation measures exist that can minimize these adverse effects. Venture Global has submitted its Underwater Noise Mitigation Plan to the FWS, NMFS, and LDWF as described in section 4.6.2.3 to minimize and avoid impacts from marine pile driving. As discussed in sections 4.6 and 4.7, bottlenose dolphins potentially occur in the river, while listed whales only occur offshore, and manatees are extremely rare in the Project area. Pile driving to support the other actions could injure fish near each site, but their pile-driving sound propagation would not accumulate with the effects of the Project to harm fish because they are too far away. Moreover, neither the actions alone nor combined would have population-level effects on fish because their area of effect would be minor compared with the adjacent river and the habitat therein.

The MMPA prohibits, with limited exceptions, harassment or take of any marine mammal. Thus, actions that would conduct pile driving are required to submit and implement mitigation

plans. Venture Global has submitted its Underwater Noise Mitigation Plan to the FWS, NMFS, and LDWF as described in section 4.6.2.3 to minimize and avoid impacts from marine pile driving.

The other actions' proponents would likely be required to implement noise mitigation before commencing any pile driving. However, even if we assumed that the actions would involve pile driving without mitigation, they would not have a significant cumulative population-level effect on manatees because their occurrence in the river is so rare. The cumulative pile-driving activities could potentially have an adverse effect on the dolphin population. Individual dolphins could experience an adverse synergistic effect if they were harmed multiple times during the course of construction. However, at the population level, the cumulative effect on dolphins would not likely be significant.

The risk of spills or leaks of hazardous materials in the Mississippi River would increase if each action were constructed and commenced operation. All actions would require Section 10 Rivers and Harbors Act and/or Section 404 CWA authorizations from the USACE and corresponding Section 401 CWA Water Quality Certifications, which Venture Global acquired from LDEQ on October 1, 2018. These authorizations require that Project recipients implement a Spill Prevention Plan during construction and an SPCC Plan during operation. Because Venture Global is regulated under FERC, EI's would be present on-site during construction to ensure implementation of all measures intended to protect the environment. Though a spill or leak from any of the actions could be significant, it is unlikely that multiple actions would result in spills or leaks in the same relative timeframe to produce a significant cumulative effect given the regulatory environment regarding spill prevention. Thus, we considered the cumulatively increased risk to be minor.

All actions except the Mid-Barataria Sediment Diversion structure would generate increases in large, ocean-going vessel traffic with terminal destinations in the affected HUC 12 subwatershed segment of the river. These vessels would discharge ballast water while in berth, which would increase risk of introducing an invasive species into the Mississippi River. As required by the USCG's regulations (33 CFR 151.2026), vessels equipped with ballast tanks must implement one of five specified options to control nonindigenous species in waters of the United States. All ships calling at U.S. ports and intending to discharge ballast water must either carry out open-sea exchange of ballast water or ballast water treatment, in addition to fouling and sediment management. The USCG considers vessel traffic levels nationwide when establishing and updating ballast water management regulations. Hence, we found it reasonable to assume that USCG regulations would adequately manage the cumulative increase in susceptibility to invasive species from the vessel calls generated by the five cumulative actions, including the LNG terminal.

Cumulative Impacts on the Barataria Basin Waterbodies

Venture Global would trench and conduct other types of excavation to install the pipeline system. They would also dredge specific segments of the barge routes in the Barataria Basin. The supply barges transiting to and from the pipeline route would, themselves, increase turbidity by stirring up sediment, as would the vessels that ferry workers back and forth.

At this time, the other industrial actions have not publicized plans to trench or excavate in the Barataria Basin or transport supplies to their respective locations through associated waterways

although Delta LNG could likely implement similar types of construction for its pipeline. Construction of the levee upgrade and the drainage canal relocation associated with the NOV/NFL Hurricane Risk Reduction Project could increase sediment in the runoff and cumulatively effect turbidity and suspended sediment in Barataria Basin waterbodies. These effects are typically adverse, but the Mid-Barataria Sediment Diversion action would actually increase sediment levels in the Barataria Basin *by design* to nourish and restore marsh vegetation. We conclude, then, that runoff, sediment, and turbidity effects from the other actions would not be significantly adverse, and, in balance, would likely be neutral.

At this time, the NOLA Oil Terminal is the only action known to include a plan to discharge treated water into waterbodies in the Barataria Basin in accordance with limits established by the LPDES. In 2016, the NOLA Oil Terminal was issued an LPDES permit to discharge industrial stormwater, fire test water, hydrostatic test water, and miscellaneous wastewater (e.g., from safety shower and eyewash stations) to a local drainage that drains to Wilkinson Canal. The limits and conditions of the permit were designed to avoid any negative impacts on the designated or existing uses of the receiving waterbody, though it does allow for changes in water quality as long as the change does not adversely affect designated or existing uses. In Wilkinson Canal, those uses are primary contact recreation, secondary contact recreation, and propagation of fish and wildlife.

During at least some portion of the LNG terminal's construction, stormwater would drain to adjacent industrial canals that flow to a pumping station, which discharges the water into Lake Judge Perez in the Barataria Basin. Eventually, stormwater on the LNG terminal site would be collected in sump tanks, treated, and pumped into the Mississippi River. Venture Global would discharge hydrostatic test water into the drainage canals along the pipeline system, and Venture Global may discharge some percentage of its hydrostatic test water into the industrial canal adjacent to the LNG terminal. Like NOLA Oil Terminal, Venture Global is required to demonstrate that its discharges would maintain the designated uses of the receiving waterbodies before an LPDES permit would be issued. All receiving waterbodies identified in Venture Global's Project plans have the same designated uses as those in Wilkinson Canal, plus oyster propagation, so effluent thresholds would be similar or more stringent. We acknowledge that both NOLA Oil Terminal and the Project would discharge into the Barataria Basin waterbodies, but their discharge points would be about 4 miles apart, limiting the potential for discharged water having an adverse cumulative effect on water quality, while discharges from the adjacent Delta LNG project are unknown at this time. This, coupled with the requirements in the LPDES program, indicate that the cumulative adverse effects from the actions' discharges would be minor.

None of the other actions have publicized plans to conduct pile driving in the Barataria Basin. Thus, pile driving conducted for the pipeline meter stations would not accumulate with other underwater noise effects to harm wildlife. Venture Global would withdraw water from canals in the Barataria Basin for hydrostatic testing of the pipeline system. Because Venture Global would have large, pressurized storage tanks, its test water budget would be up to an order of magnitude greater than NOLA Oil Terminal or Gulf Coast Methanol, activities that also could withdraw water from the Barataria Basin canals for hydrostatic testing. At this time, any plans for Delta LNG's test water budget are unknown. Venture Global would screen water intake hoses to minimize entrainment of larvae and pre-juvenile fish and would place them at the lowest possible elevation to reduce impingement of biological organisms. Although the Project's test water budget is large, mitigation would minimize effects to minor and temporary. Hydrostatic test water

withdrawal by the other actions would be subject to the general LPDES program, which would manage withdrawal limits and practices to maintain use of the waterbodies for propagation of fish and wildlife. Thus, we conclude the cumulative adverse effect on fish and wildlife would likely be minor and temporary.

We considered that the NOV/NFL Project-related wetland mitigation, Bayou Grande Chenier Marsh and Ridge Restoration, and Barataria Bay Rim Marsh Creation and Nourishment actions would have net benefits on water quality, aquatic wildlife, and habitat in the Barataria Basin. Any negative effects on water quality from vessel traffic or in-water construction activities to support those actions would likely be negligible compared with vessel traffic and excavation and trenching activities to construct the pipeline system, and we have already determine that those effects would be minor.

4.13.2.4 Wetlands

Wetlands are protected by the CWA, and the USACE and LDEQ administer regulations and issues permits in scenarios in which coastal wetlands in Louisiana would be affected. Construction of the LNG terminal would permanently fill 368.1 acres of non-forested wetlands and convert 2.8 acres of forested wetlands to non-forested ones. Per the CWA, no development is permitted to have a significant adverse impact on wetlands, so Venture Global would be required to mitigate. Venture Global proposes to utilize an in-lieu of fee program, a method currently under review by the USACE as it reviews Venture Global's permit application submitted in 2017. The final mitigation plan must result in no net loss of function, though a net loss of wetland acreage would be permitted.

Construction of the pipeline system would permanently displace about 0.4 acre of non-forested wetlands to permit construction of the mainline valves, permanent access road to the mainline valves, and portions of the pipe trestle over the levee near Lake Hermitage Road. No additional wetlands would be permanently filled. Pipeline system construction activities would result in temporary clearing or other disturbance of 70.4 acres of non-forested wetlands. Venture Global would restore these wetlands in accordance with its Project-specific Procedures immediately following construction. In addition, pipeline installation would involve clearing and excavation in 877.7 acres of adjacent open water, which could adversely affect wetland hydrology and revegetation potential if contours and elevation are not properly restored. Post-construction reports, surveys, and inspections would all be required as part of Venture Global's wetland restoration plan and in-water construction permit, which is currently under review by the USACE.

Eleven other actions could occur within the geographic and temporal extent for cumulative impacts on wetlands and could also affect those resources (see table 4.13-4). Although the site of Bayou Grande Chenier Marsh and Ridge Restoration is outside the HUC 12 subwatersheds intersected by the Project, we included the site because it would occur in the Barataria Basin only 2 miles from the pipeline system.

Table 4.13-4 Other Actions with the Potential to Cumulatively Impact Wetlands		
Action	Closest Distance to Project	Wetland Impacts in Affected HUC-12 Subwatersheds
Project	-	370 acres – LNG terminal 70 acres – pipeline system
Gulf Coast Methanol	2 miles	up to 103 acres ^a
NOLA Oil Terminal	4 miles	up to 128 acres ^a
Pointe Celeste Container Terminal	3 miles	Unavailable
Braithwaite Methanol Manufacturing Plant	18 miles	0 acres
Mid-Barataria Sediment Diversion	0 miles	52 acres
NOV/NFL Levee Upgrade	0 miles	Unavailable
NOV/NFL Drainage Canal Relocation	0 miles	Unavailable
Delta LNG	0 miles	Unavailable
Subtotal		723 acres
Action with Wetland Benefits		
NOV/NFL Wetland Mitigation	1 mile	895 acres – beneficial
Bayou Grande Chenier Marsh and Ridge Restoration	2 miles	486 acres – beneficial
Barataria Bay Rim Marsh Creation and Nourishment	2 miles	517 acres – beneficial
Subtotal		1,412 acres
a Estimated from USGS land cover data (2011); assumes all wetlands on-site impacted. Key: - = not applicable HUC = hydrologic unit code NFL = Non-Federal Levees NOV = New Orleans to Venice		

Wetland impacts were recorded from permit applications or publicly available Project plans unless otherwise noted. In these other cases, we calculated wetlands from USGS land cover data and, to be conservative, assumed all would be impacted. For the case of Delta LNG, not enough detail was publicly available to determine wetland along the pipeline route.

The combination of the construction activities of the Project and the other actions would adversely impact more than twice as much wetland as the Project would alone within the geographic scope. However, per federal regulations, no action that disturbs more than 5 acres can cause a permanent loss of wetland function. In order to acquire necessary construction permits from the USACE, each proponent would have to demonstrate no net loss of wetland function through a wetland restoration plan or participation in a mitigation program. Because of this federally mandated protection measure, we conclude that cumulative adverse impacts from construction and permanent fill would be adequately mitigated.

4.13.2.5 Vegetation and Wildlife

Vegetation and upland wildlife are combined in this analysis because actions that affect vegetation also affect wildlife—vegetation is critical to wildlife food webs, and it also serves as habitat. Development of the LNG terminal and pipeline system would have temporary and permanent effects on upland and wetland vegetation, and because cumulative wetland impacts are discussed exclusively in the previous section, we restrict our focus in this section to uplands. A basic distinction among vegetation types is the presence or absence of trees or other woody species. While they have some overlap, the two groups each support basic wildlife types that would not be found in the other. They also perform non-habitat-related ecological functions that are indicated by the presence or absence of forest or woody vegetation. According to field surveys noted in section 4.5.1, the Project would permanently impact 84.3 acres of upland forest and scrub/shrub vegetation, and 151.2 acres of herbaceous upland vegetation.

Seven other actions could occur within the geographic and temporal extent for cumulative impacts on non-wetland vegetation and upland wildlife that could also affect these resources (see table 4.13-5). The upland portion of the Braithwaite Methanol Manufacturing Plant is outside of the geographic scope, i.e., the affected HUC 12 subwatersheds. The Braithwaite project property is on the east bank of the river, and only the shoreline of the property and planned in-water docks are in an affected HUC 12 subwatershed—the one consisting of a segment of the Mississippi River that also runs along the LNG terminal.

Table 4.13-5 Other Actions with the Potential to Cumulatively Impact Vegetation and Wildlife				
Action	Distance	Area/Length	Selected Vegetation Impacts in Geographic Scope	
			Forested and Scrub-Shrub Upland	Herbaceous Upland
Project	-	637 acres	84.3 acres	151.2 acres
Gulf Coast Methanol	2 miles	140 acres	0 acres	0 acres
NOLA Oil Terminal	4 miles	128 acres	0 acres	0 acres
Pointe Celeste Container Terminal	3 miles	940 acres	25 acres	2 acres
NOV/NFL Levee Upgrade	0 miles	58 miles	Unavailable	Unavailable
NOV/NFL Drainage Canal Relocation	0 miles	Unavailable	Unavailable	Unavailable
Delta LNG	0 miles	524 acres	Unavailable	Unavailable
Mid-Barataria Sediment Diversion Structure	5 miles	4.5 acres	Unavailable	Unavailable
Total	-	-	105.9 acres	153.2 acres
Total in affected HUC-12 subwatersheds			2,484 acres	2,021 acres
Key: - = not applicable HUC = hydrologic unit code NFL = Non-Federal Levees				

Table 4.13-5 Other Actions with the Potential to Cumulatively Impact Vegetation and Wildlife				
Action	Distance	Area/Length	Selected Vegetation Impacts in Geographic Scope	
			Forested and Scrub-Shrub Upland	Herbaceous Upland
			NOV = New Orleans to Venice	

Based on their limited acreage of undeveloped woody and non-woody land cover, the actions with estimated vegetation impacts would constitute a negligible contribution to a cumulative adverse impact with the Project. In other words, these actions would not create more of an adverse effect on vegetation and wildlife beyond what is already accounted for in the evaluation of the Project in sections 4.5 through 4.7. Lacking detailed engineering drawings of the levee upgrade and drainage canal relocation projects, we did not estimate the vegetation disturbance and displacement within the affected HUC 12 subwatersheds associated with their construction. However, because much of the construction would be upgrading existing levee structures and rerouting drainage to an existing canal, we assume impacts on undisturbed swaths of vegetation would be minimal. We conclude that there would be no more than a minor, permanent cumulative impact on vegetation and associated wildlife.

4.13.2.6 Land Use

As noted in previous sections, the portion of the LNG terminal site south of SH 23 was historically used for sugar cane production and has been extensively ditched and drained. Most of the LNG terminal site is currently fallow agricultural land and used for cattle pasture. The proposed land use of the Project is major industrial; however, because it would receive large vessel calls for loading with LNG for export, this Project could also be considered a port/terminal complex. No agricultural uses would be preserved.

The geographic scope for land use is the west bank, and the temporal extent is any instance of overlap with the Project's construction or operation periods. Many actions fall within this scope, but we determined that the four other major industrial actions in the west bank had real potential to create adverse effects on the land use inventory in the west bank, whereas the others did not. We reasoned that the remaining actions—levee and drainage canal upgrades, wetland restoration, and a transportation improvement—could have indirect effects on land use but were not the types of actions that would contribute to significant adverse land use effects in a community. That said, we acknowledge that industrial developments are not necessarily adverse from a land use perspective; in fact, they are necessary and frequently economically beneficial uses in a society. To evaluate the proposed land uses' effect, then, we considered the existing context as well as future land uses envisioned by the parish as part of their master planning process.

Table 4.13-6 lists the planned or permitted developments we considered. We used the term "major industrial" to broadly identify any high-intensity use such as industrial manufacturing or an industrial port facility.

Plaquemines Parish published a draft, final Comprehensive Master Plan in 2012 (Plaquemines Parish, 2012) (Parish Plan). The Parish Plan assigned anticipated future land use designations to all developable properties and included the anticipated future land uses on maps in the “Land Use” technical addendum to the “Community Assessment.” Future land use designations in a comprehensive master plan typically represent the collective input of community stakeholders, landowners, and planning professionals.

Table 4.13-6 Other Actions With Potential for Cumulatively Impact Land Use					
Action	Site Area (acres)	Existing Land Use(s)	Planned/ Proposed Land Use	Future Land Use(s) per Parish Master Plan	Active Farming on Property?
Project	637 acres	Agricultural (Inactive farmland; active grazing land)	Major Industrial	Port/Terminal Complex/Major Industries/ Business Complex	No
Gulf Coast Methanol	140 acres	Agricultural/ Undeveloped	Major Industrial	Major Industries/Agricultural	Yes, negligible
NOLA Oil Terminal	130 acres	Undeveloped	Major Industrial	Agricultural	No
Pointe Celeste Container Terminal	Up to 1,000 acres	Agricultural/ Undeveloped	Major Industrial	Port/Terminal Complex	Yes
Delta LNG	524 acres	Agricultural (Inactive farmland; active grazing land)	Major Industrial	Major Industries/ Business Complex	Unknown

After considering the overlapping actions, our chief concerns were conversion of parcels to higher intensity uses compared with their anticipated future land use designations in the Parish Plan, and the permanent conversion of agricultural land, including prime farmland. We believe these have the highest potential for becoming significant adverse cumulative land use effects in the west bank.

Of the overlapping actions, the Pointe Celeste Container Terminal is the only action that will permanently displace more than a negligible amount of actively cultivated farmland. Based on USCG land cover data (2011), almost 700 acres of the site is farmed. However, this property and Delta LNG are Port-owned and targeted for development due to their location on a relatively wide portion of the river and other factors. The Parish Plan reinforces this future plan for development on the future site of the proposed container terminal and LNG port.

The effect of implementing all the reasonably foreseeable developments would convert five sites within 4 miles of each other on the west bank to major industrial and port terminal complex land uses. Compared with the existing uses, this change would be readily apparent; however the majority of the acreage affected would be consistent with the Parish Plan. For

instance, the majority of the 637-acre site of the LNG terminal consists of land designated as “major industries” and “port/terminal complex” in the Parish Plan. The 524 acre Delta LNG site is mostly designated as “major industries” and “business complex.” All of the nearly 1,000-acre site of the Pointe Celeste Container Terminal is designated as “port terminal complex” in the Parish Plan. Part of the 140-acre Gulf Coast Methanol site is designated with the future land use of “major industries.” Only the smallest site, the 130-acre proposed site of the NOLA Oil Terminal, lacks a “major industries” or “port/terminal complex” future land use designation on all or part of the site. Thus, we conclude that the cumulative land use change in this portion of the west bank would be mostly consistent with the Parish Plan.

4.13.2.7 Visual Resources

The operation of the LNG terminal could have an adverse impact on the residents, drivers, and recreational/commercial users of the area. Its presence on the landscape could adversely affect views from residences on Lake Hermitage Road, travelers on SH 23 and the Mississippi River, where recreational boating occurs. The LNG terminal would consist of numerous tall and bulky components, LNG loading docks, and ship berthing facilities developed on and adjacent to a site where only agricultural activities have occurred to date. In comparison, the pipeline system would minimally affect visual integrity or scenic quality in the Barataria Basin, because construction periods would not exceed 9 months and the overall visual quality would be restored in the months after installation. Moreover, we did not identify any other major industrial facilities proposed for installation or operation in the Barataria Basin with public ally available information. Thus, we limited our cumulative effects evaluation to the LNG terminal.

Three other major industrial facilities planned or permitted in the west bank are within the geographic scope and could adversely affect visual resources cumulatively with the LNG terminal (see table 4.13-7).

Table 4.13-7 Other Actions with the Potential to Cumulatively Impact Visual Resources					
Activity	Distance from Project	Site area	River frontage	Tallest Stack Height	Readily Visible Features
Project	-	637 acres	~7,000 feet	280 feet	Four LNG storage tanks, liquefaction trains, flare stacks, power generators, dock facilities
Gulf Coast Methanol	2 miles	140 acres	~5,000 feet	200 feet	Storage tanks (shorter than LNG storage tanks), stacks, power generators, dock facilities
NOLA Oil Terminal	4 miles	130 acres	~5,000 feet	Unavailable	54 storage tanks, dock facilities
Delta LNG	0 miles	524 acres	~3,100 feet	Unavailable	Four LNG storage tanks
Key: - = not applicable					

Two of the activities would not likely be visible from the residential communities on Lake Hermitage Road given their distance from the residences, topography, and intervening vegetation. However, if one or more actions would be visible from an individual residence that would also

have a view of the LNG terminal, the cumulative effect would only be negligible compared with the LNG terminal's visual effect alone.

Delta LNG would have four storage tanks located on adjacent property to the Plaquemines LNG terminal. No information is known about the heights of any of Delta LNG's terminal facilities and therefore no evaluation on the cumulative impacts to the viewshed from nearby residences can be properly addressed.

The cumulative actions would all be visible from SH 23, a scenic byway that is not heavily traveled by nature-oriented tourists. Within the 4-mile span that includes all of the foreseeable activity sites, the existing views are characterized by industrial operations, agricultural land, and undeveloped properties largely covered by scrub-shrub vegetation. International Marine Terminals, a coal distribution terminal a little more than one mile north of the LNG terminal site, is occupied by bulk piles of coal and a variety of heavy industrial equipment. Neither the river nor river vessel traffic can be seen from SH 23. In the opposite direction of the river, the view is characterized by large agricultural fields and residential development in Myrtle Grove. If the storage tanks, stacks, power generators, etc., required for each facility are constructed, their geometric forms and artificial texture would be high-contrast by comparison. The exposure to the viewers on SH 23 would be intermittent. As a result, the cumulative adverse effect on the visual integrity and scenic quality from the view provided by SH 23 would be moderate given the magnitude of the proposed changes and the duration of exposure experienced by those traveling on SH 23.

The cumulative actions would all be visible from the Mississippi River, which is transited by recreational vessels as well as commercial and industrial ones. We assume the viewer sensitivity of the recreational mariners and recreational boat passengers is moderate. Within the 4-mile stretch of the river between the LNG terminal and the proposed NOLA Oil Terminal are three existing industrial terminals serving the two coal export facilities and a cargo storage and distribution facility. If dock facilities and marine berths are constructed at the NOLA Oil Terminal, Gulf Coast Methanol Complex, Delta LNG, and LNG terminal, as planned, the change would be noticeable but would not significantly deteriorate the visual integrity or scenic quality given the existing concentration of industrial marine terminal operations. Thus, we conclude the cumulative visual impact from the perspective of the Mississippi River would be minor.

4.13.2.8 Socioeconomics

In this case, we only evaluated the other major industrial projects in the geographic scope that could potentially have overlapping construction schedules. We were concerned with determining any significant or otherwise substantial adverse cumulative effects on socioeconomic resources that might result from concurrent construction. We acknowledge that the jobs creation and capital investments from the major industrial projects would benefit the region, but we did not delve deeper to evaluate the level of this positive cumulative effect. Nor did we consider the indirect economic benefits, i.e., ecosystem services, which might stem from the wetland restoration and drainage and levee system projects.

Five other actions could occur within the geographic scope and temporal extent for cumulative impacts on socioeconomic resources and could adversely affect those resources (see

table 4.13-8). We identified the construction period of the Project as the period during which concurrent actions could have adverse socioeconomic effects, namely on housing and public services. We did not assume that the Pointe Celeste Terminal would be constructed concurrently.

Table 4.13-8 Other Actions with the Potential to Contribute to a Cumulative Adverse Effect on Socioeconomic Resources				
Activity	Site Area	Capital Investment	Construction Workforce	Operation Workforce ^a
Project	637 acres	\$8.5 billion	1,400 to 3,700 ^b	250
Gulf Coast Methanol Complex	140 acres	\$3.6 billion; \$900 million per production unit (4)	900	325
NOLA Oil Terminal	130 acres	Unavailable	Unavailable	Unavailable
Braithwaite Methanol Plant	36 acres	\$1.2 billion	1,000	50
Pointe LNG	600 acres	\$3.2 billion	Unavailable	Unavailable
Delta LNG	524 acres	Unavailable	Unavailable	Unavailable
^a Included to demonstrate the scale of the action. ^b The peak workforce estimate of 3,700 would only occur if all peak construction efforts on the LNG terminal and two pipeline laterals coincided for 1 month.				

In section 4.9, we concluded that the Project's construction could have minor, temporary adverse impacts on others in the area seeking rental housing. We assumed that half of the workforce would be locally hired, leaving half to seek housing in the three parishes nearest the Project—Plaquemines, Jefferson, and Orleans. The Greater New Orleans area has an abundance of rental and short-term housing options. The concentration of this housing would require workers to commute up to an hour to their work site, but this drive time is not unusual in the industry.

We assumed that the at least half of the workforce hired by the other projects would also be local residents, for the same reasons we examined in section 4.9. Although the combined workforce of the developments would be high, exceeding 4,000 workers, with half assumed to be non-local hires, the greater New Orleans area could absorb 2,000 or more individuals seeking rental or short-term housing without significantly adversely affecting the housing market. Likewise, we conclude that existing public and safety services would be adequate, even with the addition of these non-local workers and their households.

4.13.2.9 Roadway and Vessel Traffic

Roadway Traffic

The construction workforce traffic that would be generated by the Project is high enough that several mitigation measures would be required to maintain uninterrupted flow on SH 23 in the vicinity of the LNG terminal. Venture Global will construct auxiliary turn lanes for southbound SH 23 at the LNG terminal's main entrance. In addition, Venture Global will construct a median lane for U-turns from southbound SH 23 to northbound SH 23 to accommodate construction traffic. These auxiliary lanes would prevent the temporary traffic impact during construction from

becoming significantly adverse. The majority of construction materials would be delivered by barge directly to the site, minimizing traffic impacts from heavy traffic to negligible levels. We assume traffic impacts during operation would be minor given the comparatively small workforce.

Five other actions that may occur within the geographic and temporal extent of the Project could contribute to cumulative impacts, including more-than-negligible effects on cumulative roadway traffic, especially traffic on SH 23 (see table 4.13-9).

One action in table 4.13-9 had a beneficial impact on traffic in the region. The SH 23 Improvement Project consisted of resurfacing a 4-mile-long section of the road between Happy Jack and Port Sulphur and adding turning lanes to three intersections in Port Sulphur. The project was completed in March 2017, subsequent to the traffic impact assessments for the project. This is the only two-lane section of SH 23 in Plaquemines Parish, so this upgrade significantly improved the flow of traffic through Port Sulphur for locals as well as the freight and maritime industry (Louisiana Department of Transportation and Development, 2017). The remainder of SH 23 through the parish is four lanes.

Table 4.13-9 Other Actions with the Potential to Cumulatively Impact Roadway Traffic			
Activity	Distance and Direction from the Project	Construction Workforce	Operation Workforce
Project	-	1,400 to 3,700 ^a	250
Gulf Coast Methanol Complex	2 miles northwest	900	325
NOLA Oil Terminal	4 miles northwest	Unavailable	Unavailable
Pointe Celeste Terminal	3 miles southeast	- ^a	Unavailable
SH 23 Improvement Project	10 miles southeast	- ^b	-
Delta LNG	Adjacent Property	Unavailable	Unavailable
^a We assumed Pointe Celeste Terminal construction would overlap with the Project's operation period but not its construction period. ^b SH 23 improvement was completed in 2017. Key: - = not applicable SH = State Highway			

The other actions with construction overlap would have adverse effects on traffic. Both the Gulf Coast Methanol Complex and NOLA Oil Terminal would require large construction workforces that would commute back and forth along SH 23 to their worksites. IGP Methanol LLC estimates a construction workforce of 900 at the Gulf Coast Methanol Complex, though available documents do not clarify whether this estimate is an average or peak number. As demonstrated by the LNG terminal and pipeline system's workforce estimates, the size of a construction workforce in any given month fluctuates widely. The Delta LNG scope is similar the Project's thus we assume the workforce would be of similar size. The NOLA Oil Terminal site is approximately as large as the Gulf Coast Methanol Complex, and the development would include construction of 54 storage tanks. Thus, we assume the NOLA Oil Terminal construction

workforce would be as large as the one estimated for the Gulf Coast Methanol Complex. All three developments would require substantial amounts of construction materials, equipment, and specialty parts, and we assume these would be delivered both by heavy trucks and by barges.

Based on our assumptions, the cumulative amount of material deliveries and the number of construction workers commuting to worksites within 4 miles of each other on SH 23 could double the number of LNG terminal and pipeline system construction workers alone at some point during the 2019-2023 construction period. This cumulative adverse effect could be significant, and we would expect traffic delays on SH 23 during commute periods for construction workers. We based this finding on the conservative assumption that the NOLA Oil Terminal would be constructed concurrently with the Project, Gulf Coast Methanol Complex, and Delta LNG. In fact, the NOLA Oil Terminal is stalled; the website launched by its proponents has not been updated since 2016, and it has not broken ground despite acquiring its initial air and LPDES permits in 2013. As a result of the NOLA Terminal not going forward, the cumulative effect on SH 23 traffic would be less-than-significant.

Vessel Traffic on the Mississippi River

Vessel traffic during construction of the LNG terminal could peak at around 16 vessel transits per day for several months when Phase I and II overlap. Given the width of the river and the brief period, the vessel traffic increase would be too low to cause greater than negligible effects. During operation, LNG carrier vessel calls on the LNG terminal would average about one per day, or slightly less. The USCG issued a Letter of Recommendation advising that, upon review of Venture Global's Required Waterway Suitability Assessment, the Mississippi River in the vicinity of the LNG terminal was appropriate for LNG carrier traffic. Projected LNG carrier calls are six per week, though the maximum number of transits would be established by the USCG before operation commences.

Six other actions could cumulatively affect vessel traffic levels in the Mississippi River (see table 4.13-10).

Table 4.13-10 Other Actions with the Potential to Cumulatively Impact Vessel Traffic on the Mississippi River						
Activity	Distance and Direction from the Project	River Frontage (linear feet rounded to nearest 1,000)	Berths (number)	Vessel Traffic Types during Operation^a	Estimated Construction Period or Start Date (years)^b	Estimated Operation Period or Start Date (years)
Project	-	7,000 feet	3 LNG Loading Berths	LNG carriers	2019–2023	2022 (Phase I)
Gulf Coast Methanol	2 miles northwest	5,000 feet	N/A	Methanol carriers	2018–2025	2020 or 2021 (first phase)
NOLA Oil Terminal	4 miles northwest	5,000 feet	2 for post-panamax tankers	Tankers	Unavailable	Unavailable

Table 4.13-10 Other Actions with the Potential to Cumulatively Impact Vessel Traffic on the Mississippi River						
Activity	Distance and Direction from the Project	River Frontage (linear feet rounded to nearest 1,000)	Berths (number)	Vessel Traffic Types during Operation^a	Estimated Construction Period or Start Date (years)^b	Estimated Operation Period or Start Date (years)
Pointe Celeste Container Terminal	3 miles southeast	10,000 feet	3 deep draft and additional for inland vessel	Container ships, breakbulk cargo ships;	<i>Unavailable: overlap not assumed</i>	<i>Unavailable</i>
Braithwaite Methanol Plant	13 miles north	3,000 feet	3 deep draft	Methanol carriers	2019	2021
Pointe LNG	8 miles southeast	6,500 feet	1 LNG loading berth	LNG carriers	2022–2025	2025
Delta LNG	0 miles	Unavailable	3 LNG Loading Berths	LNG Carriers	2021 - 2024	2024
^a Not including support vessels. Key: N/A = Not available.						

If peak construction periods of all identified actions overlap, the vessel traffic increase could delay voyages of other vessels in the Lower Mississippi River for a period of several months. At its peak, LNG terminal construction traffic could increase daily vessel transits by 2.6 percent or more for several months, constituting a temporary, but an unnoticeable increase in vessel traffic. Additional vessel traffic destined for the six other major industrial construction sites could begin to cause a noticeable increase in the waterway. A mitigating factor is that material deliveries to a major industrial site are typically concentrated at the front end of a construction period, and then rapidly decline. Thus, the likelihood is low that the projects' peak vessel delivery periods to the respective sites would all overlap. The more likely outcome is that peak periods would stagger over the ensuing years, and some of the projects may never be constructed. We conclude that the overall cumulative adverse effect would be minor but acknowledge that vessel traffic increases could be noticeable for a few months if some of the projects' peak vessel traffic periods overlap.

During operation, the LNG terminal would generate about one vessel call per day by an LNG carrier, which are very large vessels and assume Delta LNG would be similar. We assume the two methanol manufacturing plants and the NOLA Oil Terminal would generate about one call per day each by a very large vessel, either a methanol carrier or a petroleum product tanker. Pointe LNG will have the capacity to load 100 LNG carriers per year (two per week). We assume that Pointe Celeste Container Terminal could generate up to two or three very large vessel calls by container and cargo ships in a day, and we conservatively assume it would average two very large ships per day. Based on these assumptions, the cumulative effect would be an addition of seven to eight very large vessels to the Lower Mississippi River in the vicinity of the LNG terminal, averaging around 15 transits per day. The Crescent River Pilots Association estimate they pilot about 44 transits each day between Pilottown, near the southern tip of Plaquemines Parish, and

New Orleans. Increasing piloted vessel transits in this stretch of the river from 44 to 59 per day, a 25 percent increase, would constitute a substantial increase. If the projects are all built as planned, the increase in piloted vessel traffic would require USCG Vessel Traffic Services - Lower Mississippi River to expend additional effort coordinating and managing the transits for safety and efficiency. The river pilots, who schedule voyages along the segment of the river in their jurisdiction, would have to increase coordination and management, but they would benefit from the increase in clients. The presence of USCG Vessel Traffic Services–Lower Mississippi River and the capacity of the Mississippi River to accommodate vessel traffic would mitigate the additional transits’ effect on traffic flow, so we do not expect any increase in wait-times to be significantly adverse.

Vessel Traffic in Waterbodies of the Barataria Basin

The designated barge routes to the pipeline system are depicted on figures 4.13-1 and 4.13-2. Crew boats and barges would transport workers and materials, respectively, to the worksite, and their effect on local vessel traffic would be minor. The only other actions that would generate construction vessel transits through or near the barge routes are the Barataria Bay Rim Marsh Creation and Nourishment project and the “Delfelice” wetland, a mitigation wetland project associated with the NOV/NFL level upgrade. Venture Global has already met with the Coastal Protection Restoration Authority about the Barataria Bay Rim Marsh Creation and Nourishment project and established that their joint use of a canal would not interfere with the other’s vessel transits (see section 4.9.8). We assume the vessel transits required in the course of construction the Delfelice wetland would be negligible. Thus, no cumulative effect on vessel traffic in or near the barge routes in the Barataria Basin would occur.

4.13.2.10 Cultural Resources

Based on fieldwork and desktop surveys, no known historic or archaeological properties, traditional cultural properties, or properties of religious or cultural importance to federally recognized tribes are present in the area of potential effect of the LNG terminal and pipeline system (see section 4.10). The SHPO has concurred that no historic properties are present.

Based on surveys to date and correspondence with tribes, we do not expect the Project to contribute to a cumulative impact on cultural resources. Venture Global has prepared an Unanticipated Discovery Plan and would implement the plan in the unlikely event that an unreported cultural resource or human remains are encountered during construction.

4.13.2.11 Air Quality

Project construction would produce significant quantities of criteria pollutant emissions over a multi-year period. During operation, the Project’s impacts on ambient air quality would be required to comply with the NAAQS, designed to protect human health, flora, and fauna. Demonstration of compliance is required by LDEQ before any construction permits may be issued. Moreover, the potential ambient impacts from toxic air pollutants emitted during Project operation are subject to review by the Louisiana Toxic Air Pollutant Program. Venture Global has submitted an air permit application for operating emissions, currently under review by LDEQ. The same dispersion modeling used in the application is summarized in section 4.11, and based on the

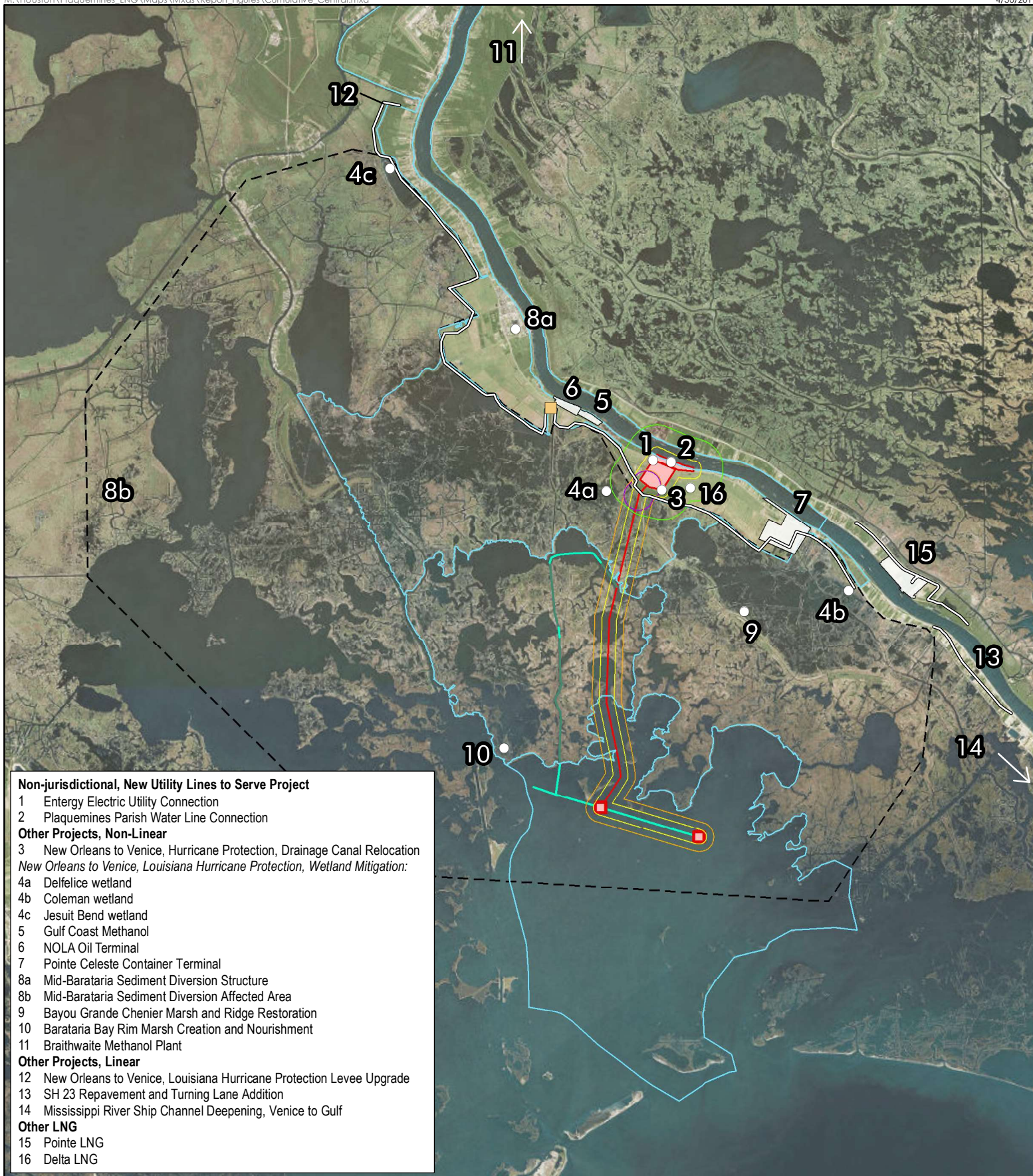
modeling results, we determined that the ambient air quality impact during operation would be below ambient air quality standards based on that submittal.

The only other actions within the 0.25-mile radius geographic scope for construction air emissions are the NOV/NFL levee upgrade and drainage canal relocation projects. These are linear projects that extend many miles. Within the geographic scope, earth-moving vehicles and equipment and other construction support vehicles would produce emissions temporarily while the levee segment adjacent to the pipe bridge is upgraded. The same would be true for the drainage canal relocation near the southern boundary of the LNG terminal. These comparatively minor emissions would not increase emissions appreciably beyond levels already accounted for in the Project's construction air impact evaluation in section 4.11. Therefore, we find no cumulative impact on air quality during the Project's construction.

All actions except the Mississippi River ship channel deepening south of Venice would occur within the geographic scope and temporal extent for cumulative impacts on air quality during operation of the LNG terminal. Aside from the major industrial developments, the other actions within scope would have no long-term or permanent air emissions, and any construction emissions they produce during the LNG terminal's operation would be negligible in comparison. Thus, we focused on these five developments upriver and downriver from the LNG terminal, centering our analysis on a future point in time when all developments would be operating concurrently.

Delta LNG requested to initiate the NEPA pre-filing process with the Commission on April 17, 2019. Delta LNG would be a 20 MTPA LNG export facility constructed in two phases, and of similar design to Plaquemines LNG. Delta LNG would be located adjacent to Plaquemines LNG. The pre-filing request indicates construction of phase 1 would occur in years 2022 and 2023, with full LNG production for phase 1 commencing in November 2024. At this time, we do not have emission or modeling estimates of the Delta LNG facility, and. Should both facilities be constructed, there would be overlapping operational emissions that would cause a cumulative impact on local and regional air quality. In addition, due to the proximity of the facilities, if construction occurs at the same time, there would be cumulative impacts on local air quality. As Delta LNG progresses through the NEPA process, it would be required to address air quality cumulative impacts during construction and operation with all projects in its region of influence, including Plaquemines LNG.

Table 4.13-11 provides the estimated potential air pollutant emissions during operation of three of the six major industrial facilities that could add to the emissions produced by the LNG terminal. Emission estimates are not available for the recently announced Pointe Celeste Container Terminal or Pointe LNG. Should they move forward, they would both require LDEQ permits.



Projects With Potential Cumulative Impacts

○ Non-linear projects*

— Linear Projects

□ Boundary of Project 8b

*Boundaries delineated for selected projects

Project Components and Buffers

■ Interconnects

■ Parking Area for Pipeline Construction Employees

— Laterals (TETCO & TGP)

— Barge Access Channel - Dredge/Excavation Proposed

— Barge Access Channel - No Dredge Required

■ Terminal Site Boundary

■ 0.25-mi buffer of Terminal and Pipeline

■ 0.5-mi buffer of HDD entry/exit

■ 0.5-mi buffer of Pipeline

■ 1-mi buffer of Terminal

■ HUC-12 Subwatersheds Intersected by Project

Figure 4.13-2
Projects with Potential
Cumulative Impacts
Plaquemines Parish,
Louisiana

Table 4.13-11 Other Activities within the Geographic and Temporal Scope for Cumulative Air Impacts during Operation							
Activity	Distance	LDEQ Air Permit Status	Title V Category (minor/major)	Triggers PSD? (yes/no)	Emissions from Five Criteria Pollutants^a (metric tons per year)	Greenhouse Gas Emissions (metric tons of CO₂e per year)	LAC Regulated Toxic Air Pollutants (metric tons per year)
Project	-	In Process	Major	Yes	2,906	7,749,799	354
Gulf Coast Methanol Complex	2 miles	Issued 2018	Major	Yes	726	2,533,377	146
NOLA Oil Terminal	4 miles	Issued 2013	Minor	No	83	N/A ^b	115
Braithwaite Methanol Manufacturing Plant	18 miles	Issued 2014	Major	No	431	746,626	77
Pointe Celeste Container Terminal	3 miles	No application submitted	Minor ^c	No ^c	Unknown	Unknown	Unknown
Pointe LNG	8 miles	No application submitted	Major ^c	Yes ^c	Unknown	Unknown	Unknown
Delta LNG	0 miles	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Total	-	-	-	-	4,146	10,979,319	-
Sources: See table 4.13-2. a carbon monoxide, sulfur dioxide, inhalable particulate matter, volatile organic compounds, and nitrogen oxide b Not calculated. As a minor source, NOLA Oil Terminal proponent was not required to calculate greenhouse gas emissions. c This classification is unconfirmed and based on professional judgment. Key: - = not applicable CO ₂ e = carbon dioxide equivalent LAC = Louisiana Administrative Code LDEQ = Louisiana Department of Environmental Quality N/A = Not available because estimate not required for minor sources per Title V PSD = Prevention of Significant Deterioration TBD = to be determined							

Section 4.11 describes the air quality permitting regime, including the two most salient programs—Title V and the PSD program—implemented after adoption of the CAA. Under Title V, the LNG terminal, Gulf Coast Methanol Complex, and Braithwaite Methanol Manufacturing Plant are considered major air emissions sources. Based on PSD program thresholds, the LNG terminal and Gulf Coast Methanol Complex are considered major sources and the NOLA Oil Terminal is considered a minor source of emissions.

Three actions in table 4.13-11 have been issued their required air permits from LDEQ, covering both state and federal preconstruction requirements. In order to be eligible for their air emissions permit, each facility had to show that it “[would] not significantly contribute to any

NAAQS exceedances” (LDEQ, 2018b). Moreover, the facilities’ emissions, in combination with background emissions, could not exceed thresholds for Louisiana state-regulated toxic air pollutants. For unconstructed facilities with LDEQ permits, construction must begin within 18 months, and extensions may be applied for 12 to 18 months prior to expiration. Braithwaite Methanol Plant was granted an extension in 2017.

LDEQ is currently reviewing an air permit application from Venture Global for operation of the LNG terminal. The substance of that application is reported in section 4.11. Federal standards require modeling of a proposed facility’s emissions along with other ongoing and background emissions to demonstrate compliance with the NAAQS. These “baseline” emissions include emissions of other permitted facilities that are not yet built, therefore Venture Global’s air permit application included the emissions from the Braithwaite Methanol Plant and NOLA Oil Terminal. Based on the results of that analysis, the cumulative impact on air quality from operations emissions at these three facilities would not exceed the limits of the NAAQS. On the other hand, emissions from the Gulf Coast Methanol Complex were not included in Venture Global’s analysis submitted to LDEQ, nor were the LNG terminal’s emissions incorporated into IGP Methanol LLC’s air permit application to LDEQ. LDEQ recently issued Gulf Coast Methanol Complex’s air permit in January 2018. We requested Venture Global include Gulf Coast Methanol’s emissions in a cumulative modeling analysis. Based on results from the updated cumulative analysis that included Gulf Coast Methanol, Venture Global demonstrated that it would not contribute significantly (i.e., would be below the significant impact level) at all locations that modeling indicated a potential exceedance of the NAAQS. Because the emissions from Venture Global that would accumulate with those from other sources would not contribute significantly, we estimate that Venture Global’s cumulative effect on air quality would not be significant.

The two unpermitted actions in table 4.13-11 are still in early phases of planning or permitting. Pointe LNG, a proposed LNG manufacturing facility and export terminal, would trigger major source regulations, requiring it to model its regulated emissions in combination with emissions from the LNG terminal and the permitted projects in table 4.13-11. Pointe LNG would be required to demonstrate that the combined emissions do not exceed NAAQS thresholds before it became eligible to receive an LDEQ air permit, thus limiting its contribution to an adverse cumulative effect and ensuring the combined air pollution from regulated pollutants does not exceed health standards.

Pointe Celeste Container Terminal would require an LDEQ air permit for onsite, stationary sources like a backup emergency generator or a maintenance shop where solvents are used. However, most of its related emissions would not be regulated by LDEQ. Its greatest emission sources would likely be vessels that call at the container terminal combined with other mobile sources.

While emissions from facilities are well regulated and require ongoing inspection and compliance, cumulative emissions from large vessels that would call at major facilities once operation commences are not evaluated in CAA air permits. Given the quantities of marine diesel fuel burned by large ocean-going vessels, their emissions of SO₂ and NO_x from fuel combustion are a concern. The major industrial actions planned along the Lower Mississippi River would generate daily vessel calls by tankers, methanol carriers, and in the case of the Pointe Celeste Container Terminal, bulk carriers and container ships, all calling on terminals within

approximately 21 miles of each other. NEPA evaluations include disclosure of these associated vessel emissions, and those associated with the LNG terminal operation are reported in section 4.11.

Although emissions from vessels calling on the six new industrial developments could contribute to an adverse cumulative effect on air quality, we do not expect the effect to be significant. Localized cumulative effects from vessel emissions would be short-lived, because vessel emissions near any of the facilities would dissipate shortly after the vessel passes by. While docked, vessels' main engines would typically operate at a very low load, known as hoteling, or go into stand-by mode, minimizing the vessels' emissions at berth.

Moreover, vessel emissions are regulated through international treaties and domestic regulatory standards, even though they are not addressed in LDEQ air permit applications at the project level. The United States is party to the International Maritime Organization, which has implemented fuel, engine, and vessel standards as a result of the International Convention of Prevention of Pollution from Ships, a treaty called "MARPOL" (EPA, 2017b). The resulting standards limiting SO_x and NO_x entered into force as early as 2005, and the most recent updates became effective in 2016. The international standards apply to U.S. vessels and foreign vessels. In addition, the EPA has adopted fuel standards and engine emission standards for engines installed on U.S. vessels under the authority of the CAA (EPA, 2017b).

Given these factors, we do not expect vessel emissions from the Project to significantly impair air quality.

If Delta LNG, as described in its pre-filing request to the Commission, moves forward, additional LNG carrier traffic would be added in the Lower Mississippi River. Delta LNG would be required to evaluate emissions and air quality impacts from the additional vessel traffic in its NEPA documentation.

4.13.2.12 Noise

Construction activities associated with the LNG terminal would have a moderate, temporary adverse effect on land-based NSAs. Land-based and marine-side pile-driving to install over 500 pile supports for the LNG loading docks would generate the loudest noise, while the composite noise level of all other heavy equipment would be somewhat less. Construction activities associated with the pipeline system would have minor, temporary effects on NSAs. Activities include pile driving at the pipe bridge and metering station locations, dredging along the barge access routes, HDD-related activities, and equipment operation. Operational noise emitted from the LNG terminal would have minor adverse effect on NSAs, while the metering stations associated with pipeline system would not affect NSAs with noise during operation.

Three other actions, in addition to the LNG terminal, could occur within the geographic and temporal extent for cumulative impacts on noise, summarized in table 4.13-12. Two of these actions, the levee upgrade and associated drainage canal relocation, would have no associated operational noise. Thus, we limited our evaluation to cumulative noise impacts during construction of the Project and the additional actions.

The Delta LNG project would likely have operational noise but no information is available to properly assess a cumulative operational impact. We can assume that if operational noise is similar to the Project then similar mitigation would be implemented to minimize any elevated operational noise levels.

The main source of noise during the levee upgrade and drainage canal relocation actions would be heavy earth-moving vehicles and other construction equipment. We do not expect that pile driving or HDD equipment would be used, which generate louder noise than other standard construction equipment. The Commission allows a maximum of a 10.0 dBA increase above ambient noise levels at NSAs, and Venture Global has demonstrated that by constructing 5-meter-high noise protection walls around piling rigs, Venture Global would limit the increase of ambient noise levels to 0.4 dBA and 2.2 dBA at the two nearest NSAs. The NSAs are residences in the Deer Range neighborhood and are located 0.60 mile and 0.9 mile from the center of the LNG terminal site. These same NSAs are 1,600 and 3,900 feet from the pipe bridge, where Venture Global would conduct pile-driving of 18 piles over 20 days. The closest NSA would experience about an 8 dBA increase during those 20 days of pile driving. Finally, HDD activities to thread the two 0.4-mile-segments of pipe under live oak sensitive habitat between the non-federal levee and the terminal boundary would be a similar distance from the NSAs. Venture Global would implement a sound curtain enclosure or acoustic barrier around the drilling rig and stationary equipment that would limit the noise level increase at the closest NSA to around 3 or 4 dBA. Pile driving to support the pipe bridge would not occur concurrently with HDD pipeline construction, but pile driving associated with the LNG loading docks could occur concurrently with one or both of these pipeline activities. We should note, however, that noise emissions are not additive, but rather accumulate, and blend such that the combined noise level is less than the sum.

Table 4.13-12 Other Activities within the Geographic Scope and Temporal Scope for Cumulative Noise Impacts during Construction			
Activity	Distance from the Project Boundary	Construction Period	Noise during Operation?
Project	-	2019–2023	Yes
NOV/NFL Levee Upgrade	0 miles	By 2024	No
NOV/NFL Drainage Canal Relocation	0 miles	By 2024	No
Delta LNG	0 miles	2021 - 2024	Yes
Key: - = not applicable NFL = Non-Federal Levees NOV = New Orleans to Venice			

The NSAs referred to above are just a few hundred feet from the levee, where construction equipment and vehicles would eventually be used to perform the levee upgrade. Heavy trucks or equipment could be used concurrently to help implement the drainage canal relocation that is necessitated by the levee upgrade, but we assume only minor earthworks activities because the canal already exists. Thus, we considered noise from the canal relocation to be negligible.

In the unlikely event that Venture Global's pile-driving and/or HDD construction activities overlap with USACE upgrades of the levee portion within 0.5 mile of the LNG terminal, the cumulative noise effects on the closest NSAs would be temporary and adverse, lasting for a few days or weeks. However, the likelihood of timing overlap is low. The USACE has not announced projected construction dates for this section of the levee, indicating that the construction start date could still be several years in the future. Venture Global, on the other hand, would commence and complete pile driving for the LNG loading docks within the first years of construction commencement in 2019. Regardless, Venture Global will coordinate its construction activities with the USACE in accordance with the Section 408 Permit issued by the USACE for the pipe bridge over the levee.

4.13.2.13 Safety and Reliability

Potential impacts on public safety would be mitigated through implementation of applicable federal, state, and local rules and regulations for the proposed Project. These rules and regulations, described in section 4.12.1 and 4.12.2, would ensure appropriate standards would be applied to design and engineering, construction, operation, and maintenance to protect the public and avoid or minimize the potential for accidental or intentional incidents. The other LNG projects listed in table 4.13-2 would be required to follow the same rules and regulations, and other large industrial projects listed in table 4.13-2 would be subject to similar rules and regulations. These rules and regulations are intended to protect the public from the potential impacts of industrial projects singularly and cumulatively, and no significant cumulative impact on public safety is anticipated. Public services, including emergency services, would need to be appropriately sized to accommodate the population at the time the Project was constructed and operated. In addition, the Project and the other LNG projects would be required to prepare a comprehensive ERP (per 49 CFR 192.615) and identify the cost sharing mechanisms for funding these emergency response activities. These plans would minimize the potential for impacts on public safety from individual projects or when considered cumulatively with the other concurrent projects. In the unlikely event that major incidents occur at multiple facilities concurrently, the acute cumulative demand on emergency services would likely be significant; however, assistance from emergency service providers from neighboring parishes and communities would serve to mitigate the demand. We conclude that the impact of the Project, when considered cumulatively with the other concurrent projects, would not have a significant impact on demand for public services.

4.13.2.14 Climate Change

Climate change is the variation in climate (including temperature, precipitation, humidity, wind, and other meteorological variables) over time, whether due to natural variability, human activities, or a combination of both, and cannot be characterized by an individual event or anomalous weather pattern. For example, a severe drought or abnormally hot summer in a particular region is not a certain indication of climate change. However, a series of severe droughts or hot summers that statistically alter the trend in average precipitation or temperature over decades may indicate climate change. Recent research has begun to attribute certain extreme weather events to climate change (USGCRP, 2018).

The leading U.S. scientific body on climate change is the U.S. Global Change Research Program (USGCRP), composed of representatives from 13 federal departments and agencies.⁴¹ The Global Change Research Act of 1990 requires the USGCRP to submit a report to the President and Congress no less than every four years that “1) integrates, evaluates, and interprets the findings of the USGCRP; 2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and 3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.” These reports describe the state of the science relating to climate change and the effects of climate change on different regions of the U.S. and on various societal and environmental sectors, such as water resources, agriculture, energy use, and human health.

In 2017 and 2018, the USGCRP issued its *Climate Science Special Report: Fourth National Climate Assessment*, Volumes I and II (Fourth Assessment Report) (USGCRP, 2017; and USGCRP, 2018, respectively). The Fourth Assessment Report states that climate change has resulted in a wide range of impacts across every region of the country. Those impacts extend beyond atmospheric climate change alone and include changes to water resources, transportation, agriculture, ecosystems, and human health. The U.S. and the world are warming; global sea level is rising and acidifying; and certain weather events are becoming more frequent and more severe. These changes are driven by accumulation of GHG in the atmosphere through combustion of fossil fuels (coal, petroleum, and natural gas), combined with agriculture, clearing of forests, and other natural sources. These impacts have accelerated throughout the end 20th and into the 21st century (USGCRP 2018).

Climate change is a global phenomenon; however, for this analysis, we will focus on the existing and potential cumulative climate change impacts in the Project area. The USGCRP’s Fourth Assessment Report notes the following observations of environmental impacts are attributed to climate change in the Southeast region (USGCRP, 2017; USGCRP, 2018):

- temperatures cycled between warm and cool periods extending from 1920 to 1970. After 1970, annual average temperatures have warmed to levels above the 1930s; the decade of 2010 through 2017 has been warmer than any previous decade for average daily maximum and average daily minimum temperature;
- since 1960, there have been lower numbers of days above 95°F compared to the pre-1960 period but during the 2010’s the number of nights above 75°F has been nearly double the average over 1901 – 1960. The length of the freeze free season was 1.5 weeks longer on average in the 2010s compared to any other historical period on record;

⁴¹ The USGCRP member agencies are: Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Department of Health and Human Services, Department of the Interior, Department of State, Department of Transportation, Environmental Protection Agency, National Aeronautics and Space Administration, National Science Foundation, Smithsonian Institution, and U.S. Agency for International Development.

- number of days with 3 or more inches of rain has been historically high over the past 25 years. The 1990s, 2000s and 2010s rank first, third and second, respectively in number of events;
- summers have been either increasingly dry or extremely wet, depending on location;
- due to a combination of sea level rise and soil subsidence, approximately 2,006 square miles of land has been lost in Louisiana between 1932 and 2016, or about 23 square miles per year; and
- in southeast Louisiana, relative sea level is rising at a rate of 1 to 3 feet per 100 years.

The USGCRP's Fourth Assessment Report notes the following projections of climate change impacts in the Project region (Southeast U.S.) with a high or very high level of confidence⁴² (USGCRP, 2018):

- climate models project nighttime temperatures above 75°F and daytime maximum temperatures above 95°F become the summer norm. Nights above 80°F and days above 100°F, which are now relatively rare, would become common;
- lowland coastal areas are expected to receive less rainfall on average but experience more frequent intense rainfall events followed by longer drought periods;
- coastal areas along the Gulf of Mexico are flat; therefore, expected sea level rises may cause inundation in certain low lying areas;
- drought and sea level rise will create stressful conditions for coastal trees that are not adapted to higher salinity levels;
- other coastal species may also be stressed by sea level rise and warmer temperatures, prompting migration out of the area; and
- tropical storms and hurricanes may become more intense.

It should be noted that while the impacts described above taken individually may be manageable for certain communities, the impacts of compound extreme events (such as simultaneous heat and drought, wildfires associated with hot and dry conditions, or flooding associated with high precipitation on top of saturated soils) can be greater than the sum of the parts (USGCRP, 2018).

⁴² The report authors assessed current scientific understanding of climate change based on available scientific literature. Each "Key Finding" listed in the report is accompanied by a confidence statement indicating the consistency of evidence or the consistency of model projections. A high level of confidence results from "moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.), medium consensus." A *very* high level of confidence results from "strong evidence (established theory, multiple sources, consistent results, well documented and accepted methods, etc.), high consensus." <https://science2017.globalchange.gov/chapter/front-matter-guide/>

The GHG emissions associated with construction and operation of the Project were identified and quantified in section 4.11. Construction and operation of the Project would increase the atmospheric concentration of GHGs in combination with past, current, and future emissions from all other sources globally and contribute incrementally to future climate change impacts.

Currently, there is no universally accepted methodology to attribute discrete, quantifiable, physical effects on the environment to the Project's incremental contribution to GHGs. We have looked at atmospheric modeling used by the EPA, National Aeronautics and Space Administration, the Intergovernmental Panel on Climate Change, and others, and we found that these models are not reasonable for project-level analysis for a number of reasons. For example, these global models are not suited to determine the incremental impact of individual projects, due to both scale and overwhelming complexity. We also reviewed simpler models and mathematical techniques to determine global physical effects caused by GHG emissions, such as increases in global atmospheric CO₂ concentrations, atmospheric forcing, or ocean CO₂ absorption. We could not identify a reliable, less complex model for this task and we are not aware of a tool to meaningfully attribute specific increases in global CO₂ concentrations, heat forcing, or similar global impacts to project-specific GHG emissions. Similarly, it is not currently possible to determine localized or regional impacts from GHG emissions from the Project.

Absent such a method for relating GHG emissions to specific resource impacts, we are not able to assess potential GHG-related impacts attributable to this project. Additionally, we have not been able to find any GHG emission reduction goals established either at the federal level⁴³ or by the State of Louisiana⁴⁴. Without either the ability to determine discrete resource impacts or an established target to compare GHG emissions against, we are unable to determine the significance of the Project's contribution to climate change.

4.13.3 Conclusion

Based on our evaluations of resources affected by the Project, geology; soils; surface waters and aquatic wildlife and habitat; wetlands; vegetation and wildlife; land use; visual resources; socioeconomics; vessel traffic; noise; and cultural resources would not sustain significant adverse cumulative impacts. In the case of geology and soils, no other present or foreseeable actions would occur within the geographic scope. Several actions would occur within the scope for surface waters and aquatic wildlife and habitat, and we assessed potential cumulative effects to the Mississippi River and the Barataria Basin. However, we found no significant adverse cumulative impact on water quality or aquatic wildlife populations or habitat from increases in turbidity, sediment, effluent discharge, ballast water discharge, increased erosion, risk of leaks and spills, or pile driving. Because federal regulations stipulate that an action disturbing more than 5 acres cannot cause a permanent loss of wetland function, we found that cumulative adverse impacts on wetlands would not be significant. The other identified actions within the area of disturbance of the Project would affect only a minimal amount of forested and herbaceous vegetated area

⁴³ The national emissions reduction targets expressed in the EPA's Clean Power Plan and the Paris climate accord are pending repeal and withdrawal, respectively.

⁴⁴ We reviewed the U.S. State Greenhouse Emission Targets site for individual state requirements located at: <https://www.c2es.org/document/greenhouse-gas-emissions-targets/>

compared with the Project, so the cumulative effect on vegetation and associated wildlife would be no more than minor.

Given the presence of New Orleans and the greater metropolitan region near the Project, existing temporary housing accommodations and public services could absorb the needs of the workforces on concurrent construction projects in Plaquemines Parish without creating significant socioeconomic adverse effects. Because field and desktop surveys and correspondence with tribes did not uncover any archaeological or historic properties in the area of potential effect of the LNG terminal or pipeline system, we do not expect any cumulative effect on cultural resources.

Potential exists for noticeable impacts on land use and visual resources. The Project and three other foreseeable industrial actions on the west bank would convert agricultural and undeveloped land to major industrial uses. This change would be clearly noticeable, but the majority of the acreage affected by foreseeable activities would be consistent with the Parish Plan. We found that the cumulative visual effect from development of the major industrial actions on SH 23 would be moderate given the magnitude of change and intermittent exposure level of travelers on the highway.

The cumulative noise effects near certain residences in the Deer Range neighborhood could be adverse for a few days or weeks if Venture Global's pile-driving and/or HDD construction activities overlap with USACE upgrades and/or Delta LNG. However, overlap of these specific activities is unlikely. Venture Global has committed to coordinating with the USACE on these activities to ensure no overlapping effects.

The only resource that could sustain significant adverse cumulative impact is air quality. Effects on ambient air quality during operation of the Project when combined with the Gulf Coast Methanol Complex operations could be significant, i.e., exceed the NAAQS. The Project's air quality application incorporated emissions from other permitted industrial actions in the vicinity, but not those from the Gulf Coast Methanol Complex.

We assessed the Project's annual GHG emissions, 7,749,799 tpy, and noted the GHG emissions of two other foreseeable actions for which GHG emissions have been calculated. The total estimated GHG emissions from the three projects is 10,979,319 tpy, while three other foreseeable industrial actions would generate additional GHG emissions which have not been quantified. Venture Global would implement multiple EPA-approved BACT to minimize GHG emissions and demonstrated through modeling in its air permit application to LDEQ and EPA the emission limits each BACT would achieve. Because of a lack of standard methodologies, we could not determine whether the Project's incremental contribution of GHGs would result in a physical effect on the environment, or whether the cumulative contribution of GHGs from multiple industrial facilities would be significant.

In this cumulative impact analysis, we established conservative assumptions about the other actions in the region. To the extent possible, we considered the most intense cumulative environmental outcomes that could reasonably be expected. In fact, the likelihood is low that all projects would go forward according to schedule or according to our assumptions that unscheduled projects would coincide with this Project.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF THE ENVIRONMENTAL ANALYSIS

The conclusions and recommendations presented in this section are those of the FERC environmental staff. Our conclusions and recommendations were developed with input from the USACE, USCG, DOE, DOT, and EPA as cooperating agencies. The federal cooperating agencies may adopt the EIS per 40 CFR 1506.13 if, after an independent review of the document, they conclude that their permitting requirements and/or regulatory responsibilities have been satisfied. However, these agencies would present their own conclusions and recommendations in their respective and applicable records of decision or determinations. Otherwise, they may elect to conduct their own supplemental environmental analysis, if necessary.

We determined that construction and operation of the Project would result in limited adverse environmental impacts. Most adverse environmental impacts would be temporary or short term during construction and operation, but long-term and permanent environmental impacts on wetlands, open water habitats, vegetation, view shed, and land use would also occur as part of the Project. This determination is based on a review of the information provided by Venture Global and further developed from data requests; field investigations; scoping; literature research; alternatives analysis; and contacts with federal, state, and local agencies, as well as tribes and individual members of the public. As part of our review, we developed specific mitigation measures that we determined would appropriately and reasonably reduce the environmental impacts resulting from construction and operation of the Project. Therefore, we are recommending that our mitigation measures be attached as conditions to any authorization issued by the Commission. If the Project is constructed and operated in accordance with applicable laws and regulations, the mitigating measures discussed in this EIS, and our recommendations, adverse environmental impacts would be reduced to less than significant levels. A summary of the anticipated impacts from the Project and our conclusions regarding impacts are provided below by resource area.

5.1.1 Geologic Resources

Construction and operation of the Project would not affect active mining or non-fuel mineral resources during construction or operation. The nearest non-fuel mineral resource is approximately 3 miles to the south and east of the pipeline system. Three plugged and abandoned former oil and gas wells are located within the proposed pipeline construction workspace. In addition to the aforementioned wells, 18 additional plugged and abandoned wells, one permitted well, and two producing wells (currently shut-in for future utility) are located within 0.25 mile of the proposed pipeline system workspace. To avoid impacts on the two producing wells, and to afford the owner(s) or their representative the opportunity to be on-site during construction activities, we have made a recommendation in section 4.1.2 that Gator Express Pipeline notify well owner(s) 72 hours prior to construction activities near the producing oil and gas wells located within 0.25 mile of the Project workspace and allow a representative to be present during construction.

The proposed pipeline system crosses two state mineral lease areas. Venture Global has indicated they will negotiate permanent easement rights and any necessary access restrictions with the lease owners.

In general, the potential for geologic hazards such as earthquakes, soil liquefaction, shoreline erosion and landslides, or a seismically generated tsunami to significantly affect construction or operation of the pipeline system is low. However, some hazards such as flooding and hurricanes could affect pipeline construction. Venture Global would construct the meter stations at an elevation to minimize potential impacts from flooding and hurricanes.

Impacts on geologic resources due to installation of the pipelines and meter stations would be primarily limited to construction activities and include disturbance by “prop-washing” for construction in open water locations. Such impacts resulting from trenching would be temporary because Venture Global would restore these areas to preconstruction contours to the maximum extent practicable.

The full design of the pipeline system is currently being developed. Venture Global has proposed a feasible design and committed to conducting additional detailed design work for if the Project is authorized by the Commission. Information regarding the development of the final design would need to be reviewed by FERC staff in order to ensure that the final design addresses the requirements identified in the FEED. Therefore, we are recommending (see section 4.3.2.1) that Venture Global file its final site preparation drawings and specifications, meter station foundation design drawings and calculations, and quality control procedures to be used for civil/structural design and construction on a schedule to be identified in its Implementation Plan.

We do not anticipate that any blasting would be required for construction of the proposed pipeline system. Based on the above discussion, in consideration of Venture Global’s proposed mitigation and design criteria, and based on our recommendations, we conclude that the pipeline system would not markedly affect or be affected by geological conditions in the area.

5.1.2 Soils

Construction of the Project could affect soil resources by increasing the potential for erosion, compaction, and rutting. Based on the soil properties reviewed, none of the soils potentially affected by the Project is considered highly susceptible to erosion by wind or water. Due to fine textured soils and nearly level topography, no revegetation concerns were identified. However, most of the soils found at the terminal site are prone to compaction and are considered hydric. Approximately 150 acres of prime farmland are found along the pipeline route and LNG terminal site.

Construction activities such as clearing, grading, excavation, backfilling, and the movement of construction equipment may affect soil resources at the LNG terminal site. In order to increase the load-bearing capacity of soils within the terminal site, soil modifications would be made through the addition of materials to the soil at the LNG terminal site such as lime or cement and a surface layer of aggregate.

Following construction, approximately 622 acres of soils at the LNG terminal site would be permanently impacted by paved or gravel plant roads or occupied by aboveground facilities.

Venture Global would seed the remaining acreage within the terminal site with native vegetation recommended by the NRCS. The remaining acres of soils would be restored to preconstruction conditions and are anticipated to retain their former productivity.

To reduce the impacts of construction on soils, Venture Global would implement measures outlined in its Project-specific Plan and Procedures, which provide measures to control erosion and sedimentation during construction and to ensure proper restoration of disturbed areas following construction. The Project-specific Plan and Procedures include some modifications to our Plan and Procedures where Venture Global consider individual measures unnecessary, technically infeasible, or unsuitable due to local conditions (see appendix C, tables 1 and 2, respectively). We agree that most of Venture Global's proposed modifications are reasonable and that its proposed alternative measures would achieve a comparable level of mitigation as the FERC measures.

In addition, disturbed areas would be monitored by Venture Global following construction for the first and second (as necessary) growing seasons in upland areas and at least 3 years in wetlands to ensure successful restoration. With implementation of the proposed mitigation measures and Project-specific Plan and Procedures, we conclude that impacts on soil resources would be adequately minimized.

5.1.3 Water Resources

5.1.3.1 Groundwater

The LNG terminal site and pipeline system route are underlain by multiple, stratified aquifer systems, including the Gramercy aquifer, Norco aquifer, Gonzales-New Orleans aquifer, and the "1,200 foot" aquifer. These aquifers are primarily saline in the vicinity of the Project and are not designated EPA sole-source aquifers. Drinking water in Plaquemines Parish is primarily from the Mississippi River. Venture Global may utilize groundwater sourced from a newly installed well or wells at the terminal site for operation. Venture Global plans to utilize surface water for hydrostatic testing of the LNG tanks, piping, and non-LNG tanks from a drainage canal located along the terminal property. No groundwater would be utilized during the construction of the proposed pipeline system.

Most of the construction activities associated with the LNG terminal and pipeline system facilities would involve shallow, temporary, and localized excavation, with the exception of the installation of groundwater wells and concrete and steel piles at the LNG terminal. Limited transmissivity data suggest that the Gramercy aquifer, Norco aquifer, Gonzales-New Orleans aquifer, and the unnamed 1,200-foot-thick sand aquifer will each have a transmissivity values greater than 10,000 square feet per day at the LNG terminal site. Aquifers with similar transmissivity values can typically yield greater than 300 gallons per minute for a properly constructed supply well. If new supply wells were to be installed at the LNG terminal site, one or more wells would be installed in the targeted aquifer to produce 600 gallons per minute for treatment and use. Concrete and steel piles required for the LNG storage tanks and LNG ship loading and berthing areas would be driven to a depth no lower than approximately 250 feet and are not expected to have direct impacts on the underlying aquifer, which is overlain by about 300 feet of surficial sediments.

Neither the LNG terminal site nor the pipeline system are within drinking water protection areas for public supply wells. The portion of the terminal within the batture habitat is within the source water protection area for the Pointe a la Hache water system and the Port Sulfur Water District and is discussed in detail below in the Surface Water section. Only one well is located within 1 mile of the LNG terminal site and pipeline system. This well is an artesian well located within the 80-acre construction yard (eastern workspace) adjacent to the LNG terminal. The well was intended for agricultural purposes; however, the water salinity is too high for agriculture use according to local farmers. Plaquemines LNG plans to plug and abandon the artesian well during construction. Since no other wells are located within a mile of the Project, it is unlikely that the Project will affect public or private supply wells.

Venture Global anticipates that surface water from an onsite drainage canal would be utilized for hydrostatic testing of the LNG storage tanks. If the drainage canal does not contain enough water at the time of testing, water would then be appropriated from the Mississippi River. Therefore, the localized effects of the LNG terminal groundwater use would not have a significant effect on the aquifers.

5.1.3.2 Surface Water

The Mississippi River at the LNG terminal site is a Navigable Waterway under section 10 of the Rivers and Harbors Act. According to Venture Global, the Mississippi River depth at the LNG terminal site is sufficient to support the terminal marine facilities. Therefore, no dredging within the Mississippi River would be required to construct and operate the Project. Construction of the terminal facilities would temporarily impact 72.7 acres of the Mississippi River, and operation of the LNG terminal would permanently impact 14.6 acres of the Mississippi River.

In addition to impacts on the Mississippi River, construction of the LNG terminal facility would impact man-made ditches within the LNG terminal Project area and within the eastern workspace adjacent to the LNG terminal site. These man-made ditches are part of the fastlands system. These impacts would primarily consist of filling the ditches to construct the LNG terminal.

In-water construction associated with the LNG loading and ship berthing facilities, ground disturbance, filling of waterbodies within the fastlands, and general construction activities within the LNG terminal site would result in localized, temporary increases in turbidity and suspended sediment levels. To minimize impacts on water quality, land disturbing activities would be conducted in compliance with the LPDES General Permit. In addition, Venture Global would implement its Project-specific construction SWPPP, Plan, and Procedures. Our Procedures require that instream work within cool-water and warm-water fisheries must occur from June 1 to November 30, unless expressly permitted or further restricted by the appropriate federal or state agency. Venture Global has stated the seasonal restriction would not be practical and has obtained written consent from the LDWF to construct outside of the warm-water construction window. As a result, impacts on water quality from terminal construction are expected to be temporary and limited to the area within and immediately adjacent to the ship berthing facilities and within the fastland ditch system.

Operation of the LNG terminal would increase the amount of impervious surface, which would result in an increased volume of stormwater. Stormwater inside the terminal facilities would

be collected through series of ditches into sumps. Sumps that service LNG spill impoundment basins and other facilities where hazardous materials may be present would be equipped with automatic shutoffs that activate when LNG or other solvents are present. This would prevent contaminated stormwater from being pumped from the facility. Sumps pumps within the floodwall would pump the stormwater to a stormwater header and then to the Mississippi River. Stormwater collected from the terminal marine facilities would be processed through oil/water separators prior to being discharged to the Mississippi River.

The majority of the pipeline system would be constructed in open water, including bays, canals, bayous, and unnamed channels. Additionally, portions of the barge access channels would require dredging to accommodate equipment and pipe delivery. None of the surface waters impacted by the pipeline system are listed as National Wild and Scenic Rivers or designated Outstanding Natural Resource Waters. The majority of the surface waters traversed by the pipeline system are considered EFH and support some federal and state listed species. Potential impacts on EFH and federally and state-listed species are summarized in section 5.1.7. Venture Global would minimize potential impacts on surface waters by implementing the Project-specific Procedures.

During construction of the LNG terminal, barges and support vessels would deliver large equipment and materials to the MOF, and during operation, LNG vessels would call on the LNG terminal. The construction and operational vessel traffic may increase shoreline erosion and temporarily increase turbidity levels within the Mississippi River and along vessel transit routes. The shoreline at the terminal site is already armored, and any impacts on the existing armoring from terminal construction would be repaired. The existing armoring would prevent erosion of the adjacent shoreline by wave activity from vessels maneuvering within the berthing area. The Mississippi River currently functions as a navigation channel that provides deep-water access for maritime commerce. As such, use of the waterways by LNG carriers, barges, and support vessels during construction and operation of the LNG terminal would be consistent with the current use of active shipping channels, and associated impacts on water quality within the shipping channel would be minor.

Ballast water discharges at the LNG terminal could impact water quality by changing the salinity, temperature, pH, and dissolved oxygen level of water within the Mississippi River in the vicinity of the LNG terminal. Differences between the physiochemical composition of ballast water and the water present within the Mississippi River would vary depending on hydrologic conditions at the time of discharge. The primary potential impact on water quality due to ballast water discharge would be a temporary increase in salinity level. The Mississippi River is usually freshwater at the LNG terminal site. However, during periods of low flow, saltwater can push up the Mississippi River to the LNG terminal site and beyond. Ballast water, which would generally consist of open ocean water, would have a salinity of approximately 35 ppt (NOAA, 2018). In general, ballast water would have a higher salinity than the surrounding water at the LNG loading docks. The amount of ballast water discharged into the Mississippi River during each LNG carrier visit to the LNG terminal would make up a small percent of the water within the Mississippi River, as the Mississippi River discharges, on average, nearly 400 billion gallons per day into the Gulf of Mexico (NPS, 2018).

During construction and operation, spills or leaks of hazardous materials flushed into waterbodies could have an adverse impact on water quality. To prevent spills and leaks, Venture Global would implement its Project-specific SPCC Plans during construction and operation of the LNG terminal and pipeline system, which identify potential sources of releases at the site, measures to prevent a release, and initial responses in the event of a spill.

Venture Global would utilize 50,000 gallons of water, recycled over five uses, to test plant piping and tanks other than the LNG storage tanks. Venture Global would utilize 26,200,000 gallons of water for hydrostatic testing of the LNG storage tanks. The water for LNG storage tank hydrostatic testing would be transferred between tanks to conserve water. The water for testing plant piping and tanks other than LNG storage tanks would also be sourced from the nearby drainage canal. Water would be withdrawn from the canal at a rate of 1,500 gallons per minute to minimize impingement of aquatic organisms and debris. The intake structure would be fitted with 0.25-inch to 1.0-inch screens to minimize entrainment of aquatic organisms and debris. Small quantities of water used for hydrostatic testing may be discharged directly to the ground. Large discharges of hydrostatic test water would be treated, as necessary, and discharged to the Mississippi River, into adjacent drainage canals, or on-site in accordance with permit conditions. Pumps and energy dissipation devices would be used to control the discharge rate and limit scouring and erosion.

Venture Global estimates that 5,626,316 gallons would be required for hydrostatic testing of the Southwest Lateral TGP pipeline and 3,997,658 gallons of water would be required for hydrostatic testing of the Southwest Lateral TETCO pipeline. The water for testing the pipeline system would be sourced from a drainage canal near the terminal. The pumping rate would vary from 250 to 500 gallons per minute, and the water would be passed through a 0.25-inch to 0.5-inch mesh screen to block the uptake of various debris and aquatic biota. After testing, the water would be discharged back into the canal through an energy dissipating structure.

Where water from the nearby drainage canal is used to hydrostatically test the LNG storage tanks and pipeline system, chemical additives may be required during the testing process to neutralize bacteria and other components that can be corrosive. Before returning hydrostatic water to its surface water source, Venture Global would pass the water through 25- to 50-micron filters and an active carbon medium to remove suspended solids and neutralize or biodegrade the chemical additives. Following completion of the hydrostatic testing and prior to being discharged, the test water would be analyzed for total suspended solids, oil and grease, and pH in accordance with LPDES general permit LAG670000.

To reduce the impacts of construction on surface waters (wetlands and waterbodies), Venture Global would implement measures outlined in its Project-specific Plan and Procedures, which provide measures to control erosion and sedimentation during construction and to ensure proper restoration of disturbed areas following construction. The Project-specific Plan and Procedures include some modifications to our Plan and Procedures where Venture Global consider individual measures unnecessary, technically infeasible, or unsuitable due to local conditions (see appendix C, tables 1 and 2, respectively). We agree that most of Venture Global's proposed modifications are reasonable and that its proposed alternative measures would achieve a comparable level of mitigation as the FERC measures. However, concerning the modification to Section V.B.1 of our Procedures that limits the time window for construction in waterbodies,

Venture Global has obtained consent from LDWF to construct instream construction outside of these windows.

With the implementation of Venture Global's Project-specific Plans and Procedures, the proposed mitigation measures discussed in this EIS, and our recommendation, we conclude that impacts on surface waters would be minimized.

5.1.4 Wetlands

Construction of the LNG terminal would result in the permanent filling of PEM wetlands, including impacts on wetlands within the eastern workspace. In addition, PFO wetlands would be permanently converted to PEM/PSS wetlands. In addition, temporary impacts, affecting PEM and PFO wetlands would result during construction of the terminal facilities. Once construction is complete, these areas of temporary impacts would be restored. Construction at the LNG terminal site has the potential to have secondary and indirect impacts on adjacent wetlands. Implementation of protective measures in the Project-specific Plan and Procedures, the SPCC Plan, and the SWPPP, including erosion and sediment controls, would minimize the impacts on adjacent wetlands.

Construction and operation of the pipeline system would result in the permanent filling of ESS wetlands and PSS wetlands. Additionally, permanent impacts on open water would result from construction of platforms for the aboveground facilities. Construction of the pipeline system would result in temporary impacts on wetlands and open water. Wetland impact acreages are shown in tables 4.4-1 and 4.4-2.

Section II.A.2 of our Procedures requires site-specific justifications for the use of a construction right-of-way greater than 75-feet-wide in wetlands. Venture Global states that the Project requires a 130-foot-wide construction right-of-way for pipeline installation where the push method is used, due to the need for a relatively wide and deep trench to ensure the required depth of cover in the wet, poorly cohesive, and easily sloughed substrate, and the consequent need for increased space to sidecast relatively high spoil volumes to be used for later restoration. Venture Global further states that the Project requires a 300-foot-wide construction right-of-way for pipeline installation in open waters, where the barge lay method is used, to accommodate an approximately 100-foot-wide flotation channel for lay barge and supply barge access and up to approximately 100 feet on either side of the flotation channel for construction workspace to deposit sidecast trench material to be used for later restoration. The 300-foot-wide construction right-of-way would allow for safe and wholly waterborne construction.

We accept that this proposed modification is necessary because the combination of pipe size, the inundated or saturated soil conditions, and the pervasiveness and extent of wetlands and open water in the Project area make the 75-foot-wide right-of-way infeasible.

Our Procedures state that aboveground facilities should be located outside of wetlands, except where such siting would prohibit compliance with DOT regulations. Venture Global has proposed locating portions of aboveground facilities within wetlands, as there are no upland alternatives because the pipeline system is largely located in wetlands and open water. Additionally, based on comments received from the LDWF, the use of bank line stabilization

material at the interface of marsh and open water for all pipelines installed via the open trench would mitigate loss of marsh from open water intrusion. We agree that locating some aboveground facilities is unavoidable in the Project area and concur with the LDWF that the pipeline construction methods and wetland compensation plan would result in no net loss of wetlands.

The USACE would require Venture Global to propose compensatory mitigation that is commensurate with the amount and type of wetland impacts resulting from construction and operation of the Project. There are three mechanisms for providing compensatory mitigation. These wetland mitigation mechanisms, in order of USACE preference, are: mitigation banks, in-lieu fee mitigation, and permittee-responsible compensatory mitigation. As part of the section 10/404 process, Venture Global would be required to develop a Compensatory Mitigation Plan to mitigate unavoidable wetland impacts. The Compensatory Mitigation Plan would be subject to review and approval by the USACE as part of the section 10/404 process.

5.1.5 Vegetation

Much of the area affected by the terminal facility is former agricultural lands that are surrounded by levees and are dewatered through pumping specifically for agriculture use and development. These lands have been utilized as pasture lands in the past and exhibit limited diversity. Therefore, the impact on vegetation communities as a result of the LNG terminal construction would be minor.

The collocation of the pipelines would minimize impacts on vegetation communities during construction and operation of the pipeline system. Venture Global would also implement the Project-specific Plan and Procedures, which require the use of temporary and permanent erosion control measures, topsoil segregation in select areas, testing and mitigation for soil compaction, post-construction monitoring, and limited routine vegetation maintenance. All disturbed areas would be routinely monitored in accordance with the Project-specific Plan and Procedures until restoration and revegetation are successful. Venture Global would also implement its Noxious Weed Plan to control the spread and introduction of noxious and invasive species.

With the implementation of the minimization efforts described above, we conclude that construction and operation of the pipeline system would have a minor impact on vegetation communities.

5.1.6 Wildlife and Aquatic Resources

5.1.6.1 Wildlife

Wildlife species occurring in the vicinity of the proposed LNG terminal and pipeline system are characteristic of the habitats provided by the vegetative communities that occur in these areas. Construction of the LNG terminal would impact vegetated wildlife habitat, of which, some acreage would be permanently converted to industrial use. Based on field surveys, over 92 percent of the permanent impacts at the LNG terminal site are to current pasture and hay production land (cultivated cropland in USGS classification). In addition to the cultivated cropland impacts, operation of the terminal would result in permanent impacts on forested/scrub-shrub uplands and

PFO wetlands (batture). Due to the site's history as pastureland, species diversity is low, which lessens its value as habitat for wildlife.

Operation of the LNG terminal would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to current industrial activities at other facilities on the Mississippi River, wildlife species in the area are expected to be acclimated to the noise and artificial lighting associated with these activities. Therefore, we expect impacts due to noise, light, and human activity during operation of the LNG terminal to be negligible. Birds could also be affected by flaring at the terminal. The terminal is designed to limit flaring events only to LNG carrier gas up/cool down operations, which may occur up to forty times a year. During operation of the LNG terminal, use of the marine and emergency flares would only occur during process upset conditions. To the extent practical, use of the flares during initial facility start-up will be limited to daylight hours, limiting potential impacts on birds, and, to the extent practical, will be planned to avoid inclement weather when the risk of bird mortalities from attraction to the flares would be the highest. Therefore, we find that occasional flaring during operation would not substantially impact migratory birds passing through the area.

The majority of the pipeline system would temporarily impact herbaceous and shrub/scrub habitats including EEM wetlands, ESS wetlands, PSS wetlands, forested/scrub-shrub upland, PEM wetlands, and coastal live oak hackberry forest, based on field surveys. These habitats would be restored post-construction to the extent allowed within temporary and permanent easements. Construction of the pipeline system would permanently convert 1.7 acres of coastal live oak hackberry forest to maintained herbaceous right-of-way. In addition, 0.4 acres of ESS wetlands would be permanently converted into aboveground facilities for the pipeline system.

Individuals of some wildlife species would be affected by construction and operation of the facilities, but most impacts on wildlife would be short term and limited predominantly to the construction period. The forested and shrub scrub portions of the pipeline system would require some maintenance and mowing. However, the majority of the pipeline system consists of open water and herbaceous wetlands and would not likely require vegetation maintenance. With the implementation of the Project-specific Plan and Procedures, and due to the fact that abundant similar habitat is available for wildlife adjacent to the affected areas, we conclude that construction and operation of the pipeline system would have permanent but minor impacts on local wildlife populations and habitat.

The vegetation communities within the LNG terminal and pipeline system facilities provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. However, much of the vegetated land associated with the LNG terminal and pipeline system facilities is previously disturbed, within or adjacent to existing facilities, and/or composed of agricultural land, all of which reduce bird nesting habitat value. Impacts on migratory birds and their habitat due to construction and operation of the Project would typically be similar to impacts on general wildlife resources. In addition, potential impacts specific to migratory birds include loss of habitat and injury or disorientation due to flaring and other artificial illumination.

Colonial nesting waterbirds that occur in the Project area include various herons, egrets, ibises, terns, gulls, pelicans, and other species. A possible colonial-nesting waterbird area on an island in Barataria Bay occurs within a 2-mile radius of the pipeline system. The island is located

between 600 and 1,800 feet from the proposed pipeline system. Based on the FWS guidance, Venture Global would educate on-site personnel to be cognizant of colonial nesting waterbirds, conduct pre-construction surveys, and restrict construction activities within 1,000 feet of any identified rookeries. Based on adherence to the FWS restrictions and completion of preconstruction surveys, impacts on colonial nesting waterbirds due to construction and operation of the Project would be minimal.

The LNG terminal and pipeline facilities would require adequate lighting for operations and safety. During construction, Venture Global would direct all nighttime lighting towards construction activity and use the minimum light level necessary to ensure site safety and security. While the facility lighting plan for operation of the LNG terminal has not been fully developed, Venture Global expects the plan to include downward-facing lights with shielding needed to meet regulatory standards and minimize illumination specifications. Measures that may be included in the final facility lighting plan include: (i) light minimization through limited outdoor lighting at the terminal and pipeline meter stations; (ii) shielded and downward-facing lights to facilitate safe operations at night or during inclement weather; (iii) the use of only white or red strobe lights at night, using the fewest number of lights as practicable, and using the minimum intensity and number of flashes per minute allowable; (iv) avoidance of solid red or pulsating red warning lights when possible; and (v) turning off perimeter lighting at aboveground facilities at night and using them only when necessary for work conducted at night.

In accordance with the facility lighting plan, lighting would be chosen to minimize the horizontal emission of light away from intended areas, and shielding would help minimize impacts on birds and other wildlife while providing the illumination needed to ensure safe operation of the facility.

5.1.6.2 Aquatic Resources

All waterbodies potentially affected by the Project support warm-water fisheries. Habitat for aquatic resources present within the LNG terminal includes the Mississippi River and man-made drainage ditches/canals within the LNG terminal site. The aquatic resources potentially affected by the pipeline system consist of drainage ditches, wetlands (PSS, PEM, ESS, and EEM) and open water.

Activities associated with construction and operation of the LNG terminal with the greatest potential to impact aquatic resources include pile driving and vessel traffic. No dredging is proposed at the LNG terminal site. The proposed waterbody modifications, water withdrawals for hydrostatic testing, stormwater runoff, lighting, and inadvertent spills could also affect aquatic resources; although the implementation of the proposed mitigation measures, would reduce these impacts to minimal levels.

Construction of the LNG terminal marine facilities would result in localized, temporary increases in turbidity and suspended sediment levels. However, these impacts are expected to be temporary (i.e., confined primarily to the period of in-water activity and shortly thereafter) and limited to the area within and immediately adjacent to the LNG loading and marine facilities. No permanent or long-term water quality impacts are anticipated. Impacts on fisheries resources and

supporting habitat as a result of construction and operation would occur in the Mississippi River from construction of the marine facilities.

Construction of the LNG terminal would require the installation of approximately 600 piles to support the proposed marine facility structures, MOF, and meter stations. It is anticipated that aquatic species would largely avoid the pile-driving area when the piles are being installed, although some aquatic resources could experience stress or injury due to the underwater sound pressure levels. Venture Global submitted an underwater noise mitigation plan based on NMFS 2018 technical guidance identifying mitigation measures that would be taken to reduce noise pressure levels. This plan was submitted to and approved by the FWS and NMFS.

During construction and operation of the LNG terminal, barges, support vessels, and LNG vessels would call on the LNG terminal, increasing ship traffic within the Mississippi River and Gulf of Mexico. Potential impacts on aquatic resources resulting from increased vessel traffic include shoreline erosion and resuspension of sediments, ballast water discharges, cooling water discharges, and increased noise levels. The Mississippi River shoreline at the LNG terminal site is currently armored to protect the shoreline from erosion, and the Mississippi River is currently a heavily utilized shipping channel. Therefore, associated impacts on aquatic resources due to increased shoreline erosion and resuspension of sediments would be negligible.

Ballast water discharges at the terminal would modify the temperature, pH, dissolved oxygen, and salinity of the water in the vicinity of the discharge. However, the impacts on water quality, and thus aquatic resources, due to changes in temperature and pH would be temporary and negligible. During and immediately following ballast water discharges, benthic aquatic species may be affected by higher salinity levels, although ships moving into and out of the LNG terminal marine facilities would displace water, circulating it into, around, and out of the berthing area. Therefore, any increased salinity levels resulting from ballast water discharges would be temporary and unlikely to adversely affect aquatic resources.

Dissolved oxygen levels below 4 mg/L are generally considered unhealthy for aquatic life, and levels below 2 mg/L are considered hypoxic and inadequate to support most aquatic life. As discussed in section 4.3.2.2, ballast water would contain low dissolved oxygen levels and could decrease existing dissolved oxygen levels within the immediate vicinity of the discharge point. Depending on the oxygen levels present in both the ballast and ambient water at the time of discharge, aquatic resources present in the vicinity of the discharge point could be exposed to dissolved oxygen levels considered unhealthy for aquatic life. The adaptability of resident species in the Mississippi River to natural spatio-temporal variation in oxygen levels, and the ability to move over a short distance to more suitable conditions, would minimize the adverse impacts associated with ballast water discharges. Given that the amount of ballast water discharged into the river during each LNG vessel visit to the LNG terminal would make up only a very small percentage of the water flowing downstream, we have determined that impacts on aquatic resources from reduced dissolved oxygen would be temporary and minor.

During construction and operation, hazardous materials resulting from spills or leaks entering the Mississippi River could have adverse impacts on aquatic resources. The impacts are caused by either the physical nature of the material (e.g., physical contamination and smothering) or by its chemical components (e.g., toxic effects and bioaccumulation). These impacts would

depend on the depth and volume of the spill, as well as the properties of the material spilled. To prevent spills and leaks, Venture Global would implement its Project-specific Spill Prevention Plan during construction and its SPCC Plan during operation of the LNG terminal. These plans outline potential sources of releases at the site, measures to prevent a release, and initial responses in the event of a spill (see detailed discussion in section 4.2.3). Given the impact minimization and mitigation measures described above, we conclude that the probability of a spill of hazardous materials is small and any resulting impacts on aquatic resources would be temporary and minor.

Pipeline system construction impacts on fisheries resources and habitat would occur primarily in estuarine wetlands and open water. Impacts would primarily be localized and temporary, with disturbed areas returning to preconstruction conditions following pipeline installation. The pipeline trench would be backfilled following construction, and the barge channels would be allowed to backfill naturally through sedimentation. The push method or barge lay method would be used for trenched pipeline installation across most waterbodies and wetlands. Although these methods are designed to minimize equipment use and disturbance during pipeline construction, the crossing methods could result in temporary loss or modification of aquatic habitat, increases in sedimentation and turbidity levels, and alteration of vegetative cover. The majority of fish present within the waterbody at the time of construction activities would likely be displaced to similar nearby habitats. However, stress, injury, or death of individual fish may occur. Increased suspended sediment and turbidity levels may cause degradation of benthic and spawning habitat and decreased dissolved oxygen levels within and downstream of the crossing location. Temporary increases in suspended solids would decrease rapidly following the completion of in-water activities.

During construction of the two pipeline meter stations in Barataria Bay, 615 12-inch-diameter steel piles would be installed during construction. Installation could result in noise impacts on fish similar to those discussed for the marine facilities in the Mississippi River. Venture Global plans to install the piles associated with the meter stations either by the impact hammer or vibratory pile-driving method. Generally, vibratory pile driving takes much less time than impact-driven pile installation. For the LNG terminal, Venture Global has agreed to general pile-driving mitigation measures such as buffers and soft starts to reduce noise impacts on aquatic species.

Dredging within barge access areas would cross private oyster leases. According to the LDWF, lessees must be notified as part of the Coastal Use permitting process about projects occurring in their oyster lease. In addition, a water bottom assessment must be conducted on those portions of leases located within 1,500 feet of the pipeline system. Further, in the event that Venture Global cannot reach an agreement within an affected oyster lease holder, Venture Global will seek a preliminary determination of damages through an arbitration process with the LDNR – Oyster Lease Damage Evaluation Board. The final damage payment to be made to each lease holder will be made following the construction activities and completion of a final biological survey subject to review by the board.

Both the LNG terminal marine facilities and significant portions of the pipeline system are mapped as EFH. Correspondence between Venture Global and NMFS (NMFS, 2017) indicate that the portion of the Mississippi River located in the Project area does not provide EFH since managed fish species would not be common this far upriver (river mile 55). Therefore, the marine facilities located in the Mississippi River at the terminal site would likely have no effect on EFH.

Construction of the pipeline system would impact EFH for post-larval and juvenile life stages of white shrimp, brown shrimp, and lane snapper, all life stages of red drum, and adult gray snapper. Affected EFH includes benthic substrates and/or water column habitats in estuarine open water (collectively referred to in this assessment as estuarine open water) and estuarine emergent wetlands. Potential adverse impacts on EFH would primarily be temporary, while some permanent impacts may be beneficial. Temporary adverse impacts during construction would be minimized through adherence to the BMPs set forth in Venture Global's Project-specific Procedures, SWPPP, and SPCC Plan.

5.1.7 Threatened, Endangered, and Other Special Status Species

Based on our review of publicly available information, agency correspondence, and field surveys, a total of 16 federally listed threatened or endangered species may occur in Plaquemines Parish (see table 4.7.1). Also within Plaquemines Parish, there is designated critical habitat for piping plover and loggerhead sea turtles. Review of the FWS Information for Planning and Conservation System database and the FWS Louisiana Ecological Services list of endangered, threatened, candidate, and proposed for listing species by county identified 10 species as potentially present in Plaquemines Parish, including the West Indian manatee, piping plover, red knot, Gulf and pallid sturgeon, and five species of sea turtles (FWS, 2018a). The NMFS Southeast Region lists 12 federally listed species as potentially occurring in the Project area or along the LNG vessel transit route in the Gulf of Mexico, including Gulf sturgeon, oceanic white-tip shark, giant manta ray, four species of whales, and five species of sea turtles (NMFS, 2018). The FWS and NMFS split jurisdiction for six species, including the Gulf sturgeon and the five sea turtles (see section 4.7.1). The FWS proposed the eastern black rail for listing as threatened under the ESA in October 2018, and there is appropriate habitat for the eastern black rail within the project area.

For the 16 species listed under the ESA, we have determined that the Project may affect but is not likely to adversely affect these species. For the eastern black rail, which the FWS proposed for listing as threatened, we have determined that the Project may affect but is not likely to jeopardize the continued existence of the eastern black rail. These determination of effects are based upon our review of the species habitat requirements, the low likelihood of the species to occur within the Project area, and Venture Global's commitment to implement mitigation measures in section 4.7. To ensure construction does not begin before FERC confirms compliance with section 7 of the ESA, we recommend in section 4.7.1.4 that Venture Global not begin construction of the Project until the staff completes formal consultation with the FWS/NMFS, if required.

Based on information obtained from the LDWF, 15 state-listed threatened or endangered species are known to occur within Plaquemines Parish (LDWF, 2018a). Twelve of the 15 state listed species are also federally listed and are discussed above. The three species that are not federally listed are the bald eagle, peregrine falcon, and the brown pelican (see table 4.7.1). Suitable bald eagle habitat exists in the vicinity of the terminal site, but no known nests have been identified. Because of the potential for bald eagles to be nesting in the Project area, Venture Global has committed to conduct preconstruction surveys to identify active bald eagle nests within 660 feet of the Project area. If active bald eagle nests are found, Venture Global will follow appropriate mitigation measures according to the National Bald Eagle Management Guidelines to minimize or

avoid impacts on individual bald eagles. Impacts on the peregrine falcon would be temporary and minor and primarily associated with seasonal disruption of foraging due to pipeline construction. Colonial waterbirds, such as the brown pelican, could potentially nest in the vicinity of the Project. Venture Global will implement measures to identify any nesting colonies prior to construction and would implement measures to prevent impacts on nesting brown pelicans. Based on the above, we have determined that the Project would not likely adversely impact state-listed species.

5.1.8 Land Use, Recreation, and Visual Resources

Construction of the LNG terminal and pipeline facilities would affect a total of 1,682.6 acres of land. Of this, 773.8 acres would be permanently affected by operation of the LNG terminal and pipeline facilities and 908.8 acres would be allowed to revert to the existing land use type after the completion of construction.

Construction of the LNG terminal would affect a total of 728.7 acres of land and water within the LNG terminal site, including the marine facility construction footprint and other workspaces adjacent to the terminal site. The USGS Land Use Land Cover data land use types affected during construction of the LNG terminal, including the marine facility construction footprint and other workspaces adjacent to the terminal site, would include cultivated crops, forested, open water, wetland, developed industrial/commercial, herbaceous, and scrub-shrub. Because the majority areas affected by construction and operation of the LNG terminal are master planned for “port/terminal complex” (Plaquemines Parish Master Plan, 2011), we have determined that impacts on land use would be negligible.

Venture Global currently leases the LNG terminal site. The property is owned by the Port of Plaquemines. A lease option agreement grants Venture Global the exclusive right to lease the terminal site for up to 70 years. Aside from the Port of Plaquemines property, no federally, state, or local agency owned or managed lands would be affected by the liquefaction facility. Likewise, the additional workspaces located adjacent to the LNG terminal site are also owned by the Port of Plaquemines, and Venture Global currently has the option to lease those lands involving additional workspaces. A USACE-maintained levee along the Mississippi River is controlled by the federal government but is located within port-owned property. Aside from the Port of Plaquemines and USACE, no federally, state, or local agency owned or managed lands would be directly affected by the LNG terminal.

Construction of the pipeline facilities would affect about 953.9 acres of land and open water. Because the activities involve new rights-of-way and easements, much of the land and open water affected by the pipeline facilities would be greenfield. The pipeline facilities would be constructed almost entirely within open water and wetlands, although small areas of herbaceous area and developed land would also be affected. Impacts on land use associated with construction and operation of the pipeline facilities would be temporary and minor, and all disturbed areas would be allowed to revert to preconstruction conditions after construction is complete. Venture Global would retain permanent easements over the header pipelines, which would be subject to vegetation maintenance and monitoring. The lands necessary for construction and operation of the pipeline and its associated facilities would consist of land currently owned or leased by Venture Global and other private land for which Venture Global would seek easement agreements with the owners.

No residential land is located within the footprint of the areas that would be affected by construction or operation of the LNG terminal and pipeline. The nearest occupied residences are 0.2 mile southwest of the terminal site. The nearest residence to any pipeline workspace is located approximately 0.3 mile northwest along Lake Hermitage Road. No residential areas or subdivisions are currently proposed within a 0.25-mile radius of the terminal site or pipeline workspaces, according to the Plaquemines Parish Department of Permits, Zoning and Planning. In addition, no commercial/industrial projects are planned or announced within a 1-mile radius of the terminal site or pipeline workspaces.

One designated management area, Barataria-Terrebonne National Estuary Program, Gulf Ecological Management Site, is located within 1 mile of the pipeline route and LNG terminal site. Recreational boating and fishing activities occurring within the proposed open water areas of the pipeline route and within the Mississippi River could be affected by construction of the pipeline and construction and operation of the LNG terminal due to increased noise, restrictions on vessel traffic in the immediate vicinity of the LNG terminal, and pipeline construction. Increased noise associated with construction of the pipeline would likely deter recreational users from fishing in the immediate vicinity of pipeline construction. Fishing and recreational boating within the Mississippi River near the terminal site is not popular; therefore, impacts would be minimal. During operation of the LNG terminal, delays to recreational users could result due to the moving security zone around LNG vessels during transit to and from the LNG terminal, which we expect would be intermittent and minor.

Other public areas, conservation lands, or special interest areas near the terminal site and/or pipeline routes include four local marinas between 0.1 and 1.8 miles from a Project workspace; Delta NWR; Breton NWR; Pass A Loutre State Wildlife Refuge; Woodland Trail and Park, a privately owned conservation land; and Jean Lafitte National Historic Park. Users of these areas may experience an increase in vehicular traffic and minor interruptions in traffic flow, particularly along SH 23 near the terminal site during construction. Vessel traffic to and from these areas may also be prevented from using established channels during pipeline construction. Because impacts on vessel traffic and vehicular traffic would be temporary, impacts are expected to be minor.

The LDWF regulates statewide fishing in addition to the harvest of crabs, crawfish, oysters, shrimp, and certain reptiles and amphibians. The Project does not encroach any public oyster areas. The closest public oyster area and active clutch planting is 5.3 miles southwest of the terminal site in Petit Bay Chene Fleur. Commercial fishing traffic is expected to experience minor, temporary impacts during pipeline construction. Venture Global was granted permission by the LDWF to conduct instream work within the warmwater fisheries associated with the Project year-round. Only areas immediately near construction barges would be restricted for safety reasons, otherwise all waters would be accessible to recreational and commercial fishing.

As stated in section 4.8, “visual resources” refer to any object or feature that is visible on a landscape and that influences the visual appeal of an area for residents, local workers, or visitors. Potential impacts on visual resources were considered for both the LNG terminal site and the pipeline system. The study area included a 2-mile buffer area from the Project (used primarily for the LNG terminal site) and the footprint of the pipeline system and its immediate surroundings. Present within the 2-mile buffer area are residences, commercial facilities, public recreational facilities, the Mississippi River, and SH 23 (a National Scenic Byway). The study area generally

is characterized by industrial views, with other land uses as described herein. Beyond an approximately 2.0-mile radius, the infrastructure associated with the Project would likely blend into its surroundings, therefore, visual resources beyond the 2 miles are not considered.

The area surrounding the LNG terminal site currently includes industrial operations and associated facilities; the LNG terminal site would be in the viewshed of local residents (particularly from elevated points-of-view), drivers, and visitors travelling along SH 23 and other nearby roadways. It also would be visible to recreational and commercial users of the Mississippi River.

Visual impacts associated with the LNG terminal site would be experienced temporarily during construction due to the presence of heavy equipment/personnel, lighting, materials storage, and infrastructure (e.g., the pipe bridge and temporary aerial conveyor system). Existing scrub-shrub and tree cover may provide some cover for those nearby observers with potential views of the LNG terminal site; a perimeter wall also may block some of the nearby views of the terminal site. Construction would be anticipated to generate minor impacts due to the industrial nature of the LNG terminal site and its surroundings, as well as the temporary nature of the construction activities.

During operation, views of the LNG terminal may include exterior plant lighting, air navigation lighting, LNG storage tanks, electric power generation facilities, liquefaction heat exchangers, air coolers, and the flare stack. Similar to the construction phase, the LNG terminal would be visible to residents (particularly from elevated points of view), drivers, and recreational/commercial users. While new facilities would be present, the impacts associated with operation is expected to be minor, as the LNG terminal would be consistent with the master planned industrial nature of the site and its surroundings. To minimize potential lighting impacts, the exterior plant lighting would primarily consist of full cutoff types, directed toward the ground, and where possible, floodlight mast locations would be directed to avoid light emissions on land and water.

The pipeline system generally would be in rural areas and areas previously disturbed by other utilities. During construction of the pipeline system, visual impacts would result from the presence of personnel and their workday activities, large construction equipment, and vehicles. Visual impacts associated with construction of the pipeline system would include the removal or alteration of existing vegetation and the exposure of bare soils, as well as earthwork and grading scars associated with heavy equipment tracks, trenching, and machinery and tool storage. A pipe bridge also would be built that would be visible to outside viewers. Existing vegetation may provide some buffer to the construction, but noticeable changes would result from the changes within the footprint and workspaces of the pipeline system.

During construction of the pipeline system, barges would be utilized in open water areas associated with the barge access channels. A short-term change in visual resources would be noticeable to recreational and commercial boaters in proximity to the workspaces due to the activity. Occupants of other vessels traveling on the barge access channels would be able to see large equipment, pipe joints, and materials being transported to the active construction sites.

Operational impacts associated with the pipeline system would be anticipated to occur in locations surrounding the permanent aboveground facilities. Similar aboveground pipeline

infrastructure is common in this area of Louisiana; therefore, the presence of these stations would not detract from the overall industrial nature of the area.

As much of the pipeline system would be located in rural or industrial areas, the pipeline system would be anticipated to cause minor impacts with regard to visual resources. Existing vegetation would help to provide some visual buffers from the operation of the pipeline system. In areas where vegetation would be removed or altered, pre-Project conditions would be restored according to the Project-specific Plan and Procedures as practicable.

The proposed LNG terminal would be located within the Louisiana Coastal Zone, and a CUP from the OCM would be required. Venture Global submitted its Joint Permit Application for activities within the Louisiana Coastal Zone to the USACE and the OCM in March 2018. Venture Global has not received its CUP and subsequent consistency determination from the OCM. We recommend that Venture Global file its consistency determination with the Secretary prior to any construction activities, if approved.

5.1.9 Socioeconomics

Venture Global expects that construction of the terminal site would occur in two 35-month phases, with start dates spaced 12 months apart. Thus, construction on the LNG terminal would be continuous for about 4 years. The pipeline system would also be constructed in two phases, each less than a year in duration, overlapping with the LNG terminal construction. Each phase of the LNG terminal's construction would average 1,400 workers and rise to 2,200 workers for a 6-month peak. However, the number of workers on-site would typically be higher during the 23 months of terminal construction phase overlap. During this 23-month period, the total number of workers at the terminal site could range from 1,500 to 3,600, and would average approximately 3,000 workers during the overlapping period. Half of the workforce is expected to be hired locally. If the remaining workforce is hired from locations farther away, we estimate those workers and their households would number a maximum of 4,100 individuals that could relocate to the affected area. This total is based on a 1-month hypothetical peak workforce, and only a portion of workers was assumed to bring householders.

Project construction would generate local jobs, local spending on supplies and services, and other local economic benefits that accrue indirectly. Venture Global estimates 10 percent of Project costs would be spent locally or regionally over the 4 years of construction, and the total estimated Project cost is \$8.5 billion. The Project's local expenditures and stimulus effects during construction would be at least a moderate benefit to local communities in Plaquemines, Jefferson, and Orleans Parishes, lasting through the 4 years of construction and for a year or two after construction ends. During operation, the economic and employment benefits would be permanent as Venture Global would hire 250 workers and spend approximately \$20 million annually on materials, land leases, and utilities (water, sewer, waste disposal) for the foreseeable future.

During construction, the Project's tax contributions to the local and state economies would be minor, short-term benefits, consisting of approximately \$7 million annually in local taxes and \$26 million annually in state taxes over the 4 years of construction. During operation, tax contributions in the form of sales, payroll, and property taxes would provide minor benefits at the state and local level, though the level of tax benefit in Plaquemines Parish could increase. The

LNG terminal may be granted a Louisiana Industrial Tax Exemption Program waiver on ad valorem taxes for up to 10 years, after which ad valorem taxes to Plaquemines Parish would be at least a moderate benefit to the local economy. The pipeline system would generate ad valorem taxes starting in year one of operation.

The LNG terminal would have a negligible impact on commercial and recreational fishing. The pipeline system, which crosses private oyster lease areas in Barataria Basin, would impact leaseholders of the traversed and adjacent oyster grounds. In addition, pipeline system construction vessel traffic could be noticeable to some recreational anglers, and the right-of-way would be off-limits to fishing during construction. The LDWF and LDNR require water bottom assessments of oyster lease areas within prescribed distances of installation activities. Venture Global would conduct the assessments, as mandated, and prepare financial impact evaluations on individual oyster leases and work with leaseholders and the state to determine compensation for leaseholders. To ensure successful and timely completion of these consultations, in section 4.9.3 we recommend that Gator Express Pipeline file the results of its consultations with any affected oyster leaseholders and the LDNR Oyster Lease Damage Evaluation Board, prior to construction. The vessel traffic impacts would be limited to the brief period of construction (12 months), and the right-of-way fishing restrictions during construction would affect a proportionately small area of Barataria Basin. Thus, we conclude that the pipeline system's effect on fishing would be temporary and minor.

Given the available housing and accommodations in the Greater New Orleans metropolitan area near the Project, the Project workforce's impact on housing in the affected area would be minor, though impacts on individual proprietors or tenants could be substantial. The terminal and pipe bridge could have a long-term, minor effect at the community level on property values, while the pipeline system's effect on property values would be negligible. Individual properties in the Deer Range neighborhood could experience property value change, but these changes would be similar to a change accompanying any "port terminal complex" and "major industries" that could be constructed according to the Parish's Master Plan.

Workers and their householders who relocate to the affected area during construction and operation would have minor impacts on schools, hospitals, and public safety departments. Venture Global would provide firefighting equipment on-site in case of an accident and would train firefighters at the nearby Myrtle Grove and/or Lake Hermitage Volunteer Fire Stations to serve as backup responders. Venture Global would also employ 24-hour security services. Thus, the Project's impact on public safety services is expected to be minor, barring a catastrophic incident.

The Project's effect on roadway transportation would be mitigated to less than significant during construction. Venture Global intends to implement several mitigation measures that would reduce heavy traffic congestion and traffic queues on SH 23 north and south of the LNG terminal during the workforce's commute hours. Example measures include constructing auxiliary turning lanes along SH 23 and limiting the number of parking permits in designated parking areas to maintain carpooling of at least two people per vehicle. During construction of the pipeline system, signs and flagmen would be appropriately positioned to alert drivers of any construction activities that would affect local roads. After construction is complete, Venture Global would restore or reconstruct any damaged roadways. During operation, roadway impacts would be negligible. In

addition, as required by the DOT regulations for LNG operators, Venture Global would develop emergency response plans in coordination with appropriate local officials.

Supply delivery barges associated with LNG terminal construction would have a negligible impact on vessel traffic in the Mississippi River and connected bayous. Pipe delivery barges, on-site construction support barges, and crew boats could have a minor effect on vessel traffic in Barataria Basin during the brief periods of pipeline construction. During operation, LNG carrier calls on the terminal could reach six to seven calls per week. Given the width of the Mississippi River and the consistency of the LNG carrier traffic with other large vessel traffic, the Project's LNG carrier calls during operation would be a minor impact.

During normal operations, the Project would not have high and adverse human health or environmental effects and would not disproportionately impact potential environmental justice populations in proximity. If a rare, catastrophic event at the LNG terminal temporarily closed SH 23, communities in the southern west would be affected, some of which have high minority or low-income population percentages. Venture Global held open houses in Plaquemines and Jefferson Parishes to circulate information about the proposed Project and has been working with local, state, and federal agencies to develop its emergency response plan. Venture Global anticipates the levee system would be available to residents in the southern west bank if SH 23 ever became temporarily closed.

5.1.10 Cultural Resources

As construction of the Project could directly affect cultural resources through ground disturbance associated with the construction, operation, and maintenance of the facility and pipelines, as well as indirectly by the presence of the personnel and associated activities (visual, auditory, or other secondary impacts), cultural resources surveys have been conducted, and consultation with the SHPO and tribes has occurred. The surveys and consultations were conducted to meet FERC's obligations for Section 106 of the NHPA.

The conclusions and recommendations resulting from SHPO review have been incorporated into this EIS. Consultation with the SHPO for the LNG terminal and pipeline system is complete.

5.1.11 Air Quality and Noise

5.1.11.1 Air Quality

Construction activities at the LNG terminal and pipeline system would generate criteria air pollutants, hazardous air pollutants, and greenhouse gas emissions during Phase I and Phase II of construction. Active construction would occur over a 70-month period. Construction activity would produce emissions from use of off-road equipment and vehicles; on-road vehicles, including delivery trucks and worker commuting; marine vessels delivering construction materials; supplies and equipment; and fugitive dust produced from vehicles and equipment operating at the site and from the handling of soils, fill material, soil stabilization components and concrete production. The duration of construction (4-plus years) and the quantity of pollutants emitted during each year of construction may have an impact on air quality.

As construction proceeds and components of the LNG terminal become ready for operation, Venture Global plans to enter into an Interim Operating mode. This mode would continue from year 2 of construction until the completion of Phase II construction. In this mode, the power-generating facility would operate in simple-cycle mode, with LNG liquefaction beginning as the LNG trains become operational. At the same time, construction on the remainder of the LNG terminal and pipeline would continue. During the Interim Operating mode, total emissions (construction plus interim operation) would be higher than during construction or operation alone. We have summarized emissions in the air quality discussion for the overlapping Interim Operating mode and continued construction.

At the completion of the Interim Operating mode, construction activities would cease and the facility would enter the final operating mode. Emissions would be produced from equipment at the power-generating facility and at the LNG terminal, and from marine vessels associated with transport of LNG from the LNG terminal. Emission controls at the LNG terminal would be fully operational during the final operating mode. Pipeline operation would generate only a minor amount of fugitive emissions; there is no compression associated with pipeline operation that would generate combustion emissions. An operational emission inventory was developed to provide an estimate of annual emissions during full LNG terminal operation.

The operational emission inventory for the final operating mode included the effects of certain mitigation measures used to reduce emissions. Mitigation is based on the applicant-prepared BACT analysis that was prepared as part of its air permit application to the LDEQ. Emissions of NO_x from the combined-cycle gas turbines, supplemental duct burners, and aeroderivative turbines at the power-generating facility would be reduced by using low NO_x combustion and SCR. Other mitigation measures proposed by Venture Global include (i) the use of catalytic oxidation on the exhaust of the combined gas turbine/duct burners to reduce CO and VOCs, (ii) use of natural gas as fuel, (iii) use of ultra-low sulfur diesel fuel in backup diesel engine electric generators and firewater pump engines, (iv) good combustion practices, (v) proper equipment design, and (vi) adherence to manufacturers' operating and maintenance procedures.

Modeling analyses were performed for emissions from two operating scenarios of the Project. Modeling analyses conducted for the Project and reviewed include the following:

- criteria pollutant dispersion modeling for emissions from the LNG terminal alone and in combination with marine vessels;
- cumulative dispersion modeling analysis for the LNG terminal (without marine vessels) as part of the air permit application to the LDEQ;
- a dispersion modeling analysis for Louisiana Toxic Air Pollutants, specifically ammonia (The use of SCR to control NO_x emissions results in the emission of ammonia, a Louisiana toxic air pollutant.);
- a Class I modeling analysis (without marine vessels) to evaluate Project stationary source effects at the Breton NWR Class I area; and

- an ambient ozone analysis using regional-scale photochemical grid modeling (without marine vessels).

The modeling studies were conducted according to modeling protocols reviewed by the LDEQ and other agencies. The modeling protocols were based on EPA and Louisiana modeling guidelines and requirements. The modeling demonstrated that the Project would comply with NAAQS, PSD increments, Louisiana toxic air pollutant limits for ammonia, and applicable Class I Area thresholds for the Project's stationary sources. The additional modeling conducted for the LNG terminal in combination with marine vessels also demonstrated compliance with the NAAQS.

Based on the analyses conducted for the final operating mode of the Project and mitigation measures proposed in the BACT analysis, operation of the Project would result in quantifiable impacts but would be in compliance with applicable standards.

During the construction period, residents in the vicinity of the Project would experience local impacts to air quality. Concurrent emissions from staged construction, commissioning and start-up, and operation of the LNG terminal would temporarily impact local air quality, and could result in exceedances of the NAAQS in the immediate vicinity of the LNG terminal during these construction years. These exceedances would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities within a day, week, or month. During operation, extensive modeling has indicated that the Project would not have significant impacts on the local and regional air quality and Class I areas.

5.1.11.2 Noise

Construction activities at the LNG terminal would generate temporary increases in sound levels over the duration of both phases of construction. Construction activities would occur predominantly during the day, Monday through Saturday. Certain activities that produce higher levels of noise would have more condensed working timeframes. In particular, dredging would occur for only 1 month and be limited to daytime hours, and land-based pile driving would occur no later than 5 p.m. HDD may occur 24 hours per day but would be shrouded by sound curtains or an acoustic barrier to mitigate stray noise.

The most prevalent sound-generating equipment and activity during construction of the LNG terminal is anticipated to be pile driving. Venture Global anticipates that impact-type pile drivers would be used during construction of the terminal facilities and auger type pile installation would be used to construct pipe bridges over levees. Onshore piles would be driven by up to 12 hydraulic piling rigs at a time. The use of one auger rig is anticipated during pipe bridge construction. Based on the construction schedule provided by Venture Global, land-based pile driving to create the foundations for the LNG storage tanks and other process equipment foundations and structures would occur over a period of 12 months, and pile driving associated with construction of the LNG loading and ship berthing area would occur over a period of 6 months.

Land-based pile driving is scheduled to occur in 10-hour shifts, 6 days per week, over a total of about 12 months. During land-based pile-driving operations, the estimated sound level at

the nearest NSA when the maximum number of land-based pile-driving platforms are in use would be 65.4 dBA L_{max} . These levels would correspond to a moderate sound level and would be clearly audible. Based on the estimates provided by Venture Global, and because of the 12-month duration of the pile-driving activities, these sound levels may have a moderate adverse impact at the nearest NSAs. Venture Global proposes to implement mitigation measures to reduce land-based and marine-side pile-driving noise impacts on NSAs. Venture Global would construct 5-meter-high noise protection walls around piling rigs for noise reduction mitigation. As modeled, these noise barriers would reduce the increase in ambient noise levels at the two nearest NSAs from 11.8 dBA and 16.0 dBA (without mitigation) to 0.4 dBA and 2.2 dBA, respectively.

The most prevalent sound-generating equipment and activity during construction of the pipeline system is anticipated to be the HDD near Lake Hermitage Road. Venture Global estimates that an increase of 13.3 dBA L_{max} would be experienced at NSA 2; no other NSAs are expected to be affected. To minimize impacts on NSAs from HDD operations, Venture Global assures to implement a sound curtain enclosure to mitigate impacts. Sound curtain enclosures would be used around the drilling rig and other stationary equipment during the HDD process. Sound curtain enclosures have been shown to provide 10 to 14 dBA of mitigation. Sound enclosures or acoustic barriers could also be used during dredging activities if nearby structures are occupied during dredging of barge access channels.

Dredging activities associated with barge access channels would increase noise levels above 10 dBA L_{max} at a structure approximately 265 feet away from a dredging area. Venture Global has committed to take measures to reduce noise levels to no greater than 10 dBA over L_{eq} ambient levels at this structure and other structures nearby.

LNG terminal operation is not expected to produce noise levels greater than 10 dBA over L_{eq} ambient levels at any NSA. Periodic operational blowdown events would be the greatest cause of stray noise emanating from the LNG terminal. The sound level produced by this vent will be approximately 50 dBA at NSA 2. Venture Global also plans to implement various mitigation measures to further reduce general operation noise not associated with blowdown events. With the implementation of the noise reducing mitigation efforts presented in section 4.11.2.4, we have determined that the terminal would be in compliance with our new facility noise level threshold of L_{dn} 55.0 dBA at all defined NSAs.

The only noise-producing facilities that would be associated with the pipeline system are the new metering stations. These facilities are not anticipated to affect ambient noise levels in the immediate vicinity or at an NSA.

Based on the analyses conducted, mitigation measures and noise barriers proposed, and with our additional recommendations, we conclude that construction of the Project would result in temporary and minor noise impacts on residents and the surrounding communities and that operation of the Project would result in permanent and minor impacts on the surrounding residents.

5.1.12 Reliability and Safety

As part of the NEPA review, Commission staff assesses the potential impact to the human environment in terms of safety and assess whether the proposed facilities would be able to operate safely, reliably, and securely.

As a cooperating agency, DOT assists FERC staff in evaluating whether Venture Global's proposed design would meet DOT's 49 CFR 193, Subpart B siting requirements. On April 3, 2019, the DOT issued an LOD to FERC regarding the proposed Project's compliance with the 49 CFR 193, Subpart B regulatory requirements. The LOD provides PHMSA's analysis and conclusions regarding 49 CFR 193, Subpart B regulatory requirements, including the resolution of legal control of exclusion zones, for the Commission's consideration in its decision on the Project application. If the Project is authorized, constructed, and operated, the facility would be subject to the DOT's inspection and enforcement program and final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the DOT staff.

As a cooperating agency, the Coast Guard also assisted the FERC staff by reviewing the proposed LNG terminal and the associated LNG carrier traffic. The USCG reviewed a WSA submitted by Plaquemines LNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On January 23, 2017, the Coast Guard issued a LOR to FERC staff indicating the Lower Mississippi River would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this Project, based on the WSA and in accordance with the guidance in the USCG's NVIC 01-11. If the Project is authorized and constructed, the facility would be subject to the Coast Guard's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

We conducted a preliminary engineering and technical review of the Venture Global design, including potential external impacts based on the site location. Based on this review, we recommend the Commission Order include a number of mitigation measures prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the facility to enhance the reliability and safety of the facility. With the incorporation of these mitigation measures, we believe that the Venture Global Project design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

5.1.13 Cumulative Impacts

During the cumulative impact analysis, we identified 16 actions, including the Project, that warranted careful consideration based on geographic and temporal criteria we established for each environmental resource. Consistent with CEQ (2005) guidelines, the effects of past actions were aggregated into our assessments of affected environments in section 4.0. Thus, we focused the cumulative analysis on effects of the Project in combination with current and future actions. Seven major industrial developments, including the Project, planned on the banks of the Mississippi River in Plaquemines Parish presented the highest potential for creating cumulative adverse effects along with the LNG terminal and pipeline system. These industrial developments, all within 21 miles of each other, include two methanol manufacturing facilities; three LNG manufacturing facilities and

export terminals, including the Project; an oil blending, storage, and distribution facility; and a container shipping terminal. The remaining actions consist of two minor non-jurisdictional utility lines associated with the LNG terminal, two drainage and shoreline protection projects, four wetland mitigation and restoration projects, a dredging project to deepen part of the Mississippi River ship channel, and a very recently completed transportation improvement on a portion of SH 23.

Because the Project would not affect or have negligible impacts on groundwater, recreation and cultural resources, it would not contribute to adverse cumulative effects on those resources. Geology and soil resources affected by the Project would not experience cumulative effects because no other identified actions are within the cumulative geographic scope for those resources.

Based on our evaluations, surface waters and aquatic wildlife and habitat; wetlands; upland vegetation and wildlife; housing and public services (socioeconomic resources); vessel traffic; noise; and safety and reliability would experience negligible or minor adverse cumulative impacts. The cumulative land use effects would be noticeable, but the majority of the affected acreage would be consistent with the parish's Comprehensive Master Plan. The cumulative visual effects from development along the designated scenic byway SH 23 would be moderate given the magnitude of change and intermittent exposure level of residents. If all proposed actions were developed, the associated increase in piloted vessel traffic would be noticeable, but the presence of USCG Vessel Traffic Services–Lower Mississippi River and the capacity of the Mississippi River to accommodate vessel traffic would mitigate the additional transits' effect on traffic flow. The cumulative noise effects near certain residences in the Deer Range neighborhood could be adverse for a few days or weeks if Venture Global's pile-driving and/or HDD construction activities overlap with USACE upgrades of the adjacent levee. However, Venture Global has stated that it would coordinate with the USACE to ensure overlapping activities would not occur.

We identified only air quality as having the potential to sustain significant adverse cumulative impacts. More information could illuminate whether cumulative effects on this resource would likely be significant or less than significant.

GHGs were identified by the EPA as pollutants in the context of climate change. GHG emissions do not directly cause local ambient air quality impacts. GHG emissions result in fundamentally global impacts that feed back to localized climate change impacts. Thus, the geographic scope for cumulative analysis of GHG emissions is global rather than local or regional. For example, a project 1 mile away emitting 1 ton of GHGs would contribute to climate change in a similar manner as a project 2,000 miles distant also emitting 1 ton of GHGs. Currently, there is no universally accepted methodology to attribute discrete, quantifiable, physical effects on the environment to the Project's incremental contribution to GHGs. Absent such a method for relating GHG emissions to specific resource impacts, we are not able to assess potential GHG-related cumulative impacts attributable to this project. Additionally, we have not been able to find any GHG emission reduction goals established either at the federal level¹ or by the State of Louisiana.²

1 The national emissions reduction targets expressed in the EPA's Clean Power Plan and the Paris climate accord are pending repeal and withdrawal, respectively.

2 We reviewed the U.S. State Greenhouse Emission Targets site for individual state requirements located at: <https://www.c2es.org/document/greenhouse-gas-emissions-targets/>

Without either the ability to determine discrete resource impacts or an established target to compare GHG emissions against, we are unable to determine the significance of the Project's contribution to climate change.

Air Quality: The Clean Air Act and implementing regulations establish limits on pollutant emissions from major industrial developments, among others. Venture Global has prepared a modeling study of the LNG terminal's future effects on air quality that includes baseline emissions from existing and permitted activities within the vicinity. Venture Global included the future effects of the permitted Braithwaite Methanol Manufacturing Plant and NOLA Oil Terminal and demonstrated that their combined emissions would not exceed the NAAQS. Gulf Coast Methanol Park was recently issued an air permit in January 2018, and Venture Global updated its cumulative modeling to include Gulf Coast Methanol Park. Although cumulative modeling showed the potential for NAAQS exceedances, the modeling indicates that the Project would not contribute above significant levels and therefore would not contribute to a significant adverse combined effect of the Project with other existing and foreseeable actions.

The recently announced Pointe LNG project would trigger major source regulations and so would be required to conduct a cumulative air modeling study that captures estimated emissions from existing and permitted projects and projects in the advanced stages of permitting, including the LNG terminal. Pointe LNG must demonstrate that the combined emissions fall below NAAQS thresholds to obtain an air permit, ensuring the cumulative air quality effect from the LNG terminal, Pointe LNG, and the other actions would not exceed health and safety standards for regulated pollutants.

Emissions from vessels, vehicles, and other mobile sources associated with operation of the foreseeable industrial facilities along the Mississippi River could contribute to an adverse effect on air quality. Vessel emissions are not addressed in LDEQ regulations and air permit application requirements, but the International Maritime Organization, of which the U.S. is a member, promulgates emissions standards limiting SO_x and NO_x. Also, the EPA adopted emission standards on engines installed on U.S. vessels. Thus, the resulting cumulative effect of vessel emissions on air quality in the geographic scope of the Project is not likely to be significant.

5.1.14 Alternatives

As alternatives to the proposed action, we evaluated the No-Action Alternative, system alternatives for the proposed LNG terminal and pipeline system, alternative LNG terminal configurations, alternative sites for the proposed LNG terminal, alternative routes for the pipelines, and alternative locations for the aboveground facilities associated with the pipeline system. While the No-Action Alternative would eliminate the short and long-term environmental impacts identified in the EIS, the stated objectives of the proposed action would not be met.

We evaluated system alternatives for the LNG terminal, including operating LNG import/export terminals with approved, proposed, or planned expansions to provide liquefaction and export capabilities, and stand-alone (greenfield) liquefaction terminals with approved, proposed, or planned liquefaction projects along the Gulf Coast in the southern United States. All of these were eliminated from further consideration as viable alternatives for reasons that include incompatible timeframes with in-service dates, capacity demands that would not meet Venture

Global's customer commitments, and environmental impacts that were considered comparable to or greater than those of the proposed LNG terminal.

We evaluated three system alternatives to the proposed pipeline system and two major route alternatives along the preferred route. To serve as a viable system alternative to the preferred pipeline system, the pipeline would have to transport all or a part of the volume of natural gas required for liquefaction at the proposed terminal and cause less impact on the environment than the preferred pipeline system route. All three systems accomplished the goal of supply. However, two were eliminated because they did not provide an environmental advantage over the preferred route. The two route alternatives were evaluated but also eliminated because they did not provide an environmental advantage over the preferred alignment of the Southwest laterals.

We evaluated five sites for the LNG terminal, including the proposed site and four alternatives. In order to meet the stated objectives of the Project, we applied screening criteria to identify sites that would be reasonable and most likely to provide some environmental advantage over the proposed LNG terminal site. The screening criteria included deep berth waterfront access, property size, land use compatibility with an LNG terminal, site availability, proximity to natural gas pipelines and transmission lines, distance from population centers and residences, distance to the interstate highway system, local and state government support, and presence of wetlands within the site. The alternatives analysis concluded that the proposed site represents an acceptable site for the proposed LNG terminal because it is currently zoned for heavy industrial use, is sufficiently sized to allow optimal facility layout design, and would not require dredging to create berths. The proposed site also contains the lowest acreage of wetlands of the alternatives considered. Therefore, the loss of habitat diversity and function resulting from facility development would be generally less than that anticipated at the other sites. Additionally, from a visual impact perspective, the new LNG terminal would be consistent with the existing industrial development along the Lower Mississippi River at this location.

The proposed aboveground facilities would occur within or adjacent to the Southwest lateral pipeline route right-of-way, which would minimize the footprint and associated environmental impacts. The new aboveground facilities are not located near residences, and their footprint would overlap with pipeline workspaces that would be disturbed by construction. We did not identify any environmental concerns that require the need to identify and evaluate alternative aboveground facility sites.

We evaluated the arrangement of plant infrastructure to ensure compliance with federal siting and safety requirements. Aligning the major infrastructure components in sequence according to process flow minimizes the amount of cryogenic piping required and optimizes the site layout for process efficiency. The proposed site layout provides the adequate minimum practical distance between the LNG loading docks and the LNG storage tanks, and the administrative offices, maintenance facilities, and the central control room are well separated from the main plant. The proposed location of each of the components of the LNG terminal is in accordance with the applicable federal safety requirements. We did not identify any alternative configurations that would meet the regulations, codes, and guidelines while avoiding or reducing impacts when compared to those of the proposed LNG terminal configuration.

Therefore, we conclude that the proposed action, as modified by our recommended mitigation measures, is the preferred alternative to meet the Project objectives.

5.2 FERC STAFF'S RECOMMENDED MITIGATION

If the Commission authorizes the Project, we are recommending that the following measures be included as specific conditions in the Commission's Order. We believe that these measures would further mitigate the environmental impacts associated with the construction and operation of the Project. Unless otherwise noted within the condition, a recommendation made for Venture Global applies to both the LNG terminal and pipeline system.

1. Venture Global shall follow the construction procedures and mitigation measures described in its applications and supplements (including responses to staff data requests) and as identified in the EIS, unless modified by the Order. Venture Global must:
 - a. request any modification to these procedures, measures, or conditions in a filing with the Secretary;
 - b. justify each modification relative to site-specific conditions;
 - c. explain how that modification provides an equal or greater level of environmental protection than the original measure; and
 - d. receive approval in writing from the Director of OEP **before using that modification.**
2. For the LNG terminal, the Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of life, health, property, and the environment during construction and operation of the Project. This authority shall allow:
 - a. the modification of conditions of the Order;
 - b. stop-work authority and authority to cease operation; and
 - c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from Project construction and operation.
3. For the pipeline facilities, the Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of environmental resources during construction and operation of the Project. This authority shall allow:

- a. the modification of conditions of the Order;
 - b. stop-work authority; and
 - c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from Project construction and operation.
4. **Prior to any construction**, Venture Global shall file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, EIs, and contractor personnel will be informed of the EI's authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs **before** becoming involved with construction and restoration activities.
5. The authorized facility locations shall be as shown in the EIS, as supplemented by filed alignment sheets. **As soon as they are available, and before the start of construction**, Venture Global shall file with the Secretary any revised detailed survey alignment maps/sheets at a scale not smaller than 1:6,000 with station positions for all facilities approved by the Order. All requests for modifications of environmental conditions of the Order or site-specific clearances must be written and must reference locations designated on these alignment maps/sheets.

For the pipeline, Gator Express Pipeline's exercise of eminent domain authority granted under NGA section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. Gator Express Pipeline's right of eminent domain granted under NGA section 7(h) does not authorize it to increase the size of its natural gas pipeline to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.

6. Venture Global shall file with the Secretary detailed alignment maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all route realignments or facility relocations, and staging areas, pipe storage yards, new access roads, and other areas that would be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP **before construction in or near that area**.

This requirement does not apply to extra workspace allowed by the Commission's Plan and/or minor field realignments per landowner needs and requirements which do not affect other landowners or sensitive environmental areas such as wetlands.

Examples of alterations requiring approval include all route realignments and facility location changes resulting from:

- a. implementation of cultural resources mitigation measures;
 - b. implementation of endangered, threatened, or special concern species mitigation measures;
 - c. recommendations by state regulatory authorities; and
 - d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.
7. **Within 60 days of the Order and before construction begins**, Venture Global shall file an Implementation Plan with the Secretary for review and written approval by the Director of OEP. Venture Global must file revisions to the plan as schedules change. The plan(s) shall identify:
- a. how Venture Global will implement the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests), identified in the EIS, and required by the Order;
 - b. how Venture Global will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to on-site construction and inspection personnel;
 - c. the number of EIs assigned per spread, and how Venture Global will ensure that sufficient personnel are available to implement the environmental mitigation;
 - d. company personnel, including EIs and contractors, who will receive copies of the appropriate material;
 - e. the location and dates of the environmental compliance training and instructions Venture Global will give to all personnel involved with construction and restoration initial and refresher training as the Project progresses and personnel change, with the opportunity for OEP staff to participate in the training session(s);
 - f. the company personnel and specific portion of Venture Global's organization having responsibility for compliance;
 - g. the procedures (including use of contract penalties) Venture Global will follow if noncompliance occurs; and

- h. for each discrete facility, a Gantt or PERT chart (or similar Project scheduling diagram), and dates for:
 - 1) the completion of all required surveys and reports;
 - 2) the environmental compliance training of on-site personnel;
 - 3) the start of construction; and
 - 4) the start and completion of restoration.
- 8. Venture Global shall employ at least one EI for the terminal and one EI per pipeline construction spread, or as may be required by the Director of OEP. The EIs shall be:
 - a. responsible for monitoring and ensuring compliance with all mitigation measures required by the Order and other grants, permits, certificates, or other authorizing documents;
 - b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 6 above) and any other authorizing document;
 - c. empowered to order correction of acts that violate the environmental conditions of the Order, and any other authorizing document;
 - d. a full-time position, separate from all other activity inspectors;
 - e. responsible for documenting compliance with the environmental conditions of the Order, as well as any environmental conditions/permit requirements imposed by other federal, state, or local agencies; and
 - f. responsible for maintaining status reports.
- 9. Beginning with the filing of its Implementation Plan, Venture Global shall file updated status reports with the Secretary, on a **monthly** basis for the terminal and on a **biweekly** basis for the pipeline system, until all construction and restoration activities are complete. On request, these status reports will also be provided to other federal and state agencies with permitting responsibilities. Status reports shall include:
 - a. an update on Venture Global's efforts to obtain the necessary federal authorizations;
 - b. the construction status of the LNG terminal and each pipeline spread, work planned for the following reporting period, and any schedule changes for stream crossings or work in other environmentally-sensitive areas;

- c. a listing of all problems encountered, contractor nonconformance/deficiency logs, and each instance of noncompliance observed by the EIs during the reporting period (both for the conditions imposed by the Commission and any environmental conditions/permit requirements imposed by other federal, state, or local agencies);
 - d. a description of the corrective actions implemented in response to all instances of noncompliance;
 - e. the effectiveness of all corrective actions implemented;
 - f. a description of any landowner/resident complaints which may relate to compliance with the requirements of the Order, and the measures taken to satisfy their concerns; and
 - g. copies of any correspondence received by Venture Global from other federal, state, or local permitting agencies concerning instances of noncompliance, and Venture Global's response.
10. Venture Global must receive written authorization from the Director of OEP **before commencing construction of any Project facilities**. To obtain such authorization, Venture Global must file with the Secretary documentation that it has received all applicable authorizations required under federal law (or evidence of waiver thereof).
 11. Plaquemines LNG must receive written authorization from the Director of OEP **prior to introducing hazardous fluids into the terminal facilities**. Instrumentation and controls, hazard detection, hazard control, and security components/systems necessary for the safe introduction of such fluids shall be installed and functional.
 12. Plaquemines LNG must receive written authorization from the Director of OEP **before placing each phase of the LNG terminal into service**. Such authorization will only be granted following a determination that the facilities have been constructed in accordance with FERC approval, can be expected to operate safely as designed, and the rehabilitation and restoration of the right-of-way and other areas affected by the Project are proceeding satisfactorily.
 13. Gator Express Pipeline must receive written authorization from the Director of OEP, **before placing each phase of the pipeline system into service** (i.e., the Southwest Lateral TGP in Phase 1 and the Southwest Lateral TETCO in Phase II). Such authorization will only be granted following a determination that rehabilitation and restoration of the right-of-way and other areas affected by the Project are proceeding satisfactorily.
 14. **Within 30 days of placing each of the authorized facilities in service**, Venture Global shall file an affirmative statement with the Secretary, certified by a senior company official:

- a. that the facilities have been constructed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or
 - b. that identifies which of the conditions in the Order Venture Global has complied with or will comply with. This statement shall also identify any areas affected by the Project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.
- 15. Gator Express Pipeline shall provide **72 hours' notice** to the owner(s) of producing oil and gas wells located within 0.25 mile from the pipeline workspace in order to allow the owner's representative to be on-site during construction activities. (See section 4.1.2)
- 16. Venture Global shall **not begin construction of the Project until:**
 - a. FERC staff receives comments from the FWS and NMFS regarding the proposed action;
 - b. FERC staff completes formal consultation or conference with the FWS and NMFS, if required; and
 - c. Venture Global has received written notification from the Director of OEP that construction or use of mitigation may begin. (See section 4.7.1.4)
- 17. Venture Global shall **not begin** construction of the Project **until** it files with the Secretary a copy of the determination of consistency with the Coastal Zone Management Plan issued by the LDNR. (See section 4.8.7)
- 18. **Prior to construction of the pipelines**, Gator Express Pipeline shall file with the Secretary documentation that consultation with the LDNR Oyster Lease Damage Evaluation Board and/or the affected lease holder(s) has been completed. (See section 4.9.3.1)
- 19. **Prior to beginning the HDD at Lake Hermitage**, Gator Express Pipeline shall file with the Secretary, for the review and written approval by the Director of OEP, an HDD noise mitigation plan for the crossing to reduce the projected noise level attributable to the proposed drilling operations at the nearby NSA. During drilling operations, Gator Express Pipeline shall implement the approved plan, monitor noise levels, and make all reasonable efforts to restrict the noise attributable to the drilling operations to no more than an L_{dn} of 55 dBA at the NSA. (See section 4.11.2.3)
- 20. **No later than 60 days after placing Phase I into service**, Plaquemines LNG shall file a full power load noise survey with the Secretary for the LNG terminal. If the noise attributable to operation of the equipment at the LNG terminal exceeds an L_{dn} of 55 dBA at the nearest NSA, **within 60 days** Plaquemines LNG shall modify operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the NSA is achieved. Plaquemines LNG shall

confirm compliance with the above requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. (See section 4.11.2.4)

21. **No later than 60 days after placing the entire LNG terminal into service**, Plaquemines LNG shall file a noise survey with the Secretary. If a full load condition noise survey is not possible, Plaquemines LNG shall provide an interim survey at the maximum possible horsepower load **within 60 days** of placing the LNG terminal into service and provide the full load survey **within 6 months**. If the noise attributable to operation of the equipment at the LNG terminal exceeds an L_{dn} of 55 dBA at the nearest NSA under interim or full horsepower load conditions, Plaquemines LNG shall file a report on what changes are needed and shall install the additional noise controls to meet the level **within 1 year** of the in-service date. Plaquemines LNG shall confirm compliance with the above requirement by filing an additional noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. (See section 4.11.2.4)
22. **Prior to initial site preparation**, Plaquemines LNG shall file with the Secretary a study that determines the presence or absence of growth faults extending across the site using geophysically logged borings that is stamped and sealed by the professional engineer-of-record, registered in Louisiana. If growth faults are determined to be present, Plaquemines LNG shall file a plan to avoid or mitigate growth fault impacts with the Secretary that is stamped and sealed by the professional engineer-of record, registered in Louisiana.
23. **Prior to construction of final design**, Plaquemines LNG shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:
 - a. site preparation drawings and specifications;
 - b. LNG terminal structures and foundation design drawings and calculations (including prefabricated and field constructed structures);
 - c. seismic specifications for procured equipment; and
 - d. quality control procedures to be used for civil/structural design and construction.

In addition, Plaquemines LNG shall file, in its Implementation Plan, the schedule for producing this information.

24. **Prior to commencement of service**, Plaquemines LNG shall file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Louisiana, for the perimeter levee which ensures the crest elevation relative to mean sea level will be maintained for the life of the facility considering berm settlement, subsidence, and sea level rise.

Conditions 25 through 121 shall apply to the Plaquemines LNG terminal. Information pertaining to these specific conditions shall be filed with the Secretary for review and written approval by the Director of OEP, or the Director's designee, within the timeframe indicated by each condition. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, shall be filed as critical energy infrastructure information pursuant to 18 CFR §388.113. See Critical Electric Infrastructure Security and Amending Critical Energy Infrastructure Information, Order No. 833, 81 Fed. Reg. 93,732 (December 21, 2016), FERC Stats. & Regs. 31,389 (2016). Information pertaining to items such as offsite emergency response, procedures for public notification and evacuation, and construction and operating reporting requirements would be subject to public disclosure. All information shall be filed **a minimum of 30 days** before approval to proceed is requested.

25. **Prior to initial site preparation**, Plaquemines LNG shall file an overall project schedule, which includes the proposed stages of the commissioning plan.
26. **Prior to initial site preparation**, Plaquemines LNG shall file quality assurance and quality control procedures for construction activities.
27. **Prior to initial site preparation**, Plaquemines LNG shall file procedures for controlling access during construction.
28. **Prior to initial site preparation**, Plaquemines LNG shall file its design wind speed criteria for all other facilities not covered by DOT PHMSA's LOD to be designed to withstand wind speeds commensurate with the risk and reliability associated with the facilities in accordance with ASCE 7-16 or equivalent.
29. **Prior to initial site preparation**, Plaquemines LNG shall develop an ERP (including evacuation) and coordinate procedures with the Coast Guard; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies. This plan shall 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 and public use areas that are within any transient hazard areas along the route of the LNG marine transit;
 - e. locations of permanent sirens and other warning devices; and
 - f. an "emergency coordinator" on each LNG marine vessel to activate sirens and other warning devices.

Plaquemines LNG shall notify the FERC staff of all planning meetings in advance and shall report progress on the development of its ERP at 3-month intervals.

30. **Prior to initial site preparation**, Plaquemines LNG shall file 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. This comprehensive plan shall include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. Plaquemines LNG shall notify FERC staff of all planning meetings in advance and shall report progress on the development of its Cost-Sharing Plan at 3-month intervals.
31. **Prior to construction of final design**, Plaquemines LNG shall include spill containment (e.g., a trough collection system) for the entire length of the pipe-in-pipe system between the LNG storage tanks and the marine berth area sized for a full guillotine rupture of the pipe-in-pipe line based on a 10-minute duration.
32. **Prior to construction of final design**, Plaquemines LNG shall file details of the pipe-in-pipe system design, including wall thicknesses, spacers, expansion bellows or loops, and transitions.
33. **Prior to construction of final design**, Plaquemines LNG shall file change logs that list and explain any changes made from the front end engineering design provided in Plaquemines LNG's application and filings. A list of all changes with an explanation for the design alteration shall be provided and all changes shall be clearly indicated on all diagrams and drawings.
34. **Prior to construction of final design**, Plaquemines LNG shall file information/revisions pertaining to the response numbers 14 of its October 11, 2018 filing, response numbers 8, 15, 24, 25, 27, 39, 40, and 43 of its October 16, 2018 filing, and response numbers 11, 31, and 38 of its October 30, 2018 filing, which indicated features to be included or considered in the final design.
35. **Prior to construction of final design**, Plaquemines LNG shall file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.
36. **Prior to construction of final design**, Plaquemines LNG shall file drawings of the storage tank piping support structure and support of horizontal piping at grade including pump columns, relief valves, pipe penetrations, instrumentation, and appurtenances.
37. **Prior to construction of final design**, Plaquemines LNG shall file an up-to-date equipment list, process and mechanical data sheets, and specifications. The specifications shall be in consistent units and include:

- a. Building Specifications (e.g., control buildings, electrical buildings, compressor buildings, storage buildings, pressurized buildings, ventilated buildings, blast resistant buildings);
 - b. Mechanical Specifications (e.g., piping, valve, insulation, rotating equipment, heat exchanger, storage tank, pressure vessel, other specialized equipment);
 - c. Electrical and Instrumentation Specifications (e.g., power system specifications, control system specifications, SIS specifications, cable specifications, other electrical and instrumentation specifications);
 - d. Security and Fire Safety Specifications (e.g., security, passive protection, hazard detection, hazard control, firewater).
38. **Prior to construction of final design**, Plaquemines LNG specify and design their control systems and human machine interfaces in accordance with the ISA Standards 5.3, 5.5, 60.1, 60.3, 60.4, and 60.6, or other equivalent standards and recommended practices for designing control buildings, displaying graphic symbols for human machine interfaces, and consideration of other human factors.
39. **Prior to construction of final design**, Plaquemines LNG shall file a list of all codes and standards and the final specification document number where they are referenced.
40. **Prior to construction of final design**, Plaquemines LNG shall file three-dimensional plant drawings, or other documentation, to confirm plant layout for maintenance, access, egress, and congestion.
41. **Prior to construction of final design**, Plaquemines LNG shall file up-to-date PFDs and P&IDs. The PFDs shall include heat and material balances. The P&IDs shall include the following information:
- a. equipment tag number, name, size, duty, capacity, and design conditions;
 - b. equipment insulation type and thickness;
 - c. storage tank pipe penetration size and nozzle schedule;
 - d. valve high pressure side and internal and external vent locations;
 - e. piping with line number, piping class specification, size, and insulation type and thickness;
 - f. piping specification breaks and insulation limits;
 - g. all control and manual valves numbered;
 - h. relief valves with size and set points; and
 - i. drawing revision number and date.

42. **Prior to construction of final design**, Plaquemines LNG shall include a means to remove mercury as part of the design to limit concentrations to less than 0.01 micrograms per normal cubic meter or alternatively provide monitoring for mercury by means of an analyzer or preventative maintenance inspections of the heat exchangers and connections for a mercury removal package.
43. **Prior to construction of final design**, Plaquemines LNG shall file layout and design specifications of the pig trap, inlet separation and liquid disposal, inlet/send-out meter station, filters, and pressure control.
44. **Prior to construction of final design**, Plaquemines LNG shall file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs.
45. **Prior to construction of final design**, Plaquemines LNG shall file documentation demonstrating that the recommendations from the Front End Engineering Design Hazard Identification are complete and consistent with the requirements of the final design as determined by the engineering, procurement, and construction contractor.
46. **Prior to construction of final design**, Plaquemines LNG shall file a hazard and operability review prior to issuing the P&IDs for construction. A copy of the review, a list of the recommendations, and actions taken on the recommendations shall be filed.
47. **Prior to construction of final design**, Plaquemines LNG shall file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (i.e., temperature, pressures, flows, and compositions).
48. **Prior to construction of final design**, Plaquemines LNG shall include LNG tank fill flow measurement with high flow alarm.
49. **Prior to construction of final design**, Plaquemines LNG shall include BOG flow, tank density profile and temperature profile measurement for each tank.
50. **Prior to construction of final design**, Plaquemines LNG shall file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system for review and approval. The cause-and-effect matrices shall include alarms and shutdown functions, details of the voting and shutdown logic, and set points.
51. **Prior to construction of final design**, Plaquemines LNG shall specify that all ESD valves are to be equipped with open and closed position switches connected to the DCS/SIS.
52. **Prior to construction of final design**, Plaquemines LNG shall specify the minimum distance required for valve maintenance, between the LNG loading header and the first valve in the discharge piping to the loading arm.

53. **Prior to construction of final design**, Plaquemines LNG shall specify that piping and equipment that may be cooled with liquid nitrogen is to be designed for liquid nitrogen temperatures, with regard to allowable movement and stresses.
54. **Prior to construction of final design**, Plaquemines LNG shall include any isolation valves necessary for startup, operation, shutdown, restart, and maintenance procedures.
55. **Prior to construction of final design**, Plaquemines LNG shall demonstrate that, for hazardous fluids, piping and piping nipples 2 inches or less in diameter are designed to withstand external loads, including vibrational loads in the vicinity of rotating equipment and operator live loads in areas accessible by operators.
56. **Prior to construction of final design**, Plaquemines LNG shall specify that all drains from high pressure hazardous fluid systems are to be equipped with double isolation and bleed valves or equivalent positive isolation.
57. **Prior to construction of final design**, Plaquemines LNG shall file the sizing basis and capacity for the final design of the flares and/or vent stacks as well as the pressure and vacuum relief valves for major process equipment, vessels, and storage tanks.
58. **Prior to construction of final design**, Plaquemines LNG shall file pressure relieving protection for flammable liquid piping segments (i.e., refrigerants, liquid hydrocarbons, condensate products) that can be isolated by valves.
59. **Prior to construction of final design**, Plaquemines LNG shall file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations shall be filed. The evaluation shall justify the type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, firewater, and emergency response equipment, training, and qualifications in accordance with NFPA 59A (2001). The justification for the flammable and combustible gas detection and flame and heat detection shall be in accordance with ISA 84.00.07 or equivalent methodologies that would demonstrate 90 percent or more of releases (unignited and ignited) that could result in an offsite or cascading impact would be detected by two or more detectors and result in isolation and deinventory within 10 minutes. The analysis shall take into account the set points, voting logic, wind speeds, and wind directions. The justification for firewater shall provide calculations for all firewater demands (including firewater coverage on the LNG storage tanks) based on design densities, surface area, and throw distance and specifications for the corresponding hydrant and monitors needed to reach and cool equipment.
60. **Prior to construction of final design**, Plaquemines LNG shall file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations considering any foundations and equipment within

impoundments, as well as the sizing and design of the down-comer that would transfer spills from the tank top to the ground-level impoundment system. The spill containment drawings shall show containment for all hazardous fluids, including all liquids handled above their flashpoint, from the largest flow from a single line for 10 minutes, including de-inventory, or the maximum liquid from the largest vessel (or total of impounded vessels) or otherwise demonstrate that providing spill containment would not significantly reduce the flammable vapor dispersion or radiant heat consequences of a spill. In addition, Plaquemines LNG shall demonstrate that the stainless steel piping spill trays at each LNG storage tank would withstand the force and shock of a sudden cryogenic release.

61. **Prior to construction of final design**, Plaquemines LNG shall consult with DOT PHMSA on compliance with 49 CFR 193 for the water removal design using drains.
62. **Prior to construction of final design**, Plaquemines LNG shall file electrical area classification drawings. The drawings shall be updated with the latest design, including liquefaction blocks and full containment tanks, and demonstrate compliance with NFPA 59A, NFPA 70, NFPA 497, API 500, or equivalent, including but not limited to, illustrating Class 1 Division 1 and Division 2, as applicable, at all impoundment trenches, the LNG ship transfer connection, refrigerant truck transfer connection, diesel truck transfer connection, diesel and other combustible tank vents, power plant area, gas turbines, feed gas aftercoolers, MR coolers, and pig launchers.
63. **Prior to construction of final design**, Plaquemines LNG shall file detailed calculations to confirm that the final fire water volumes would be accounted for when evaluating the capacity of the impoundment system during a spill and fire scenario.
64. **Prior to construction of final design**, Plaquemines LNG shall file an analysis demonstrating the flammable vapor dispersion from design spills would be prevented from dispersing underneath the elevated LNG storage tanks, or demonstrating the LNG storage tanks would be able to withstand the overpressure due to ignition of the flammable vapors that disperses underneath the elevated LNG storage tanks.
65. **Prior to construction of final design**, Plaquemines LNG shall file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001 edition). Plaquemines LNG shall also provide the results of consultation with DOT PHMSA indicating that the proposed electrical process seal design would be considered to meet the design requirements of NFPA 59A (2001), as incorporated by 49 CFR 193.2101.
66. **Prior to construction of final design**, Plaquemines LNG shall file details of an air gap or vent installed downstream of process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap shall vent to a safe location and be equipped with a leak detection device that shall continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems.

67. **Prior to construction of final design**, Plaquemines LNG shall file an analysis of the localized hazards to operators from a potential liquid nitrogen release and shall also provide spill containment and low oxygen detectors to mitigate liquid nitrogen releases.
68. **Prior to construction of final design**, Plaquemines LNG shall file a drawing showing the location of the emergency shutdown buttons. Emergency shutdown buttons shall be easily accessible, conspicuously labeled, and located in an area which would be accessible during an emergency.
69. **Prior to construction of the final design**, Plaquemines LNG shall install a plant-wide shutdown button or provide a human reliability analysis that demonstrates the multiple pushbutton approach does not significantly increase the risk compared to a plant-wide shutdown button.
70. **Prior to construction of final design**, Plaquemines LNG shall file complete drawings and a list of the hazard detection equipment. The drawings shall clearly show the location and elevation of all detection equipment, including near the diesel and hot oil tanks, steam turbine power plant, flare KO drums, ethylene packages, peaking generator, essential diesel generator, acid gas removal area, hot oil furnaces, thermal oxidizer, combustion air intakes and HVAC intakes of buildings. The list shall include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.
71. **Prior to construction of final design**, Plaquemines LNG shall account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for methane, propane, butane, ethylene, and condensate.
72. **Prior to construction of final design**, Plaquemines LNG shall account for the calibration gas of hazard detectors when determining the set points for toxic components such as aqueous ammonia, natural gas liquids and hydrogen sulfide. Include a list of alarm and shutdown set points for each hazard detector.
73. **Prior to construction of final design**, Plaquemines LNG shall file a technical review of facility design that:
 - a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and
 - b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.
74. **Prior to construction of final design**, Plaquemines LNG shall file an analysis of the off gassing of hydrogen in battery rooms and ventilation calculations that limit concentrations below the lower flammability limits (e.g., 25 percent LFL) and shall

also provide hydrogen detectors that alarm (e.g., 20 to 25 percent LFL) and initiate mitigative actions (e.g., 40 to 50 percent LFL).

75. **Prior to construction of final design**, Plaquemines LNG shall specify smoke detection in occupied buildings.
76. **Prior to construction of final design**, Plaquemines LNG shall specify hazard detection suitable to detect high temperatures and smoldering combustion products in electrical buildings and control room buildings.
77. **Prior to construction of final design**, Plaquemines LNG shall file an evaluation of the voting logic and voting degradation for hazard detectors.
78. **Prior to construction of final design**, Plaquemines LNG shall file facility plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Plan drawings shall clearly show the location and elevation by tag number of all fixed dry chemical systems in accordance with NFPA 17, and wheeled and hand-held extinguishers along normal paths of access and egress in accordance with NFPA 10 travel distances, including but not limited to, at the liquefaction blocks, near the metering station and pig launchers, on top of all tanks, and in all buildings. The list shall include the equipment tag number, manufacturer and model, agent type, agent capacity, discharge rate, automatic and manual remote signals initiating discharge of the units, and equipment covered.
79. **Prior to construction of final design**, Plaquemines LNG shall specify carbon dioxide systems installed in accordance with NFPA 12 or equivalent in gas turbine enclosures.
80. **Prior to construction of final design**, Plaquemines LNG shall specify clean agent systems installed in accordance with NFPA 2001 or equivalent in instrumentation buildings.
81. **Prior to construction of final design**, Plaquemines LNG shall file drawings and calculations for the structural passive protection systems to protect equipment and supports from cryogenic releases.
82. **Prior to construction of final design**, Plaquemines LNG shall file calculations or test results for the structural passive protection systems to demonstrate that equipment and supports are protected from cryogenic releases.
83. **Prior to construction of final design**, Plaquemines LNG shall file drawings and specifications for the structural passive protection systems to demonstrate the equipment and supports are protected from pool and jet fires.
84. **Prior to construction of final design**, Plaquemines LNG shall file a detailed quantitative analysis to demonstrate that adequate mitigation would be provided for each significant component within the 4,000 BTU/ft²-hr zone from pool and jet fires

that could cause failure of the component. Trucks at the truck loading/unloading areas shall be included in the analysis. A combination of passive and active protection for pool fires and passive and/or active protection for jet fires shall be provided and demonstrate the effectiveness and reliability. Effectiveness of passive mitigation shall be supported by calculations or test results for the thickness limiting temperature rise and active mitigation shall be justified with calculations or test results demonstrating flow rates and durations of any cooling water will mitigate the heat absorbed by the vessel.

85. **Prior to construction of final design**, Plaquemines LNG shall file a projectile analysis to demonstrate that the outer concrete impoundment wall of a full-containment LNG storage tank could withstand projectiles from explosions and high winds. The analysis shall detail the projectile speeds and characteristics and method used to determine penetration or perforation depths.
86. **Prior to construction of final design**, Plaquemines LNG shall file specifications and drawings demonstrating how cascading damage of transformers would be prevented (e.g., firewalls or spacing) in accordance with NFPA 850 or equivalent.
87. **Prior to construction of final design**, Plaquemines LNG shall file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings shall clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings shall also include piping and instrumentation diagrams of the firewater and foam systems. The firewater coverage drawings shall illustrate firewater coverage by two or more hydrants or monitors accounting for obstructions (or deluge systems) for all process areas that contain flammable or combustible fluids, including all three docks, diesel generators and storage, hot oil storage, gas dehydration units, and LNG storage tanks.
88. **Prior to construction of final design**, Plaquemines LNG shall specify remotely operated or automatic firewater monitors in areas inaccessible or difficult to access in the event of an emergency.
89. **Prior to construction of final design**, Plaquemines LNG shall specify firewater capacities for the monitors and hydrants.
90. **Prior to construction of final design**, Plaquemines LNG shall design the firewater pump shelter for maintenance access to the firewater pumps.
91. **Prior to construction of final design**, Plaquemines LNG shall specify that a firewater flow test meter is installed and equipped with a transmitter and that a pressure transmitter is installed upstream of the flow transmitter. The flow transmitter and pressure transmitter shall be connected to the DCS and recorded.
92. **Prior to construction of final design**, Plaquemines LNG shall specify the reducer on the suction side of the firewater pump to be eccentric or otherwise justify the use

of an alternative reducer that will not cause air pockets to form and cause possible damage to the firewater pump.

93. **Prior to construction of final design**, Plaquemines LNG shall file an analysis of the structural integrity of the outer containment of the full containment storage tanks when exposed to a roof tank top fire or adjacent tank top fire.
94. **Prior to construction of final design**, Plaquemines LNG shall file drawings and specifications for protecting transfer piping, pumps, and compressors, etc. to ensure that they are located away from roadway or protected from inadvertent damage from vehicles.
95. **Prior to construction of final design**, Plaquemines LNG shall file specifications, drawings, and details of vehicle barriers at each facility entrance for access control.
96. **Prior to construction of final design**, Plaquemines LNG shall file specifications, drawings, and details of the vehicle collision protection at the SH 23 road crossing of the LNG transfer line that demonstrate it can withstand impact from the most severe loading, including potential explosion loads from any trucks carrying hazardous materials.
97. **Prior to construction of final design**, Plaquemines LNG shall file security camera drawings showing the location, areas covered, and features of the camera (fixed, tilt/pan/zoom, motion detection alerts, low light, mounting height, etc.) to verify camera coverage of the entire perimeter with redundancies and cameras interior to the facility, including atop the LNG storage tanks, that would enable rapid monitoring of the LNG plant.
98. **Prior to construction of final design**, Plaquemines LNG shall file a photometric lighting simulation or other calculations that demonstrate lighting coverage adequately covers, in accordance with API 540, the interior and perimeter of the facility, including in liquefaction blocks, oily water treatment plant area, exterior of buildings, and along paths/roads of access and egress.
99. **Prior to construction of final design**, Plaquemines LNG shall file details of fencing with barbed or razor wire, or equivalent, at road crossing that would restrict and deter access.
100. **Prior to construction of final design**, Plaquemines LNG shall file drawings of the security fence. The fencing drawings shall provide details of fencing that demonstrates it would restrict and deter access around the entire facility and has a setback from exterior features (e.g., power lines, trees, etc.) and from interior features (e.g., piping, equipment, buildings, etc.) that does not allow the fence to be overcome. **Prior to the construction of the final design**, Plaquemines LNG shall provide an evaluation that demonstrates the storm surge barrier, including any gated areas and water discharge through the storm surge barrier, would prevent LNG from extending offsite in the event of a release of the full contents of a LNG storage tank. The

evaluation shall also demonstrate whether and how high the sheet piles would need to be protected from embrittlement.

101. **Prior to commissioning**, Plaquemines LNG shall file a detailed schedule for commissioning through equipment startup. The schedule shall include milestones for all procedures and tests to be completed: prior to introduction of hazardous fluids and during commissioning and startup. Plaquemines LNG shall file with the Secretary documentation certifying that each of these milestones has been completed before authorization to commence the next phase of commissioning and startup will be issued.
102. **Prior to commissioning**, Plaquemines LNG shall file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms.
103. **Prior to commissioning**, Plaquemines LNG shall provide procedures for removing the spent H₂S catalyst.
104. **Prior to commissioning**, Plaquemines LNG shall tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.
105. **Prior to commissioning**, Plaquemines LNG shall file and maintain a detailed training log to demonstrate that operating, maintenance and emergency response staff has completed the required training.
106. **Prior to commissioning**, Plaquemines LNG shall file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service.
107. **Prior to commissioning**, Plaquemines LNG shall file the procedures for pressure/leak tests which address the requirements of ASME VIII and ASME B31.3.
108. **Prior to commissioning**, Plaquemines LNG shall file a plan for clean-out, dry-out, purging, and tightness testing. This plan shall address the requirements of the American Gas Association's Purging Principles and Practice, and shall provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing.
109. **Prior to commissioning**, Plaquemines LNG shall equip the LNG storage tanks and adjacent piping and supports with permanent settlement monitors to allow personnel to observe and record the total and relative settlement between the LNG storage tank and adjacent piping. The settlement record shall be reported in the semi-annual operational reports.

110. **Prior to introduction of hazardous fluids**, Plaquemines LNG shall file settlement results from the hydrostatic tests of the LNG storage containers and shall file a plan to periodically verify settlement is as expected and does not exceed the applicable criteria set forth in API 620, API 625, API 653, and ACI 376.
111. **Prior to introduction of hazardous fluids**, Plaquemines LNG shall complete all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the DCS and SIS that demonstrates full functionality and operability of the system.
112. **Prior to introduction of hazardous fluids**, Plaquemines LNG shall develop and implement an alarm management program to ensure effectiveness of process alarms.
113. **Prior to introduction of hazardous fluids**, Plaquemines LNG shall complete a firewater pump acceptance test and firewater monitor and hydrant coverage test. The actual coverage area from each monitor and hydrant shall be shown on facility plot plan(s).
114. **Prior to introduction of hazardous fluids**, Plaquemines LNG shall complete and document foam system and sprinkler system acceptance tests.
115. **Prior to introduction of hazardous fluids**, Plaquemines LNG shall complete and document a clean agent acceptance tests.
116. **Prior to introduction of hazardous fluids**, Plaquemines LNG shall complete and document a pre-startup safety review to ensure that installed equipment meets the design and operating intent of the facility. The pre-startup safety review shall include any changes since the last hazard review, operating procedures, and operator training. A copy of the review with a list of recommendations, and actions taken on each recommendation, shall be filed.
117. Plaquemines LNG shall file a request for written authorization from the Director of OEP **prior to unloading or loading the first LNG commissioning cargo**. After production of first LNG, Plaquemines LNG shall file weekly reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports shall include a summary of activities, problems encountered, and remedial actions taken. The weekly reports shall also include the latest commissioning schedule, including projected and actual LNG production by each liquefaction train, LNG storage inventories in each storage tank, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports shall include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude shall be reported to the FERC **within 24 hours**.
118. **Prior to commencement of service**, Plaquemines LNG shall label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001 edition).

119. **Prior to commencement of service**, Plaquemines LNG shall file any preventative and predictive maintenance program that performs periodic or continuous equipment condition monitoring to ensure mechanical integrity of equipment.
120. **Prior to commencement of service**, Plaquemines LNG shall file procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by Plaquemines LNG staff.
121. **Prior to commencement of service**, Plaquemines LNG shall notify the FERC staff of any proposed revisions to the security plan and physical security of the plant. **Prior to commencement of service**, Plaquemines LNG shall file a request for written authorization from the Director of OEP. Such authorization would only be granted following a determination by the Coast Guard, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the Maritime Transportation Security Act of 2002, and the Security and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by Plaquemines LNG or other appropriate parties.

In addition, conditions 122 through 125 shall apply throughout the life of the Plaquemines LNG terminal.

122. The facility shall be subject to regular FERC staff technical reviews and site inspections on at least an **annual basis** or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Plaquemines LNG shall 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 P&IDs 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, shall be submitted.
123. **Semi-annual** operational reports shall be filed to identify changes in facility design and operating conditions; abnormal operating experiences; activities (e.g., LNG marine vessel arrivals, quantity and composition of imported and exported LNG, liquefied and vaporized quantities, boil off/flash gas); and plant modifications, including future plans and progress thereof. Abnormalities shall include, but not be limited to, unloading/loading/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, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil off rates. Adverse weather conditions and the effect on the facility also shall be reported. Reports shall be submitted **within 45 days after each period ending June 30 and December 31**. In addition to the above items, a section entitled "Significant Plant

Modifications Proposed for the Next 12 Months (dates)” shall be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities.

124. In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission shall be notified **within 24 hours** and procedures for corrective action shall be specified.
125. Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) shall be reported to the FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification shall be made **immediately**, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances, notification shall be made to the FERC staff **within 24 hours**. This notification practice shall be incorporated into the LNG facility’s emergency plan. Examples of reportable hazardous fluids-related incidents include:
 - a. fire;
 - b. explosion;
 - c. estimated property damage of \$50,000 or more;
 - d. death or personal injury necessitating in-patient hospitalization;
 - e. release of hazardous fluids for 5 minutes or more;
 - f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of a facility that contains, controls, or processes hazardous fluids;
 - g. any crack or other material defect that impairs the structural integrity or reliability of a facility that contains, controls, or processes hazardous fluids;
 - h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (or working pressure for facilities) plus the build-up allowed for operation of pressure-limiting or control devices;
 - i. a leak in a facility that contains or processes hazardous fluids 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 a facility that contains or processes hazardous fluids;
- l. safety-related incidents from hazardous fluids transportation 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 terminal's incident management plan.

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